CHAPTER 5

Rice-based traditions and rituals in the Mekong River Valley

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The Mekong River Valley (MRV) area of Laos occupies the central and southern parts of the country and primarily consists of the provinces of Vientiane, Khammouane, Savannakhet, Champassak, Saravane, Sayabouly, and Vientiane Municipality. Approximately 93% of the Lao population lives in this area (Hook et al 2003). As is the case elsewhere in Laos, rice cultivation is the main agricultural activity in the MRV. The MRV accounts for the majority of lowland rice production in the country, in both the rainfed lowland and irrigated environments, contributing about 74% of national rice production (MAF 2004). Until the early 1990s, traditional rice production practices prevailed in most of the MRV, with more than 90% of the lowland rice area being planted to traditional rice varieties, there being little by way of inputs of commercial fertilizers and very little use of chemical pesticides. There was also almost no mechanization of production until after 1995.

In general, farmers in the MRV produce sufficient rice to meet family needs, within given labor and resource constraints; the MRV is also the most favorable area for rice cultivation in Laos. Poor farmers in the area are generally those who have to cultivate poor soils, or those not having draft animals or sufficient paddy land. Relatively rich farmers are those living on fertile soils, usually immediately adjacent to the Mekong River and its tributaries or near the larger provincial towns where they have potential access to markets and off-farm employment. In years of good rainfall, self-sufficiency in rice is achieved; in years with poor rainfall, rice and food deficits often prevail.

The people of the MRV are mainly those with Tai-Lao ethnicity. They speak Lao and as many as 80% are engaged in lowland rice cultivation, although slash-and-burn upland cultivation is practiced in some hilly areas, mainly in the lower central and southern agricultural zones. The vast majority of farming households in the MRV prefer to grow and consume glutinous rice. Rice not only provides the major food source for the population but is also the basis of many of the cultural and social traditions of farming families in this region. In addition to ritualistic traditions, the majority of traditional cultural practices revolve around the cultivation and consumption of rice. These include traditional dances based on the cycle of rice cropping, and the performance of plays and songs associated with rice. Typically, dances taught to

children, as well as those performed by professional dance troups, will include group movements set to music and reflecting communal planting, harvesting, and threshing of the rice crop. The wording of one of the most well-known traditional and patriotic farming songs, *Yin sabaai saonaa* ("The Contented Rice Farmer"), is an example of this rice-based association with contentment in life. The words to this song are as follows:

The Contented Rice Farmer

We are rice farmers' children,
We take plows and buffaloes to the fields,
We look for food in the forests,
We look for food in the forests.

After sunset, we go home,
Everyone in our village is very happy and contented,
Very happy, very contented.
In our village, there is rice and there are fish in the rice fields,
When the wind blows, we have fresh air,
Contented, contented farmer; contented, contented farmer.

In the afternoon, we ride wild buffaloes,
We sing songs, dance, and play the "khaen."[1]
We urge everyone to come together to play, work, and develop the nation.
Contented, contented farmer; contented, contented farmer.

The direction of our lives is a happy thing,
In the fields, our skin becomes dark, but we are still happy to work for our nation,
To work to fight hunger and poverty,
Contented, contented farmer; contented, contented farmer.

We are proud to use our work to develop our nation,
We have buffaloes as powerful friends,
Our leaders direct us on the right path,
Contented, contented farmer; contented, contented farmer.

In researching this chapter on the rice-based traditions and beliefs of lowland rice farmers, interviews were conducted with farmers living in areas broadly representative of the lowland rice-farming areas in the MRV. The majority of the information was gathered in Saythany District of Vientiane Municipality, Kong District of Champas-

[1]A traditional Lao wind instrument made from bamboo.

sak Province, and a village in Nasaythong District of Vientiane Municipality, where the current inhabitants are descendants of families who were relocated to the area from Xieng Khouang Province during the 19th century, and who carried with them the rice-based traditions and beliefs of their former abode. The farmers interviewed were mainly village elders, whom it was recognized were likely to have the most vivid knowledge of rice-based traditions and beliefs. Not all the rituals described are currently still being practiced by the younger generations of farmers.

Spiritual and ritualistic practices are important to most Lao people, and lowland farmers in the MRV engage in many rituals and ceremonies associated with all aspects of the rice-cropping cycle. Most ceremonies involve a belief in *pi*, powerful, invisible beings of the spirit world. Most Lao have traditionally believed in various forms of *pi* that are thought to live in the trees and forests, and other plants found in the forests, mountains, fields, and streams; also in their homes and bodies (when both alive and deceased), and sometimes in some kinds of animals. The ceremonies and rituals of MRV farmers have been practiced and passed down through many generations of farming families. Many are believed to have originated in the Hindu traditions of India; others have their origins in the animistic, pre-Buddhist era of Laos. Some have combined aspects of Buddhist-animist rituals and ceremonies.

The traditions and rituals specifically associated with rice in the MRV are many and varied. It is beyond the scope of this chapter to comprehensively document all these rituals and beliefs, or to establish conclusively their exact origins. Rather, the chapter aims to document the main rice-based rituals as they have been traditionally practiced by the Tai-Lao in the MRV. These rituals are presented in the sequence of the normal cropping cycle for rainfed lowland rice.

Ceremonies prior to the start of the rice cropping cycle

In May to early June (the sixth month of the Lao lunar calendar[2]), communities in the MRV (and in northeast Thailand) celebrate the *boun bang fai* or "rocket festival." Traditionally, this pre-Buddhist festival can last up to three days and is held in order to prompt the heavens to initiate the rainy season and to bring much-needed early rain to allow the planting of the wet-season rice crop. Projectiles consisting of bamboo (or, in more recent times, aluminum) tubes filled with gunpowder are fired high into the air over the fallow fields to gain the particular attention of *Phaya thaen* (the protector of paradise who resides on the frontier between "paradise" and Earth). The first rocket to be fired is to honor the local spirit of the host village, whereas later rockets are fired in a rocket competition (Fig. 1). It is believed that a successful rocket festival will ensure sufficient rainfall for the coming rice cultivation season. During the festivities, pigs

[2]The traditional Lao calendar is based on the movement and phases of the moon. There are 15 days in the waxing moon and 14 or 15 days in the waning moon. Some months (the 1st, 3rd, 5th, 7th, 9th, and 11th) have 29 days; others (the 2nd, 4th, 6th, 8th, 10th, and 12th) have 30 days. The Lao lunar year therefore has 354 days, unlike the 365 days in the European (solar) calendar.

are often slaughtered, and drinks, particularly *Lao lao* (rice whisky) and *Lao hai* (rice wine), flow freely with people repeatedly toasting each other's health.

In Kong District in Champassak Province in southern Laos, specific to this festival is the exhibiting of erotic images such as naked wooden puppets with enlarged sexual organs that are meant to represent fertility in general and fertility of the rice crop in particular. However, these erotic exhibitions are not common to all areas in the MRV. Pongkhao (2005a) states that although traditionally, the objective of the festival was to ostensibly create favorable growing conditions for the rice crop during the coming rainy season, it has now come to mean a lot more than that and is seen as a means of building harmony between villages as people from a number of villages congregate for a large celebration. The same traditions associated with the annual rocket festival are also widely practiced in neighboring northeastern Thailand.

Traditions associated with land preparation and transplanting

Before transplanting the main wet-season rice crop, villagers have traditionally first transplanted seven bundles of seedlings around the "field hut" (or *hor*), which is usually located at the edge of the rice field of individual families. This ritual, referred to as "*ta haek*," includes making an offering of cooked chicken, alcohol, and fruit to the resident spirits, while chanting prayers requesting that the spirits protect the forthcoming rice crop. Villagers believe that, if these seedlings grow well, the main rice crop will also grow well and give a good grain yield.

The most auspicious day to begin land preparation is believed to be the first day of the sixth month of the Lao lunar calendar. In some districts, before seeding the nursery plot, many farmers plow the main field along its diagonals and along its levees in a ritualistic operation known as *haek na*. Only after the rains fall is the rest of the plot prepared and planted according to usual lowland cultivation practices. Following preparation of the main fields, an auspicious day is then chosen for transplanting the main rice crop. Generally, it is believed that planting on a Thursday will ensure good, abundant grain, planting on Wednesday will ensure abundant leaves on the rice plants, and planting on Saturday will ensure an abundance of tillers. Most farmers believe, therefore, that Thursday is the most auspicious day for transplanting rice. A small planting of 10–15 hills may also be undertaken prior to full transplanting of the main plots. These hills will receive special care and attention during the growth phase of the rice crop. It is believed that maintaining these practices will ensure a good relationship with the spirits near the rice fields and is necessary to ensure good rice yields and that those farmers who do not follow these practices may suffer pest attacks, disease attacks, and other problems resulting in lower yields.

Rituals performed during the period of growth of the rice crop

During the growth stages of the rice crop, villagers go into the fields to perform weeding, bund maintenance, and other necessary tasks. However, little by way of rituals is performed during this period, apart from the days of *wan sin yai* (the 15th day of

each Lao lunar month) when no work should be undertaken in the rice fields; if work is done on this day, it is traditionally believed that it can result in a high probability of bringing about misfortune for the farm household. Each evening, before returning to their homes from their fields, many lowland farmers request the spirits to protect their crops from disease, pest attacks, and other dangers. These requests are made in simple, respectful Lao language.

At the milky stage of grain development, farmers in Saythany District of Vientiane Municipality have traditionally selected a small number of beautiful immature panicles to prepare *khao mao*, which is prepared by threshing and drying immature rice grains, which are then mixed with sugar and grated coconut to prepare a sweet that is then offered to the *phi ta haek* (the field spirits), together with one cup of rice alcohol. These offerings are placed in the field hut (*hor)* and it has traditionally been accepted that, unless this ritual is performed, the villagers cannot later consume the grain produced from their rice fields.

Rituals associated with harvesting of the rice crop

Villagers choose an auspicious couple of days for harvesting their rice crop, according to tradition and in relation to the lunar calendar. It is generally believed that harvesting should not commence on either the 2nd or 12th day of the month. Before harvesting the main crop, some villagers harvest the plants around their field hut until they have a handful of grain; these grains are then counted. If the total number of grains amounts to an even number, the main crop can be harvested on the first day selected. However, if the total number of grains forms an odd number, harvesting has to begin on a day other than that first selected. Villagers believe that selecting single grains or pairs of grain (even or odd numbers) represents a balance between high and low yields. Pairs of grain (even numbers) indicate a high yield, whereas single grains (odd numbers) reflect a low yield.

Before the harvest of the main crop begins, the seven bundles of plants that were transplanted around the field hut at the commencement of planting are harvested, tied into a bundle attached to a wooden pole, and placed in the center of the area to be used for drying and threshing of the main crop.

Traditions associated with threshing the rice crop

When all the rice has been harvested and moved to the drying area, a ritual is performed whereby villagers return to the rice fields to request the spirits of the fields to send any uncollected grains or panicles to the rice threshing and drying area. This is performed by the men of the village while the women prepare the rice storage area. In the fields, the men place their hands together in a traditional *nob* (prayer-like positioning of the hands) and make the following request of the *nang kosuk* (female rice spirit):

"Nang kosuk, we invite you to come back with us to the rice store.
Glutinous rice (or nonglutinous rice), come to the store!
Nang kosuk! Send the uncollected grains to the rice store!
Come! Come with us to the rice store!
Nang kosuk! Come with us to the rice store!"

At this time, the villagers then physically collect any remaining grains or panicles in the paddy field, and carry them to the drying and threshing area. In the rice-drying area, the bundle of panicles that was earlier placed at the center of the drying area is placed on the top of the threshed grain for a later ritual. On completion of threshing and before the rice can be taken to the rice mill, the traditional, semi-Buddhist *baci* ceremony must be held. Offerings of cooked chicken, alcohol, banana, sugarcane, and taro are made. This offering of thanks to the spirits of the rice fields includes the chanting of prayers in Pali, and the lighting of incense sticks and candles. Rice from that harvest cannot be milled or eaten until this *baci* has been held.

The *baci* ceremony[3]

This most popular of Lao traditional ceremonies involves the ritualistic tying of holy cotton threads to ensure blessings of the spirits on specific persons, activities, or places (Fig. 2). It is believed to restore the natural order of things and bring communities closer together. The ceremony originated in the Hindu tradition and began to mix with Buddhist traditions in Laos 500 years ago. It is performed by a *mor phon* who is usually an elder who has spent some time as a Buddhist monk. The *mor phon* and invited guests sit around a *baci* centerpiece, which is an elaborately decorated flower arrangement. A long chain of cotton threads is placed in the hands of guests connecting them to each other and to the centerpiece. The *mor phon* then lights candles on the centerpiece and begins to chant Buddhist scriptures in the Pali language.

The guests clasp their hands together in respect and those familiar with Pali prayers participate in various points of the chanting. On conclusion of the chanting, holy, scented water is sprinkled over the guests and uncooked rice grains are thrown in the air. At this point, special guests may be presented with an offering bowl containing cooked chicken and other simple foods. The special guests must hold aloft the offering bowl in their palms and drink from cups of Lao rice wine. It is believed that this will ensure that they have sufficient to eat and drink in the future.

Following this, the *mor phon* and other guests tie cotton threads on guests' and each other's wrists. These cotton threads as well as the centerpiece have been prepared by the women of the group in advance of the ceremony. The threads used in the *baci* ceremony are usually white as Lao people believe that white represents innocence, friendship, and kindness. However, recently, other colors such as red, yellow, and black have been introduced to the ceremony. Red threads are believed to represent bravery, yellow can symbolize faith, and black can mean sympathy for a person's sadness or

[3]Adapted from The Vientiane Times, April 2005.

loss. Before tying on the threads, a knot is tied in the strings. This, it is believed, firmly ties the guests' souls to their bodies.

While tying on the threads, good wishes are offered to the recipient, usually along the lines of "bad things go out," "good things come in," or "wish you good health, long life, and happiness." The form of these good wishes is very flexible and may be offered in any language. The recipient then raises his or her right hand to chest level to show respect for the person who ties the string. During this process, the *mor phon* and special guests will be encouraged to drink more ceremonial glasses of Lao rice wine or similar alcoholic drink.

On conclusion of the ceremony, the *mor phon* and guests will usually move to a nearby area to eat, drink, and engage in other, nonritualistic activities.

With the recent and widespread adoption of mechanized threshers throughout the MRV, the traditional rituals associated with the harvest and threshing of the wet season's rice crop are now rarely practiced.

Rituals associated with storage of the rice grain

Before moving the rice to the storage area, the symbolic bundle of rice panicles that had been placed on the heap of drying rice is taken to the store and placed high up on the front of the building above the entrance. After that, all rice can be moved from the drying area and placed in storage. When all the rice has been placed in storage, the *mor phon* will go to each family's rice store to pay respects to the *nang kosuk* (female rice spirit) and chant from standard Buddhist scriptures in the Pali language.

When the rice is moved from the store to the mill, rice containers must be filled from the bottom of the heap and not vice versa, as the latter is believed to bring about bad luck. While the rice is in storage, if there is a sound of thunder in the area, rice cannot be taken from the store, nor can the door of the rice store be opened until three days have passed. Ideally, the door of the rice store should be opened on the third day of the third month of the Lao calendar.

When preparing the rice for storage, villagers divide the harvest into two components. One component is placed into large containers for family consumption. The other is put aside for the *boun koun kao* ceremony. This important ceremony is widespread throughout all areas of the MRV and continues to be practiced by young and old alike. Each farming family takes the proportion of their threshed rice they have set aside to be ceremonially donated into a "rice bank" located in the village temple. The amount each family donates to the rice bank is up to the individual family, but, generally, wealthier families donate more. On an auspicious day, a *boun koun kao* ceremony will be held within the grounds of the local temple, during which at least four monks must be present. All villagers are expected to attend the ceremony and participate in the chanting of Buddhist prayers in the Pali language. The senior monk will bless the rice and the villagers, and sprinkle the donated rice with scented holy water. Assuming that there is sufficient rice for village consumption, this donated rice will later be sold and the proceeds administered by the village council for the benefit of

the local community, such as temple construction and maintenance of village schools, roads, etc.

Other rituals associated with growing the rice crop

Ritual associated with the clearing of new land

In the past, when a new area was selected for an expansion of rainfed lowland rice fields, the villagers had to first perform rituals to seek the approval of the forest spirits before they could prepare the land for rice cultivation. The ritual involved in this process often varied from village to village and between the different areas in the MRV. However, in all instances, its objective was the same—to ensure that the local spirit chief (*Phum* in Saythany District and *Pi lak ban* in Nasaithong District, of Vientiane Municipality) is agreeable to the land being cleared for rice cultivation. As part of the ceremony, in most areas, the villagers first prepare a *khanhar* or *khanpaed*. The *khanhar* is an offering of five pairs of candles and flowers, whereas the *khanpaed* consists of an offering of eight pairs of flowers and candles. A small field hut (*hor*) is built in a small part of the area to be cultivated. Villagers then call on nearby spirits to come and stay in the *hor* to help protect their crops. The villagers hold the *khanhar* or *khanpaed* offerings above their heads and make requests to *Mae-thorrany* (the spirits that live in that area). Although this ritual is mainly associated with gaining the approval of the spirits for the clearing of new land for rice cultivation, requests are often also made to these same spirits to protect the rice crop from pests such as birds and rodents, and, in general, spiritual support to ensure that the rice crops are bountiful. These requests are made in simple, respectful Lao language and may include recitations such as the following:

> *"Honorable Pi lak ban! Honorable Mae-thorrany! We would like to use this land.*
> *We respectfully request permission from you to allow us to do this.*
> *We will use it for some time and then return it to you.*
> *Please allow us to prepare the land for rice cultivation and protect our crop from all bad things.*
> *Also, please protect us and our families from illness and other bad things.*
> *All this we respectfully request from you."*

There is no standard form for these requests and they are not made by monks or shamans but by laymen and women farmers. The candles, flowers, and offerings of glutinous rice cake are placed inside or nearby the *hor* for the benefit of future spirit residents, and small baskets of farmyard manure may be placed at each corner of what will become the main paddy field.

Drought-breaking ceremony—*hee nang meaw* (procession of the female cat)

Rice cultivation in the MRV is primarily rainfed based rather than irrigated. The soils are predominantly sandy and extended periods without rain can have a devastating effect on crop yield. Drought is a common occurrence in this region and farmers in the rainfed lowland environment of the Mekong River Valley consider drought as their most consistent production constraint (Khotsimuang et al 1995). Traditionally, when faced with such conditions, the villagers in this part of Laos and northeast Thailand have conducted a special ceremony called the *hee nang meaw* (procession of the female cat). In the ceremony, villagers construct a bamboo, wooden, or metal cage into which they place a female cat. They then carry the cage (and the unhappy cat) through the village in a procession, while playing traditional drums and gongs, making as much noise as possible in order to gain the attention of the spirits. Villagers not in the procession but who line its path vigorously throw water over the cat, while loudly calling on the spirits to do the same, that is, produce rain for the rice fields. This ritual, once common in most areas of the MRV, is well remembered by village elders but is now rarely observed.

Paying respect to the buffalo

Buffaloes play an important role in lowland rice cultivation and, on completion of harvest, a special *baci* ceremony is sometimes held to pay respect to these animals. In some areas, as part of this ceremony, glutinous rice cake, flowers, and a pair of candles are tied to the horn of one buffalo. In addition, a handful of cooked rice is mixed with salt and presented to the buffalo for consumption. This occasional ceremony is performed by individual households.

Other festivals relating to rice or in which rice plays an important role

Postrice harvest and other festivals, traditions, and ceremonies are numerous and are summarized in Table 1. Two of the largest and most important are the "fire boat festival" (*Boun lay heua fai*) and the "boat-racing festival" (*Boun song heua*). These festivals are held every year some time after the completion of the rice harvest. During the morning, boat-racing competitions are organized, temporary stalls and restaurants are set up along the river bank, and there is much revelry. In the evening, small ceremonial "fire boats" are decorated with candles, incense sticks, white rice, and flowers before being ritualistically set adrift in the river. During both these events, people enjoy eating rice products, drinking rice alcohol, and listening to music while also making rice offerings and other offerings to the *Naga* spirits of the Mekong River and tributaries. Offerings to the Nagas include cooked or uncooked white rice, rice alcohol, cake, fruits, and leaves.

Other rituals in which rice plays an important role

During funeral ceremonies, fried rice is traditionally thrown on and around the coffin of the deceased person. Many Lao people believe that this inspires the soul of the

Table 1. Important festivals (Boun) associated with rice in the Mekong River Valley of Laos.

No.	Festival name	Time festival held	Objective	Rice processing/preparation	Activity/ceremony
1	Boun Khoun Khao (maintaining the paddy festival)	December	To celebrate the success of rainfed rice production, to wish the producer family success, and to establish a rice bank to be used for the benefit of the village.	The newly produced sticky rice is prepared as *Khao tom* (rice-coconut-banana/mungbean boiled in banana sheets), *Khao lam* (rice-coconut cooked in bamboo canes), and *Khao poun* (vermicelli in fish or chicken-coconut extract-spicy sauce).	Construction of an elevated plateau of paddy in the postharvest operation area. The plateau is covered with bamboo or cyprus woven sheets. Monks are invited to sit on these and give benediction, receive offerings, and eat rice.
2	Boun Khao Chi (grilled rice festival)	February	To celebrate the success of the rainfed rice production for the second time. To acknowledge the spirits of ancestors who passed on knowledge of rice production.	The cooked sticky rice is taken in clumps, skewered with long, thin bamboo sticks, and grilled while marinating with egg and pork fat.	The ceremony is conducted in the temple where villagers come to assemble and invite monks to receive offerings of food and give benediction.
3	Boun Bang Fai (rocket festival)	Sixth month of the Lao lunar calendar (approx. May to early June)	To encourage the spirits to provide rain for the coming wet-season rice crop.	Preparation of rice cakes and candies, slaughtering of pigs, and consumption of Lao rice whisky and Lao rice wine.	Firing of rockets high into the air to attract the attention of the spirits living on the frontier between Heaven and Earth.
4	Boun Ho Khao Padabdin (wrapped rice presentation on Earth festival)	End of August	For the deceased parents and relatives. To transfer the benediction as their spirits reach heaven.	*Khao tom* is wrapped in separate small units that are then attached together.	In the early morning at about 3–4 o'clock, the prepared offerings are distributed on the stupas and around the temple. In the morning, a ceremony is performed in the temple to present offerings to the monks who give benediction.
5	Boun Ho Khao Salak (gift offerings to the ancestors festival)	Mid-September	(Same as above.)	Same as above plus the preparation of meat and fish as a complete set of offerings.	(Same as above.)

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Table 1 continued.

No.	Festival name	Time festival held	Objective	Rice processing/preparation	Activity/ceremony
6	Boun Khao Sampapi (rice mixed with everything festival)	End of September	For good health and long life, to transfer benediction to deceased relatives, and to receive personal benediction.	Rice flour is prepared and mixed with coconut oil, sugar, and different medicinal plants for longevity. The whole mixture is boiled together to obtain a concentrated preparation that is ready to serve.	The preparation of rice and other offerings is conducted in the temple. The finished products are offered to monks and distributed to each family in the village and can be given to friends.
7	Boun Khao Phanh Kone (festival of 1,000 rice pieces)	End of September	To present to the sacred spirits in the universe with the spirits of the deceased persons and to establish good relations between the two.	Cooked sticky rice is taken in small clumps (1,000 pieces) and skewered on fine sticks that are placed into small stupas made with banana leaves. These stupas are prepared as a receptacle for offerings.	The ceremony is conducted in the temple. At night, people walk around and celebrate. In the morning, offerings are presented and people receive the Buddhist precepts from the monks.
8	Boun Tieak Khao (dispatching rice festival)	Any month	To transfer benediction to parents and relatives who are recently deceased, and to lead their spirit to happiness.	*Khao tom, Khao nom* (cake), *Khao pat* (rice flour + coconut extract + sugar + green-leaf extract), and vermicelli (*Khao poun*) are prepared and offered.	Relatives and friends come to contribute offerings for the deceased. Monks are invited to give benediction and receive offerings from the families.

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Table 1 continued.

No.	Festival name	Time festival held	Objective	Rice processing/preparation	Activity/ceremony
9	Boun Tak Batevo (alms bowl ceremony)	August-October	To offer to the monks the new rice prepared at different stages: milky stage (*Khao mao*), late milky stage (*Khao hang*), and maturity stage (*Khao mai*), after the monks have just finished the 3-month rains retreat.To get benediction and transfer it to ancestors' spirits.	*Khao mao, Khao hang* (immature rice), and *Khao mai* (new white rice) are prepared and offered.	The ceremony is conducted in the village temple.
10	Boun Song Heua (boat-racing festival), Boun Lay Heua Fai (fire boat festival)	Full moon, 11th lunar month (after the end of Buddhist Lent)	To celebrate the end of Buddhist Lent and provide entertainment at the end of the planting season. To offer respect to the Nagas (mythical river serpents) and ask for blessings from ancestors.	Offerings to the Nagas include cooked or uncooked white rice, rice alcohol, cake, fruit, and leaves.	During the day, boat-racing competitions are organized. At night, small ceremonial flower boats are set adrift on the river.

dead person to leave the coffin, thus making it lighter to carry. However, Phouthonesy (2005) suggests that this ritual encourages people to accept that the person has passed on and that, like the fried rice, cannot be expected to grow again in this world.

Variations and changes in the rituals in recent times

The extent to which rice-based rituals are adhered to and the depth of the belief in spiritual phenomena such as *pi* vary greatly among the Lao people in the MRV. The Lao generally tend not to be dogmatic about their religious beliefs and accept a wide variety of adherence to ritual and custom. In recent times, many people have performed the rituals associated with rice, and other rituals, without necessarily having an unwavering belief in the existence or influence of spirits of the fields and forests. One lowland rice farmer, educated in the Buddhist tradition, has expressed the current level of belief in the following terms:

> *"Even for those farmers who do not believe in the existence of spirits, the performance of rituals can have many potential benefits. In these cases, the benefits of ritual do not accrue to the rice crop, to the spirits, or even to the ancestors of the person participating in the ritual. Rather, the benefits accrue to the person participating in the ritual. Participation in ritual is a way of controlling the mind. It is similar to the meditation and chanting practices learnt in the Buddhist temples. Those farmers who practice the rituals are better able to control their minds than those who do not participate in rituals, and persons who can control their minds are better able to endure life's misfortunes and challenges."*

It can be expected that, as a result of the combination of improvements in the general education standards of the Lao people living in the MRV, combined with the increased adoption of improved rice production technologies, belief in, and the conduct of, many of the rice-based rituals will show a steady decline. This is already apparent in many areas, particularly where land preparation and threshing have become mechanized, at the same time as improved varieties have been adopted. Farmers can also increasingly be expected to plant their crops according to optimum dates recommended by researchers and extension workers, rather than on dates that are astrologically or ritualistically determined. These changes, as well as increasing migration of the young people of rice-farming families to urban and periurban areas, and exposure of the rural people of Laos to other beliefs and rice-growing practices, through improvements to infrastructure and telecommunications, can be expected to lead to an irreversible decline in the practice of the rituals and traditions that have been an integral part of these communities for centuries.

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CHAPTER 6

Rice-based traditions and rituals of the Kmhmu'

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The Kmhmu'[1] are one of the major ethnic groups of Laos, considering themselves as indigenous people of the northern part of Indochina. The Kmhmu' currently living in and around Laos number around 700,000, with the majority living in Laos, where they represent abut 11% of the population (613,893 in the 2005 census). Kmhmu' are also found in areas adjacent to Laos: in Vietnam (about 56,542 in the 2001 census), in the Sipsoong Phanna area of China (3,000), and in Thailand (10,000). In Laos, the Kmhmu' are found throughout the northern region (where they make up as much as 20% of the population), with the highest concentrations in the provinces of Luang Prabang (47%) and Oudomxay (59%). In spite of minor regional cultural and linguistic differences, all Kmhmu', wherever they may live, always understand themselves to be members of the same ethnic group.

The Kmhmu' language belongs to the Khmuic subdivision of the northern Mon-Khmer branch of the larger Austro-Asiatic language family and is subdivided into a number of regional dialects that form two larger dialect categories.[2] Within each dialect group are additional subgroups corresponding to family descent lines *(smta')*, each of which follows its own particular rituals and traditions, dictated by the totemic ancestry and passed down through the patriline.

In traditional Kmhmu' villages (Photo 6.1)) and families, life is generally organized according to customs of the larger regional subgroup (or dialect group) one belongs to, and the totemic ancestry *smta'* of the family's clan. The Kmhmu' social structure and their entire traditional system of beliefs are characterized by the ancestral lineages named after their totem-plant or totem-animal, and their intricate network of relationships of exchange, expressed through cooperation, mutual respect, and support. Furthermore, the Kmhmu' pay respect to natural phenomena and the powers of the universe that may hinder or facilitate their daily life and struggle for survival based to

[1]Alternative spellings are Khmu, Kammu, Khmou, Khamou, and Khơmu.

[2]The larger dialect group includes about two-thirds of the Kmhmu' people and is spoken in the provinces of Luang Prabang, Phongsaly, Xiengkhouang, Houaphan, Vientiane, and Bolikhamxay, and parts of Sayabouly. The second group is divided into several more distinct dialects called Kmhmu' Lue, Kmhmu' Khvèèn, Kmhmu' Rook, and Kmhmu' Khroong, found in parts of the provinces of Oudomxay, Bokeo, Luang Namtha, and northern Sayabouly, as well aș China and Thailand.

a large extent on producing enough rice to eat. Traditionally, community-related and clan business affairs are conducted by a council of elders, and decisions are reached by consensus, with both men and women participating in the decision-making process. Currently, a political system operates alongside the council of elders.

Most Kmhmu' adhere, in varying degrees, to their traditional animistic[3] world-view, according to which there is a world of spirits and a world of humans. Spirits *(hrôôy)* have an influence on people's lives, and it is accepted that people become spirits when they die. These spirits may live in the natural environment. Each living person also has a sum of personal spirits or "spirit-souls" *(hmmaal)*, in the absence of which it is believed that the person can get sick and may die. To restore the body involves calling back the personal spirit-souls by family, friends, and community, sometimes with the help of a spirit specialist *(mo môn).* Furthermore, it is believed that, just like people, other beings or bodies such as the traditional Kmhmu' bronze drum-gong *(yaan)*, important plants such as the rice plant, or particular animals such as the tiger, may also be animated by such personal spirit-souls.

The first-generation patrilineal ancestors are respected as house-spirits *(hrôôy gaang),* who are in turn expected to protect the family in their daily lives as well as their belongings, crops, and animals. In the Kmhmu' worldview, the human world is believed to be the model for the spirit world. What works in the human world is thought to work similarly in the invisible world. So, what feeds the people and their preferences is also thought to satisfy and feed the spirits as well. *Rice, as the most important food for people, is therefore, in all its forms, the choice food for all versions of spirits as well, including raw and steamed rice, as well as various rice-alcohols.* So, rice culture and the traditional beliefs of the Kmhmu' are closely interrelated and play an important role in the every-day lives of the people. In addition, dreams also play an important role in relating the human and spirit worlds.

Rice cultivation by the Kmhmu'

The Kmhmu' are mostly upland subsistence farmers. Traditionally, they have lived in relatively remote mountainous areas where little land was usually suited to wet- rice cultivation. Where paddy-type rice cultivation has been undertaken by the Kmhmu', this development is relatively recent, in response to the national government's policy encouraging the adoption of more sustainable forms of agricultural production.

The staple food of the Kmhmu' is glutinous rice, which they grow in their upland "swiddens." This is complemented by whatever grows and lives wild around the rice fields, in the forest, and in the waters, and can be gathered or hunted as needed for their own use and survival. Together with upland rice, some corn, tubers, taro, cotton, hot peppers, eggplant, sesame, sorghum, pumpkins, cucumbers, beans, and Job's tears are grown. These are planted around the edges of the rice fields, over stumps,

[3]During the last 100 years, a small percentage of Kmhmu' have become Christians, others are Buddhists having received education in the temples, while many, under modern influences and the revolution, have given up most of their traditional spirit beliefs and rituals.

or in separate plots or fields according to the crop, available work force, and regional traditions. Predators of the crops are hunted and eaten if edible. These include bamboo rats, mice, squirrels, birds, monkeys, and whatever other animals are trying to eat the crop. In times of famine, the Kmhmu' dig for wild tubers and eat other food from the forest to survive. Around the villages (which may vary in size from about 20 to 80 or more households) and around their houses, they also plant small areas of herbs, vegetables, and bananas, and raise domestic animals such as water buffalo, cattle, dogs, pigs, chickens, and sometimes goats and horses. Traditionally, domestic animals were raised not so much for regular meat consumption as for feeding the spirits in times of sickness and calamity, and for ancestor veneration or for use in other rituals along both the life cycle and planting cycle. The choice of animals raised was related to the believed preference of the spirits that were to be pleased. In more recent times, many Kmhmu' raise some domestic animals to generate income.

The importance of rice to the Kmhmu' households and community is reflected in one of the old Kmhmu' sayings:

> *"Making rice fields is eating rice, and eating rice is EVERYTHING; not enough rice means that there is not enough of ANYTHING."*
> *"To eat rice means to be alive*
> *but to not eat rice means death."*

The most important activity of the Kmhmu' is therefore the work in their rice fields. Individual Kmhmu' households usually plant several varieties of rice. The names of the rice varieties are taken from trees, bamboo or grasses, silver and gold, "winged" white, black, yellow, etc., and are qualified as soft, nice and soft, or robust, fragrant, growing anywhere, good for alcohol but hard, ritual black rice with long grains or round grains, small or big grains, etc. The names given to particular varieties are meant to be flattering as if to suggest how the rice should grow nicely and beautifully. Small areas of black rice are usually grown to meet the needs of some of the rice-based rituals of the Kmhmu', for which black rather than white rice is often used.

Traditions and rituals of the Kmhmu' associated with upland rice cultivation[4]

In the past, the Kmhmu' believed that rice had a soul or a personal spirit similar to that which is believed to be associated with humans. The rice spirit-soul was also thought to be capable of getting angry and cross. If the rice spirit-soul stayed with the owner and master of a field, then it was believed that the owner could plant a rice crop and

[4]The sacred activities for fertility, just as other rituals, are not usually open to outsiders to attend for fear of trespassing and consequences thereof, and are therefore often unknown even to neighboring ethnic groups. However, during the Kmhmu' harvest festivals, *greh*, nowadays often performed as village festivals with a folkloristic note, ritual and other instruments as well as field tools used during the planting cycle are displayed and demonstrated in an artistic way for the pleasure of officials, guests, and the community.

be assured of a good yield. However, if the rice spirit-soul became angry and was staying elsewhere (other than in the householder's field), the owner of the field would not get a good harvest. For this reason, the rice-field owner was obliged to love the rice and the rice seed that was planted. Furthermore, he had to store his rice properly, so that not one grain would fall on the ground and be wasted. If he didn't take all the necessary precautions, he would fear that the rice spirit-soul would become angry and leave. This is why, every year, the Kmhmu' perform two or more rice spirit-soul blessing rituals during which they call the rice spirit-soul home, first before the rice gets planted and one or more times when it is harvested.

The rice-planting cycle of the Kmhmu' usually starts in February, after the celebration of the traditional year passage rite and harvest festival, followed by the annual rest, family-related activities such as weddings or other rituals, and the undertaking of repairs to, or the building of, a house. Tools are also prepared for use during the next planting season.

Taboos and spiritual considerations in the choice of a field

The selection of a field is a most important activity that takes place in January to February, depending on geographic location. It includes not only the examination of the natural conditions, such as the environment, the soil, sun exposure, rain, moisture, etc., but also the supernatural conditions such as spirits living in the area, and the working conditions in the field. For this complex activity, the Kmhmu' form solidarity groups *(thung hré')* of family members and friends that will help each other throughout the planting cycle with work that must be done collectively.

In choosing a field site, several taboos and beliefs are adhered to. In some areas, the Kmhmu' are taught not to select a rice field site from where their own cotton field would be visible. If a farmer has more than one field, the separate fields should also be out of sight of each other. Farmers should also not be able to see the fields of their siblings (fields of family members may be close together, as long as they are out of each other's sight).

Ritual related to the selection and marking of a new field

The evening before it is planned to go, examine, and select new fields, a jar of rice wine is opened and the house-spirit is notified of the plan by the recitation of the following words:

> *"Master, father and mother, we are breaking open wine*
> *for you to consume and we let you eat this rice.*
> *The month in which to make our field and its divisions has already come.*
> *Tomorrow is the day to go to examine the field and the divisions.*
> *Watch over the path of the fields and the walkways of the paddy.*
> *Don't be critical and scared. Yes!*
> *Accident spirit don't pass by; devouring spirit,*
> *don't shine on us (=target with a signal).*

May our dream show signs of a good spirit-soul
or else have a pleasant meaning,
so we can see that we will get rice and be fortunate with animals."

The fields are then examined on the nominated day by a team of Kmhmu' men and, when an appropriate field has been chosen and agreed upon for the family, the following prayer is recited:

"Yes, we are the Tva'- family (prayer by fern clan family).
I would like to start clearing this place for testing,
on a day that is auspicious for lush rice and perfect animals.
In case we can't proceed, we will understand it:
If whatever spirit passes by, will signal it and manifest itself to us.
If it is good and we can go ahead with clearing, we will know:
If whatever spirit passes by will signal this by being quiet and by not manifesting itself.
Make our dream good and perfect,
meeting the rice spirit-soul and perfect animal spirits.
May we dream of a very good and perfect omen,
Such as of the luck bringing rice spirit-soul and the perfect (quiet) animal spirit-soul."

After reciting this prayer, a small part of the land selected is cleared as a basis for checking with the spirits as to the suitability of the land. If, during the time of clearing, no calls of particular animals or birds are heard (the birds or animals that were asked to remain quiet in their prayers), the members of the household return to their home to sleep on the choice that was made. If, during the following night, members of the household dream of the rice spirit-soul in a positive way, it means that the family may proceed with the clearing of the remainder of the field on the first auspicious day, according to the Kmhmu' calendar for work. If, however, the dream is about something that is regarded as taboo, or not good, or if a bad omen is observed (such as fly eggs or other inauspicious signs), the site must be abandoned and another area of land selected.

On the day that the family is to proceed with clearing, those who are to be involved in the clearing work should not have any problems with their hands and legs such as open wounds or other injuries. As the clearing and subsequent burning can potentially be dangerous, the elders of the group will seek the consent and protection of the spirits, preparing an offering tray with food gifts, trying to form a pact with them, with the following words:

"We are the Tva'-family!
We will engage in the work.
We will enter the fields and clear them and their divisions
and then we will cut the trees and the logs.
Watch over our feet and over our hands so they will have no injuries!
When the time has come (harvest time), we promise to make a meal for you!"

Clearing and preparation of fields for planting

Clearing the land in readiness for planting is a collective activity of the Kmhmu', with the different families of the "field working group" helping each other. By working together, the clearing can proceed rapidly and, as a result of the social interaction on these occasions, is enjoyed by all participants. Both men and women participate in the work of clearing. The initial clearing of the field (*hrwam*) can take between one and two "10-day weeks" (the traditional Kmhmu' week, *vèèng*, has 10 days, each day being assigned special duties and taboos). After the clearing of small trees, branches, and undergrowth is completed, the women usually engage in other activities while the men use axes to cut down (*kool*) any large trees. The felled trees and vegetation are then left to dry so all can be burned on a day that is very hot and preferably when there is also a breeze. Burning (*guuc*) is carried out according to traditional passed-down methods. If the burning is done well, the work of field preparation that follows will be easier. Women and children generally do not participate in the burning, as it is regarded as being too dangerous. After the initial burning, the whole family then works together to collect and burn any remaining debris, leaving a clear but rough seedbed that is covered with ash, which, in turn, provides a source of nutrients for the rice crop that is planted in the area. The quality of the cleaning up and preparation of the seedbed, called *puur*, is important, as it also affects the ease with which the subsequent hand weeding of the rice crop can be undertaken.

In ordinary (most) years, there are no important rituals to perform, or special customs to observe, during the process of clearing, burning, and cleaning up of the fields being prepared for the wet-season's rice crop. An exception exists for those family households that have constructed a new family house of the type that is also the residence for the house-spirit *(gaang tè')* in the previous dry season. These families have to prepare two additional ritual meals in the field to honor their house-spirit *(hrôôy gaang)*. One meal, called *mah pnggwl,* is prepared just after the fields have been burned*,* but before the final burning of the remaining debris. The second meal, called *mah tmbri',* is prepared when the rice is well established and about knee-high. Detailed descriptions follow in a later section of this chapter.

Rituals associated with the planting of the rice crop

The Kmhmu' have many different traditional ways of planting their upland rice crops, reflecting the geographic conditions and their traditional belief that putting the seeds into the ground may cause offense to the rice spirit-soul. Rituals that are followed by individual families reflect their particular totemic ancestry and beliefs. The actual method of planting the fields may also vary among different regional groups.

Ritual miniature rice field and blessing of the rice seed. On account of their dependence on rice as their staple food, the Kmhmu' consider and respect rice as something of utmost importance. So, when the time of rice planting approaches, they still think and worry that when they abandon the rice seeds in the earth, the rice spirit-soul might become angry and leave. Therefore, to please the rice spirits, before planting the main rice crop, a small ritual garden or "miniature rice field" *(mat rèèk)* is prepared and planted with a small quantity of seed of each variety of rice to be grown in the main field.

The "mat rèèk" *or ritual miniature rice field.* The miniature rice field *(mat rèèk)* is prepared on the first day selected for dibble planting by the male head of the household that owns the field. This miniature rice field usually does not exceed about 4 m^2 in area, with a symbolic giant rice plant made from bamboo planted in its middle, and other symbols related to rice cultivation arranged around it (Photo 6.2). The *mat rèèk* is made in the following way: a *tala* bamboo stalk of about two full double-arm-stretches in length is cut and its top end beveled off so it looks pointed like a rice leaf. The third internode down is slit lengthways several times and then expanded with bamboo sticks to make it resemble a large, full, round rice grain. At some distance up from the base of the bamboo stalk, a hole is pierced, through which a rope is then pulled to represent a double phallus pointing in two directions. Finally, a loosely woven bamboo disk *(thèlè)* is attached to the stalk to mark it as being taboo or sacred. The bamboo stalk, symbolizing a giant rice plant, stands firmly planted in the ground in the small field. On the ground around the base of the bamboo stalk, miniature water channels are made to represent the channeling of water into water containers placed at the base of the stalk. At the foot of this giant imitation rice plant, some small symbolic rice-wine tubes are sometimes placed too. To complete the ritual rice plot, split bamboo is used to make a fence around it. The bamboo stalk in the garden symbolizes giant rice plants that the Kmhmu' farmers wish the rice in their main field to take after. The water channels and the bamboo water containers below symbolize the rainwater needed for the rice to grow. The symbolic phalluses are supposed to scare off the "foamy-grasshopper-widow-spirits" and "insatiable consuming spirits," which might want to steal the rice. The fence around the little field is to indicate to the animals of the forest, which might want to come and eat the rice that is planted, that they should stay out of the field. All is symbolic for the main field.

The blessing of the rice seed with chicken blood (baak smlah hngo'). For the ritual action of initiating the planting season, the mother of the household (*ma'gaang*) has to get herself ready, wearing new clothes and a new headscarf, a silver bracelet, and necklace, before carrying the family seed-rice to the field in a back-basket. After arriving in the field, she places the back-basket with the seed in the center of the field.

When the father of the household has finished preparing the ritual miniature field, the mother will take a silver bracelet, a silver necklace, and their talisman (*prnèèt*) (consisting of a small bagful of items such as special stones with special powers, that are used to attract the spirits) and place them all inside a small basket (*bèèm*). She then adds a small quantity of seed of each variety of rice to be grown to the offerings

already in the small basket. Once this is done, she slits open the beak of the chicken, intended for the sacrifice, letting its blood run over the rice seed, the talisman, and the silver items. This is what is called *baak,* to "smear" (sacrificial blood on) the rice seed. While the blood is applied to the rice seed varieties, the mother recites (*a bor*) the following prayer:

"Please, spirit-soul of unthreshed rice (hmmal hngo'),
spirit-soul of cooked rice (hmmaal mah), don't be angry or cross.
Today is the good and perfect, and long-awaited day.
The other people (jè') far around also say this is the one,
and the holy man in the cave also believes it's a good day today
to start planting the rice seed.
Let every grain sprout and every root grow fast!
Oh, yes!
If there are no runners, go and get some from the elephant grass.
If there is no mother-plant (ma'), go and ask for one from the tall "cèèp" grass.
Grow and sprout in a hurry, stump and tree!
Would anyone forget the apple of his own eye?(=descendants)"

After communicating in this manner with the rice spirit-soul, the spirit-soul of cowrie[5] and money *(hmmaal kmuul ksôông)* is addressed as follows:

"Oh, yes, we are pouring blood on cowrie (shells) and money and talisman.
May the rice we plant and the rice we eat be lucky!
Climbing up the slope above the village,
may we meet the nest of the bronze drum-gong yaan (= treasure).
Climbing up the slope above the houses,
may we meet the silver stack.
May we get bundles of silver and bags full of silver "six-alloy" (nam hrôk).
May we get good silver like they have in (Kmhmu'-) Rook country (= pure),
Chinese and Vietnamese white silver.
May goodness turn towards us.
We implore, we implore you!"

Following the offering to the rice spirit-soul, a tray-table of food is prepared and served to the participants in the ritual. After this ritual meal is finished, the mother of the household *(ma' gaang)* goes to initiate the planting work by taking some seed of each variety of rice the family will plant, dibble planting a small area of each in the ritual miniature starter field, while reciting the following blessing:

[5]Although cowrie shells (*ksôông*) are not used as a form of currency anymore, reference to them is often made when talking about money and wealth in a poetic way.

"Oh yes, a good and perfect day—a beautiful day—it is today
for initiating the planting of this rice!
May each germ sprout and every root grow!
If there are no runners, go ask for some from the elephant grass.
If there is no plant, go and ask for one from the tall grass.
Grow, sprout, explode, stump and tree!
We are initiating the planting this new year on this cleared field.
No one should forget his own eyes or nose (=offspring)."

When this ritual initiation of the planting is completed, the mother of the family will scoop out rice seed into each of the belt-baskets that are to be worn by different female members of the household and others assisting in the planting of the family's rice field. She then still has one more ritual to perform. For this, she lights a special foul-smelling torch made with a grease-soaked rag or with the bark of a rotten tree, sits down in the field, and again addresses the spirits:

"Hey, let's not have any devouring and the consuming spirits,
nor any "foamy-grasshopper-widow-spirit" come in.
Come and help us plant the rice, the food we need most.
From now and forever, keep them away!"

The smelly torch is then discarded and the dibble planting of the rice in the main field can then commence and it is usually completed within two or three days as a collective effort by family and friends.

Dibble planting of upland rice

Depending on the region, the Kmhmu' use different tools to dibble-plant their rice fields. Some regions use long, wooden planting sticks *(groong cmool)*, while others use a shorter planting stick *(clè),* or diggers with a small, narrow, spade-like iron blade. Dibbling done with the long, wooden planting sticks requires two people working together, one (usually a man) taking the lead while punching seed holes in the ground, with the second (usually a woman) following behind to drop seed into the holes (Photo 6.3). Dibbling with a short *clè* digger can be done by one person making the holes with one hand, while dropping the seeds into the hole with the other. In some areas with relatively flat, smooth terrain, such as the plain of Xieng Khouang, people also use a special kind of long dibble stick called a "sounding-stick," so named because of the musical sound it makes when being used. The sounding-sticks (*groong wwyh*) are usually used along with the ordinary long dibble sticks (also called "dumb-sticks," *groong sluut*). The musical dibble sticks are ancient ritual instruments, which, in the past, were used not only to make the work of dibbling proceed quickly according to their rhythm but also to call rain for the fields at the same time. The choice of dibble sticks depends on both the type of land and the regional ritual traditions of the Kmhmu' planting the rice.

Feeding the field-spirits

Traditionally, the Kmhmu' also feed the area-spirits of the fields while they cultivate their rice crops. This is usually done twice. The ritual of "closing the seed hole" is the first of these rituals, the purpose of which is to make a pact with the spirits living in the field area, asking them to keep and protect the rice seed that has been placed in the seed holes. In turn, the farming household promises to prepare another meal for these spirits once the rice is being harvested. This promised meal will represent a second offering to the field area-spirits at harvest time. Both events are commonly referred to as "feeding the field-spirits" *(liang hrôôy hré')*. For each of these rituals, an elder or an older member of the family with a knowledge of the prayers and rituals presides over the ceremony.

Ritual of "closing the seed hole" (first feeding of the field-spirits)

In preparation for the ritual of closing the seed hole, a temporary platform *(raan)* is constructed beside the ritual miniature rice field (Photo 6.4). A bamboo stalk is then used to make a symbolic giant arched rice stalk. Thin, narrowly split bamboo bands are woven into rings and a chain; a woven cricket and a woven fish are then attached to the ends of the bamboo chain, which, in turn, is suspended from the top of the arched stalk. On the ceremonial bamboo platform are placed four pieces of wood, cut into the shape of silver bars, together with two skirts and two double-arm-span lengths of cloth. Also added to the platform as offerings are plates of traditional delicacies such as chewing bark, tobacco, betel leaves, areca nuts, and lime. Underneath the platform are placed a silver bracelet and a necklace, together with an open jar of rice wine (to attract the invited spirits and let them smell the rice-wine vapors). Three prayers are then recited. The first prayer (in a type of ritual Lao-Thai language marking the distance) calls upon these spirits to receive the gifts:

> *"Oh spirits (hrôôy) of the soil, of the termite hills,*
> *of the region and of the surroundings!*
> *Owners of the country, owners of the place where we live*
> *and of this very piece of land here!*
> *Protect this field and this section of field, take care of it.*
> *Care for the gardens of the Tva' family and of their house.*
> *Now, oh, do not let the mice bite the shoots off*
> *and the animals scratch them out;*
> *don't let the first leaves die or the top leaves droop."*

Such words are spoken while feeding the area-spirits of the field and the spirits of people known to have died in the area, calling them by name, one by one.

For the second prayer, a chicken is cooked and then offered to the spirits. When they have eaten (acceptance of offerings is determined by divination), a third prayer of thanks is recited. These prayers can differ, depending on the reason for which the spirits are called upon. To ensure that everything is done correctly, other signs are

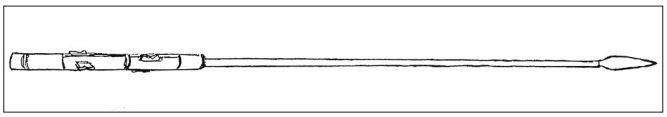

Fig. 1. Musical dibble stick *(groong wwyh)*.

examined, such as the shape and look of the feet of the cooked sacrificed chicken once it is boiled. This is all done in a way similar to when making offerings to other spirits such as the "spirits of the country and the paths" or the "spirit of the graves."

Rituals calling for rain during, or following, dibble planting

When the dibbling work is completed, special rituals to call for rain are sometimes performed by some of the Kmhmu' subgroups such as the Kmhmu' Rook in Oudomxay Province and the Kmhmu' who live in the mountainous areas of Sam Tay District of Houaphanh Province. Some subgroups do not have separate rain-calling ceremonies, while others use musical dibble sticks during planting to simultaneously call for rain to assist the germination of the newly planted rice crop.

The musical dibble sticks of Xieng Khouang Province. In the past, the Kmhmu' of Xieng Khouang Province made musical dibble sticks *(groong wwyh)* for use on days when they called on other members of the community to help with the planting of their rice fields (Fig. 1). The fields in which such dibble sticks were used had to have smooth terrain. They could not be used on steep slopes. As the season for planting the rice crop approached, all Kmhmu' households in this part of Laos would make musical dibble sticks, making one, two, and sometimes three per family. On the day when they were called upon to help with the planting of someone else's rice fields, the men and household heads would shoulder their own musical dibble stick and go to the fields. Planting would commence with those carrying the dibble sticks moving in a line across the field, making seed holes by hitting the ground with the sticks, while at the same time producing "the rhythmic music" for everyone to work by. Behind the men would follow the women and children, dropping rice seed into the holes. Sometimes between 10 and 20 of these musical dibble sticks would resonate with their *"bring bring"* vibrating sounds being carried over the fields and echoing through the air. The sounds created by the musical dibble sticks were believed to ascend to the place of *Lord In* and *Lord Thèèn* of the heavens, who, upon hearing them, would then respond, sending rain down on the fields of newly planted rice.

The termite-hill-drum (groong wwt) of Sam Tay District, Houaphanh Province. The Kmhmu' in some remote mountainous areas of Sam Tay District of Houaphanh Province near the Vietnamese border used to perform another rain-calling ceremony using a type of "earth-drum" or "termite-hill-drum" (Fig. 2). This drum is built using a cavity in the ground such as an earth nest of termites. The cavity (about 40 to 60 cm in diameter) is covered with a woven bamboo screen or thin layer of bark, which serves as the drum membrane, its edges firmly attached to the ground with wooden

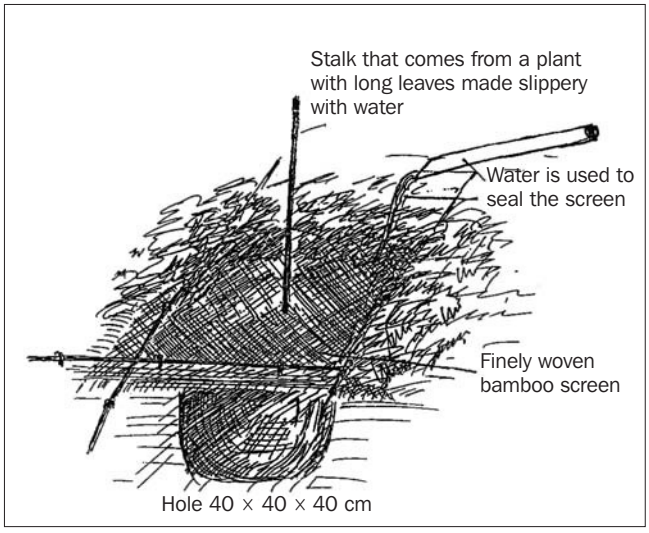

Fig. 2. Earth-drum or termite-hill-drum *(iit iing)*.

pegs. A leaf-stalk of the fragrant *dru* plant[6] (*Phrynium capitatum*), knotted and then run through the center of the screen, provides a string that can be pulled, rubbed, or stroked, causing the screen to vibrate and the cavity beneath in the ground to resound with loud, complaining *wwt wwt* sounds. This instrument has therefore been given the Kmhmu' name *groong wwt* ("plaintive stalk"), but it is also called "*iit iing*" (a name reminding of its sound).

The occasion for making and playing the earth-drum or termite-hill-drum was usually at the beginning of the season, if rain was late in arriving, or later, around the time of making offerings to the field-spirits, when the rice was about knee-high. So, in an attempt to induce the rain to fall, an earth-drum was made and played, "making earth and sky vibrate to its thundering sound." Upon hearing it, the "spirit of lightning" *(hrôôy cndrayh)*, also called "dragon spirit" *(hrôôy pryoong)*, was expected to get annoyed and angry, finally pouring rain down on the thirsty land, thereby allowing the rice seed to germinate and the plants to grow and provide the people with rice grain to eat.

The rice-kldoong of the Kmhmu' Rook of Hun District, Oudomxay Province. The Kmhmu' Rook from Meuang Hun of Oudomxay Province have a yet different tradition for calling for rain. This tradition is based on an orchestra of four to six people who play paired bamboo resonator tubes (*kldoong*), while being accompanied by other percussion instruments such as a long foot-drum or button gongs. The orchestra produces, in a rhythmic way, an unusual combination of percussion and droning sounds. Each Kmhmu' Rook village usually has its own special interesting type and size of

[6]The leaf of this plant is also used as the fragrant wrapper of traditional rice cakes.

bamboo *kldoong* that produce their own unique sounds (Photo 6.5). Each bamboo resonator tube pair has a special name according to the role in the rhythmic playing of the orchestra. The names of larger tubes are preceded by "mother" and the smaller ones by "child."

On the final day of rice planting, the *kldoong* are made from *r-haang* bamboo and already beaten on the way home from the fields. Once arriving at home, the planters take rice wine and a pig to the house of the respected brother of the mother's family *(éém)* to eat and drink and celebrate there.

That evening, the whole village would gather and beat the *kldoong* and listen to their playing, drink rice alcohol, and have a good time together. In the old days, the villagers also dressed up two people like forest spirits, using forest palm leaves to clothe them and transforming and painting their faces so they would look like fierce animalistic spirits with pointed heads and long teeth. In addition, the two monsters would have a big, frightening-looking symbolic phallus bound on a string from their waist. The young and old men would play the *kldoong* while the women would try to splash water over the players to indicate that it was female heavenly angels and spirits that were responsible for making the rain for the rice crop. The two forest spirit-monsters would dance around the players trying to keep the women and girls away from the *kldoong*-playing men using their frightening giant phallus to chase and scare the womenfolk away. Just before the end of the *kldoong* playing, the women would take water and throw it on the players and declare:

"There shall be rain and thunder and splashing water.
Water shall splash on the chestnut flowers, and on the flowers of the lôôñ[7]
fruit,
come to our village, so be it please!"

Everybody would then loudly call out and shout their approval together.

The period of growth of the rice crop

During the period of crop growth following planting, no special rituals or customs are observed until the crop approaches maturity. The only exception to this, as mentioned earlier, is for households that have constructed a type of house called *gaang tè'* in the preceding dry season, and who will need to offer a special meal, called *mah tmbri*', to their house-spirit at the time when the rice is about knee-high in order to lift a food taboo. However, during this time of growth of the rice, two or three weedings are undertaken, mostly done by the women using a special bent hand-hoe called *vêêr*. The men protect the field area against incursions of forest animals that might damage the precious ripening crop by using diverse traps and scaring devices and by hunting and so also keep the family supplied with meat to eat.

[7]A tree species whose wood is highly regarded for construction purposes.

The harvest and threshing of the rice crop

In connection with the harvest of their rice crop and subsequent storage of the grain, the Kmhmu' maintain many different customs and traditions related to their beliefs and respect for their house-spirit *(hrôôy gaang)*, the spirits of the fields *(hrôôy hré')* and the land *(hrôôy pté')*, and among others the many wandering spirits *(hrôôy hyaap, hrôôy boor)*.

The Kmhmu' rice harvest under upland conditions starts about early September and, if additional paddy fields are planted, it can last until December (depending on the climate, the maturity time of rice varieties, and field type). Harvesting is a collective activity in which many people of the "field working group" as well as other friends and family members participate. Harvesting requires a lot of preparation, as the family whose field is to be reaped is responsible for equipping and feeding all participants, including providing a supply of rice wine. Harvest time is a happy time of working and being together, of courting, singing, and sharing stories with each other.

The rice crops of the Kmhmu' are harvested in different ways depending on the rice variety and the region. The so-called "sickle-rice" *(hngo' kiiv)* is, as the term suggests, cut with a sickle and then stacked in round rice-stacks with the grain-filled panicles pointed to the center of the stack, where it will be left to dry. When dry and ready for threshing, it is threshed by beating the grains off the panicles using a special L-shaped threshing stick, or by beating the rice bundles onto a slanted threshing board similar to that traditionally used by the Lao of the lowlands. In recent times, there has been increased used of threshing machines. The *kiiv*-rice may also be harvested by hand-stripping *(hoot)* the grains directly from the panicles into the belt-basket, which is carried in front around the waist of the harvester. Hand-stripped grain is considered softer when cooked. In northeastern Laos, in Sam Tay, other varieties known as *taan*-rice are harvested using a special hand-held cutter *(hèèp)* that harvests just the panicles with enough stalk attached to allow for binding them into bundles. As *taan*-rice does not shatter or lose grains easily, it is first stored in a temporary drying-rack-wall built in the field, and is allowed to dry while the rest of the rice is harvested. After the harvest, the *taan*-rice bundles are carried to the village and stored in the permanent family rice storage-house at the edge of the village.

Rituals during the time of harvest and threshing of the rice crop

Prior to and immediately after the rice harvest, a variety of traditions are observed by the Kmhmu'.

Ritual of starting to eat new rice. When the new rice starts to ripen, the Kmhmu' perform the "starting to eat new rice" ceremony *(rèèk mah hngo' hmmé')* in order to begin eating the new rice. For this ritual rice harvest, an auspicious time and day have to be chosen. On that day, no rice should be accidentally spilled by anyone, lest the "never satisfied spirits" *(hrôôy hyaap)* and the "consuming spirits" *(hrôôy bôôr)* be attracted. On the appointed day, the mother of the household carries her back-basket, takes a wooden torch *(cndôh h'é'),* and walks up toward the rice field until she arrives at the last path, which branches off leading to her own field. There, she, or whoever is with her, will build an arch over that particular path. Two long wooden sticks are

planted into the ground on each side of the path and then bent toward the middle of the path to get an arched top. A palm-leaf or some other type of leaf is used to finish the arch. A torch that burns by means of a grease-soaked cloth (and spreads an unpleasant smell) is fastened onto the arch. The mother then addresses the spirits with the following words:

"Hey, spirits (hrôôy), if you want to eat, there's grass there!
Don't you try to follow me and get our first new rice!
I'll enter into the archway now and leave you behind!
We don't allow you to pass here and go on any further!"

On finishing this warning, she passes through the arched gate carrying her back-basket. When she arrives at the center of her field, she reaps some of the almost ripe rice, in all a quantity contained in about two sheaves of ten bundles. If it is *taan*-rice, she cuts the heads using the hand-held rice-cutter, and, if it is sickle-rice that easily shatters, she strips the grain directly from the panicle into her small belt-basket. She then carries this first portion of the new crop home, where she prepares a special kind of ritual "first rice"[8] *(mah pr'wp)*.

The same evening at home, a chicken is killed as an offering to the honor and well-being of the members and descendants of the family line. The *pr'wp* rice is served and the house-spirit is notified that the first new rice has already arrived and will presently be sampled and tasted. After the tasting, the house-spirit is expected to be eager to come and watch over the rice crop, preventing wild animals and pests from destroying or eating it. A jar of rice wine is opened and some of the alcoholic rice and husk material is lifted out with two flat sticks, and offered to the house-spirit to taste also.

Feeding of the field-spirits at harvest time. At the stage when about half or two-thirds of the rice has been harvested, the second ritual food offering to the spirits of the fields is performed. It takes place on an auspicious day and requires a pig, two chickens, and two jars of rice wine. The day before, the villagers and all members of the extended family are notified and invited to join the final stages of the harvest and the ritual meal. The ceremony for the second feeding of the field spirits uses an enlarged version of the ritual platform (*raan*) that was used earlier for the ritual of "closing the seed-hole." On top of the platform are displayed several items, including two token silver bars made from wood, a carved wooden rhinoceros horn, and a wooden elephant tusk. Various items of clothing and pieces of cloth are also placed on the platform, together with many offering plates decorated the same way as for the "closing of the seed-hole" ceremony and containing chewing bark, tobacco, betel leaves, areca nut, and lime.

[8]*Mah pr'wp* is rice that is harvested before it is quite ripe. Before it is eaten, it is presteamed within the husks, then dried above the fireplace and only after that pounded and steamed again. The flavor is nutty and the color light brown.

When the villagers and relatives arrive at the field on the appointed day, they all join in the final stages of the rice harvest. Only the close friends of the mother and father and the village elders, including the performer of the ritual, remain at the platform near the field hut in order to attend the ritual of feeding the spirits of the fields *(liang hrôôy hré')*. After the offerings are laid out on the platform and the rice wine is opened, the performer of the ritual lights a beeswax candle, places it next to the platform, and recites the following prayer (in a mix of ritual Lao-Thai and Kmhmu' languages marking the distant relationship to these spirits):

"Oh how beautifully yellow and ripe are the rice plants!
Oh, we will cut them off, may we be very lucky from now on!
Now the rice has come, it has arrived!
Spirits of the region, owners of the land,
of the area and of the plots of land,
keep your guard over the field as true noble owners of land.

After the prayer, divination *(knè')* is used to consult the spirits. A pinch of rice grains is placed into the hollow hand and checked as to whether the number of grains is even or odd. If the grains of several consecutive pinches are an even number, this is regarded as a sign that the spirits have accepted the gifts. The pig is then killed and cooked, and presented as an offering to the spirits, with more prayers. The rice wine is then opened and the spirits are first invited to taste it. A special wine-serving set consisting of a water container *(rngbaang)*,[9] a ladle *('muay)*, and a buffalo horn measure *(nééng)* is used for measuring and serving the rice wine. The elder conducting the ceremony recites a prayer while taking hold of a bunch of bamboo drinking straws, raises them up toward the platform, and motions to the different spirits, inviting them to come and drink. After that, he raises the buffalo horn that is used to measure water into the rice-wine jar, as if offering drinks up to the spirits, urging them to drink well and plenty.

Following this feeding of the area-spirits *(hrôôy A-vông)*, the grave-spirits *(hrôôy rmaan*, representing the people that died while in this area and were buried here and are now watching over it) are fed. This is done on a smaller, separate ritual platform or altar that is erected and decorated in a similar manner, next to the first one. For this additional ritual, the requirements are two chickens and two bamboo tubes of rice wine, together with an assortment of clothes, a bracelet, a necklace, some ancient cowrie shell money, silver money, and other items. As the spirits of the graves of the dead are fed, they are addressed with the following words in the Kmhmu' language:

[9]The water basin was originally made from a half of a big gourd *(plé' gôôk)* and the ladle from a half of a smaller type of bottle-gourd.

"Spirits of the graves, spirits of the water-barriers,
you that are the keepers of these surroundings,
feed yourselves and your own.
Don't feed on the food of the regional spirit (A-vông).
Eat by yourselves, drink by yourselves!"[10]

Ritual of the "rice-mother calling the rice-child." On the same day as conducting the ritual of feeding the field-spirits during the harvest, yet another ritual, the "rice-mother calling the rice-child" *(ma' hngo' k'eey koon hngo')*, is performed. The people who have been working together on completing the rice harvest are now called to return. When they arrive, the mother of the household that owns the field prepares what is called the "rice-child" *(koon hngo').* For this, she gathers two or three panicles of each variety of rice that she herself has planted inside the ritual ministarter-field *(mat rèèk)* with the symbolic giant bamboo rice stalk that was established before the planting of the main field. She puts these rice panicles in her small waist-basket. Inside the basket are already a silver bracelet, a silver necklace, and the family talisman objects. The whole basket is now referred to as the "rice-child *(koon hngo')* (Photo 6.6)." The mother of the family then takes a chicken, boils it, and pinches off some of its soft comb and tail, then calls the rice spirit-soul *(hmmaal hngo')* to come and receive the food offering *(sngkhvan hmmaal koon hngo')* while reciting the following words:

"Rice-child,[11] *don't you ever forget your own body or face again!*[12]
From now to the twelfth month the new rice of the field will be dry.
We want to take the rice-spirit to go and cut off rice, oh, yes.
We will bless you, will pour blood on you, and wash you,
will keep feeding you and serving you food to eat
and drinks to drink in abundance."

This blessing ceremony for the rice child requires a chicken and a jar of rice wine. The rice wine is then set aside for only the womenfolk to drink. The mother of the family is now referred to as the "rice-mother" *(ma' hngo')*. Following the offering to the rice-child, food is served to all people attending the harvest. After people have eaten, jars of rice wine are served for everyone to drink in the traditional way. The festive mood carries on well into the night, with the harvesters chanting poetry they have composed themselves, wishing each other well and telling their personal stories. After the ceremony, the rice-mother carries home the small waist-basket (containing the rice panicles she placed in it before, and which now represents the rice-child) and keeps it in her house[13] until the day when the rice harvest is officially brought into the

[10]This prayer to the grave-spirits is all in the Kmhmu' language.

[11]Both field rice and cooked rice are invoked in reduplication (*koon hngo', koon mah*).

[12]That is, "remember your duty."

[13]The attractive gifts that were first in the basket when she collected the rice-child are put there only for the ritual and are removed afterward and stored in safety.

"rice storage-house" *(c'ô')*. Then she moves the rice child to the rice storage-house, where the small basket with the rice panicles is tied to hang down from the main roof-beam (*phraang gaang*). Tying the rice-child basket to the roof-beam in this way has the meaning of storing and safe-keeping the spirit-soul of all rice: field rice as well as cooked rice (*hmmaal hngo', hmmaal mah*).

Feeding the rice spirit-soul before threshing. On the first day of threshing before the actual commencement of threshing, the mother of the household again has to kill a chicken and offer it to the rice spirit-soul. Enacting the role of the mother of the rice-child, she climbs on top of the rice stack *(knduur koong hngo')* to perform this blessing of the rice spirit-soul (*sngkhvan hmmaal hngo'*) before pulling from the top of the stack the first rice bundles that will be threshed to ritually initiate the threshing (Photo 6.7).

Rituals related to the transportation and storage of the rice harvest

Seed of each rice variety is always kept for planting in the following year. The grain to serve as seed is carefully selected and sorted, with seed of different varieties being stored separately. The rice that is to be kept for family consumption or sale and the seed-rice is stored in the rice-house *(c'ô')* (Photo 6.8). If the rice fields are close to the village, the rice-house will be in the village; these rice-stores are often at a distance from the family houses as a precaution against the loss of their food in the event of a fire in the village. If the rice fields are a long way from the village, a rice-store may be constructed there, with the rice then being carried to the village for consumption as needed. With recent improvements in roads and transportation in some areas, vehicular transportation of the rice crop to villages is increasing. Specific rituals are also followed relating to ensuring the safe-keeping of the rice during storage.

Feeding the rice spirit-soul before transporting the harvest home. Once the rice is threshed and winnowed, a chicken is killed and its blood poured on the rice as an offering and blessing to the rice spirit-soul (Photo 6.9). This action is called *baak sngkhvan hmmaal hngo'* (smearing-blessing the rice spirit-soul)**.** The rice is then transported home to the rice-house. This work continues until all stacks are threshed and the grain is stored in the granary.

Calling the rice-soul home to the rice-house. On the occasion of transferring the rice into the storage house, the following prayer is recited by the father of the family that owns the rice, in order to call the rice spirit-soul *(hmmaal hngo')* home:

> *"Oh, we call the rice spirit-soul to go home to the rice-house,*
> *to the roof-beam of length, to the roof-beam of width.*
> *Hey, return home to create, to repair, so we will have a long life.*
> *Be elevated, be raised (in status) rice spirit-soul!*
> *Hey, "white rice" that has long panicles, return, return to me (male[14]) today.*

[14]In this prayer, the person praying uses the Lao word for "young man" *(laang)* for himself, so it must be done by the father of the family: if it is the mother, she would replace *"laang"* with *"naang."*

"Vaay" rice, with long panicles like banana stalks, come home to me (male) today.
"White rice," I (male) will smear (bless) you on the threshing mat,
and you, "vaay" rice, in the basket.
I (male) will store and keep you for the village: they are all waiting to get some.
I will store and keep you for the village,
for the young generation of the family and of the house
is waiting to have something to chew.

The fathers sit in the corners by the fireplace
and the mothers in the corners of the bedroom.
I myself will sit here to contemplate and chew.
The room is not bad.
The house looks full from the outside,
it's stuffed full up to the rooftop, full, ready to burst,
the rice is filling up every space.

The village will have something to chew
and everybody will rush trying to chew it first.
The rice plant will sprout for me in all its strength;
the leaves will be sprouting nicely, wide and spread out.
The "black rice" is like the young man and
the "white rice" like the young lady.
Rice-soul, rice-spirit,
come to the rice-house under the roof.
Hey! When my basket will be suspended on the ladder,
pounding rice in the foot-rice-husker is a pleasant thought.
It is a beautiful sight like seeing a handsome young man,
just perfect and strong.
Slowly kick the husker, slowly step down, slowly step,
slowly observe from afar.

Return, come and eat, soul of rice, spirit of rice.
Coming home at day time, it is good;
coming home at night time, it is fine.
Staying up there,[15] *you will fear rats;*
staying on the ground, you will fear the "koon dèèn".
So come home and stay in the rice-house here,
under the beams, with the roof overflowing with rice.
Rice-spirit-soul, come home and eat!"

[15]In the fields.

Other rice-based field rituals connected with the family's house-spirit

The ritual meal for the house-spirit. In those years in which a family has built a particular type of new house (called *gaang tè'*) to be the home for themselves and also for the spirits of their dead parents, that family has to perform two additional rituals during the planting season. A first ritual meal (called *mah pnggwl*) is celebrated when the fields are burned (which is a time of special vulnerability for those involved). If there is sufficient time, this ritual meal is prepared on the same day as that on which the burning takes place. If there is insufficient time on that particular day, the meal can be prepared and the ritual performed within two to three days after the main burning *(guuc)*, but before the final cleaning up of the fields *(puur)*.

First, a small hut is constructed not far from the village, on the path that leads to the farmer's field. Two narrow offering trays, resembling the ones used to feed the house-spirit at home are made, one from a half of a small bamboo tube and one of woven bamboo strips, and then attached to an inside wall of the hut. A jar of rice wine, a chicken, a bamboo tube of sweet fermented rice, and a rice-basket full of black rice are prepared and carried to the hut, where a ritual meal takes place around three or four o'clock in the afternoon. The rice wine is opened and placed near the ancestor-feeding-trays. The father of the house takes the chicken, cuts its beak, and applies the blood first to the woven upper shelf, which stands for the direct patrilineal ancestors, reciting the following words:

"Now the grandchildren, the children, and the younger siblings
have burned the fields and their divisions already.
We want to let you know, our mother and father,
who are our house-spirit.
Tomorrow or the day after, we will go and clean up our field divisions.
Please do watch over us, over our hands and feet.
Don't cause any thin leeches to get in our nostrils,
nor anything to hit or hurt our eyes.
Slanted tree, don't point at us; twisted serpent, don't bite us.
Father, mother, house-spirit, now you can't say that we haven't told you."

After smearing the upper tray, he lets some of the chicken blood run into the bamboo tray underneath. This second application of blood is to represent the symbolic feeding of deceased in-laws and any dead children of the family. The following words are recited at that time:

"So that there be fields,
watch the field divisions and the separations of the wet fields.
Please don't let the mice bite, or the animals dig out the rice!"

Then the chicken is cooked, and some of its soft meat is first offered to the spirits, followed by the meal for the family and the customary drinking of rice wine. The family then returns to its home.

The ritual of eating new leaves. Later in the growing cycle, during the time of weeding when the rice has grown to about knee height, and the pumpkin leaves and bean leaves (which are usually planted along with the rice) have put out long shoots, some shoots of these plants as well as of some specific wild fern types are collected and cooked in a soup to use in the ritual of "eating new leaves" *(mah hla' tmbri')*. When conducting this second field ritual in honor of the house-spirit, the old hut on the way to the field and the offering trays (earlier built for the first ritual meal in the fields and designated to the house-spirit, *"mah pnggwl")* are repaired and used again. The ritual of eating new leaves requires in all two chickens and two jars of rice wine. In the evening of the selected day, one jar of rice wine and a chicken are taken out to the hut and offered to the spirits while reciting the following words:

"This is the meal of freshly-harvested leaves and greens,
cooked to eat around the table.
From now on don't say you didn't hear us tell this to you,
or that we didn't let you know anything, our father and mother, our house-spirit.
We will eat of the leaves and greens, of the fern stalks and fern leaves.
We will cook them back at home and then bring them out here to eat on the tray.
Now the rice is already quite big and tall!
Watch over us all, go and watch over all
so that the mice won't bite,
or the animals dig up the harvest.
The first leaves: don't let them die;
the top leaf: don't allow it to droop.

We prepare for you to eat, plenty of stems and leaves of the fern,
mid-way to the water channel, on the way to the fields.
After eating, take your responsibility and watch over all:
the children, grandchildren, the younger siblings,
the nephews and nieces who will work the fields and go trapping,
who are doing all the work,
and who make things happen."

The ritual meal itself is celebrated in the same way as the earlier meal for the house-spirit. The only difference is that, on this occasion, the first leaves and new shoots of vegetables also grown in the rice fields are cooked and served along with the chicken. After the food is eaten, the offered rice wine is drunk. The family then packs up everything and returns back home where a second chicken is killed and another rice-wine jar opened and offered there to the house-spirit to taste first. The chicken is cooked and pumpkin leaves and the young shoots of other plants are also added. After the chicken is cooked, some of the food is offered to the house-spirit on the family's spirit-feeding trays to taste, while saying:

"Don't forbid or taboo (sri') from now on (in the year)
that we offer you to eat new leaves and greens,
new pumpkin leaves, and new daisy leaves (hla' hmbrèèt)!"

From that time on, the leaves of the various plants can be cooked and consumed again. Before this ritual is performed, traditionally the Kmhmu' concerned with the described ritual duty were not allowed to cook any leafy food in the private room of their house, nor offer any such food to the house-spirit in his residence *(lôôk),* which is also where rice is cooked.

End-of-harvest and Kmhmu' New Year celebrations

After the harvest is brought in, the Kmhmu' people celebrate yet another ritual connecting both their ancestors and rice. It is a type of passage rite of rice cycles, or yearly cycles, and at the same time a thanksgiving celebration for the blessings of the year that has passed, which some people equate with their traditional New Year celebration. However, this very important celebration was traditionally not on a particular date, nor was it celebrated by all Kmhmu' around the country or even in one village on one specific day.

Rice-cycle and year-cycle passage rite

In times past, the months of December and January of every year were observed as taboo (*sri'*) for work, in memory of the famous Kmhmu' ancestor and hero Cheuang. During this time, the Kmhmu' had to offer food sacrifices and prayers to the spirit of Cheuang, who, as a child, was also called Ñi and who is regarded as the Kmhmu' people's mighty ancestor leader and the source of all knowledge. So, in December or January, after the rice harvest has been brought to the rice storage-house, a *greh* ceremony or *vwayh* ritual in honor of the spirit of Cheuang and Ñi must be performed. Traditionally, these activities did not involve the whole village or community, as is commonly the case in more recent times. Whichever household or family completed its harvest first was the first to celebrate its individual family *greh;* households that finished their harvest later celebrated their *greh* later. The *greh* celebration is simply a ritual ceremony with a meal during which the family formally concludes or "takes down" the old year and welcomes or "puts up" the new year. The *greh* celebration does not have to be elaborate but needs to be celebrated every year, sometime in either December (Cheuang) or January (Ñi). (January is considered the birth month and December the death month of Cheuang.) To return to the fields for preparation of the succeeding year's rice crop, without first having celebrated the *greh* on completing the harvest of the previous year's crop, is regarded as being very inauspicious.

The *greh* ritual touches on a great many aspects of the life and culture of the Kmhmu', such as preparing and serving food, planting fields, harvesting and storing the rice crop, and raising various kinds of animals. It also relates to the digging up *(grwayh)* of various kinds of tubers, thereby reminding the Kmhmu' people of how they have survived in times of famine without rice. Furthermore, *greh* is a ritual of thanksgiving for all things that have contributed to the productivity of their fields.

Finally, in this ritual, all the personal spirits *(hmmaal)* are called for each person, to return home, and the spirits of their deceased parents, who now rank as beloved house-spirits *(hrôôy gaang-'naam pang),* are fed while asking them to look after their offspring and their belongings, including animals and valuables, in the year ahead.

During the *greh* ceremony, the father of the house cuts open the beak of a chicken and smears some blood onto the knees of the family members, starting with the smallest child and ending with the oldest member. The father gets his knees smeared last by his wife. All valuables belonging to the family such as cowrie, money (silver) and any talisman, the rice-child, and field tools are also smeared with chicken blood, as are any animals such as cows or buffaloes (if not directly, then on a pictorial representation of them) to feed their personal spirit-souls. This is how each family concludes, or "takes down," the old year, and then opens, or "puts up," the new year. Many prayers are recited in which the house-spirit is honored, praised, and begged to keep protecting the family and belongings throughout another year.

The *greh* celebration, whether conducted as a large or small ritual, in one or another regional variation or family totem tradition, is always a very important event in the lives of most Kmhmu' people and there would be fears of repercussions in case of an omission of this ritual duty.

Art in greh. The communal *greh* celebrations have both ritual and social components. The ritual component takes place around a richly decorated bamboo pole from which flowers, fruit, tubers, and field tools are hung, and under which various instruments, traps, rice wine in jars and in bamboo tubes, and different kinds of rice cakes and steamed tubers are displayed (Photo 6.10). During the communal celebrations, which have become fashionable in the last 15 years, the people sometimes carry out various artistic performances of which they are proud and display artifacts and wear costumes that have now mostly become folklore. Among the field tools are sometimes included the musical dibble sticks that were used for planting rice in some areas and these can also be used in a rice-planting dance. Cymbals, button-gongs, stamping tubes, and whatever percussion instruments the family may have are also played during the second more social part of the *greh* celebrations. In the provinces of Oudomxay and Bokeo, the Kmhmu' also play their bamboo resonance tubes (*kldoong*) in orchestras of four to six players, in the same way as when they play them to call for rain after the completion of dibbling work. Well-off Kmhmu' families may display their bronze gong-drum *(yaan*) and have it played along with the other percussion instruments during the feast that marks the celebration. Other instruments that may be part of the *greh* ceremonies are bamboo stamping tubes, bamboo dulcimers, gourd fiddles, flutes and pipes of many types and sizes, and finally bamboo humming forks, all of which may be played to accompany the *teem* poetic singing or as part of musical groups.

Rice alcohol in Kmhmu' rituals

Every ritual in Kmhmu' society uses rice alcohol of some sort. Probably by the nature of its volatility and smell, alcohol has become thought of as an especially appropriate form of rice to attract spiritual beings, just as it is enjoyed by the Kmhmu' people celebrating. Alcoholic rice preparations create a special joyous atmosphere, which, it

is believed, the spirits would like to be a part of. Furthermore, rice alcohol links and unites people of a great many social and ethnic backgrounds, breaking down social barriers that otherwise cannot be easily trespassed. Beyond that, rice alcohol passes the barriers between the material and spiritual world and is used in facilitating and sealing pacts and important contracts in family and society.

The Kmhmu' drink mainly two types of rice alcohol: rice wine *(buuc kdong, buuc sa),* which is either kept in sealed bamboo tubes *(tông)* or earthenware rice-wine jars *(kdong)*, and the stronger, distilled rice alcohol*,* or brandy *(buuc siav)*, made from rice wine. A third kind of alcoholic preparation is a sweet fermented rice *(buuc sthô')*, reserved for very special purposes.

Rice wine is consumed when a house is built, when magic is performed, when a wedding is celebrated, during healing rituals, and when feeding the spirits of the ancestors of the Kmhmu'. Rice wine is also used in blessing rituals called *hmmaal*, be it for the personal spirit *(hmmaal)* of a person, rice, important possessions such as the bronze drum-gong, or an animal such as a buffalo that is newly acquired and brought into the family. It is also served to welcome one's respected or close family members and dependents when they call to socialize and discuss family affairs (Photo 6.11).

Preparation of rice alcohols

Rice wine. Rice wine is made from glutinous rice and husks. The rice is steamed and then, after some fermenting agent has been mixed with the rice and husks, it is fermented, first in banana leaves and then in sealed earthenware jars. After three more days, the rice wine is ready to drink, but the alcohol level and quality increase if the wine is stored longer. Following precise traditional recipes maintained by families, different flavors of rice wine are produced, from bitter to sweet. The fermenting agent used by the Kmhmu' is also home-made from glutinous rice. Just like all handling of rice in general, the production of the fermenting agent, as well as the production of the various kinds of rice-based alcohol, is considered a feminine duty. The mother of the household is responsible for always maintaining a supply of "fermenting agent patties" (*jwa pdô'*) of each of the strains and rice-wine flavors the family has the tradition to keep and produce (Photo 6.12).

Rice brandy. Rice alcohol or brandy (*buuc siav*) is made from rice wine and is produced by distilling the rice wine a second time, using a simple home distillation technique. Although the Kmhmu' drink some rice brandy, it is not as popular as rice wine. Many Kmhmu' make rice brandy strictly for ritual purposes. It is generally not consumed in the same way or as frequently as rice wine. However, in some northern provinces such as Luang Nam Tha, Oudomxay, and Phongsaly, this type of alcohol is also served to guests to welcome them and announce them to the house-spirit.

Sweet fermented rice. A sweet fermented rice porridge (*buuc sthô*) is both consumed by the people and used in offerings to the spirits. The Kmhmu' like to eat sweet fermented rice porridge during heavy clearing work and when they are felling trees in the fields, as they regard it as a good source of needed energy for such work. It is also often used for ritual meals for the house-spirit held outside the village, or when magic is used to solve problems.

To prepare sweet fermented rice, black glutinous rice is preferred together with a sweet strain of the fermenting agent. Black rice, when fermented, is regarded as being more delicious and nutritious than white rice; it is also regarded as being more attractive. In producing sweet fermented rice, the rice is first cooked like ordinary glutinous rice. After cooling, the appropriate amount of fermenting agent is added. The rice is then put into a jar or bamboo tube, which is covered with a leaf and allowed to ferment for about two days before it is ready to eat.

Conclusions

The rich inventory of the Kmhmu' rice-based rituals and traditions described above provides glimpses into the rice culture of the Kmhmu' people, who are not concerned only with planting a cereal and eating it as a staple food. Rice is totally intertwined with every aspect of Kmhmu' everyday life, involving their worldview, beliefs, and kinship system, in fact, with their entire intangible culture as well. This is expressed throughout the life cycle of the people, the year cycle, and life cycles of nature and vegetation, with which rice in some ways interrelates. It could be said that rice, the sustainer in all its forms and functions, together with the house-spirit and the totem of the family, constitutes the life line of each clan, representing, in a way, an intertwined centerpiece of the Kmhmu' culture, linked to their survival and perpetuation.

Everything in the life cycle of the Kmhmu' involves rice, not just as food but as a grain people plant and eat to have life. Rice is more—it represents life beyond the physical body whose health is believed to depend on a life element or spirit-soul. This is manifested in the many rituals in which rice is given to feed the soul-spirit of the person to return life and health starting from the day the baby is born up to the effort of feeding the spirit-soul when it is trying to leave the person's body at death. Furthermore, rice is considered as if it were a person itself and is believed to have a spirit-soul just as people do. This is reflected in the ritual of the rice child, in which rice is symbolically adopted as a child of the human family and thereby socially bonded with the Kmhmu' society that depends so much on rice. But, beyond this dimension, rice also constitutes the medium of contact and flow of forces between the living and the dead, between the spirit world and the human world, which is considered essential for the survival of the society in its environment.

These are among the reasons why the planting and subsequent care for the rice crop until it can be eaten and planted again are of such great importance for the Kmhmu'. This involves not only their whole human being but also the cooperation of their extended family, and the protecting ancestors. The work of making rice fields, apart from the heavy physical effort and attempt of keeping predators away from the crop, is accompanied by a constant spiritual concern of maintaining appropriate relations or distance with potentially harmful or helpful spirits in order to protect themselves and their field. At the same time, every effort is made to protect and please the rice spirit-souls in order to not lose any rice. In this effort, each family seeks the help of its respective house-spirit, representing the first ascending patrilineal ancestors (or, if not following the old traditions, of whomever they consider and respect

as the spiritual power the family respects and depends on). It is considered to be the house-spirit's duty to help his descendants to get a rice crop so they will survive and be able to continue their family line.

For all these reasons, changes in the lifestyle of the Kmhmu' people reflect strongly on their rice culture and the underlying system of beliefs that link the food chain, kinship, life and death, health and sickness, and their entire culture, including respect, privileges, and duties in society and well-being in life after death. Changing habits and patterns of livelihood (such as the adoption of new production techniques, the planting and production of cash crops such that part of the household rice needs can be purchased, or accepting work outside their traditional culture or changes in role patterns) can have profound implications for the Kmhmu' in their struggle for survival and a hopefully brighter future. Too many changes, changes that come too fast, or changes too great in the patterns of livelihood, especially if they happen involuntarily or by accident, can result in a deterioration of culture, and of the established social order, leading to an identity crisis for the ethnic group. As demonstrated throughout this chapter, Kmhmu' livelihood, family traditions, worldview, and rituals in their traditional way of life are all intricately interrelated, forming a well-rounded culture owned by this distinct society in its distinct social, geographic, and historical setting. Although culture as such is subject to constant transformation, as old components get lost and new ones need fitting in, time and thought are needed if the change is to become a positive, harmonious experience that enhances the development of the society that owns the culture.

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CHAPTER 7

Rice-based traditions and beliefs of the Hmong

Pheng Sengxua

The Hmong are among the most recent ethnic groups to arrive in Laos. The late 18th century to as recent as the early 20th century saw the migration of the Hmong-Mien (Yao) and Tibeto-Burmese–speaking peoples from southern China, tightening administrative controls in their Chinese homeland being behind this move (Batson 1991, Quincy 1995, UNDP 1997). The Hmong initially generally settled at higher altitudes in the more mountainous areas of northern and northeastern Laos, and later in upland areas as far south as the provinces of Sayabouly and Borikhamxay (Dommen 1995, UNDP 1997). In addition to their movement into Laos, during this period there was also a significant movement of Hmong into northern Vietnam and also into northern Thailand and adjacent mountainous areas of Myanmar (Quincy 1995). In the 1995 census, the Hmong-Mien ethnic group was estimated to represent 7.5% of the population of Laos, with the Hmong comprising the larger component of this group. The Hmong comprise three subgroups—Striped Hmong, White Hmong, and Black Hmong. The three subgroups are similar, with the main basis for the subgroup classification being differences in their traditional clothing. Linguistically, 85–90% of the language is common among the three subgroups, with differences in traditions and beliefs and family relations being relatively small.

The Hmong are animistic in their beliefs, with a strong tradition in shamanism and spirit worship. As with other ethnic groups with ancestral and traditional links with the land, the Hmong have many traditions and beliefs that are associated with the main crop that sustains their lives—rice. This chapter describes some of the rice-based traditions and beliefs of the Hmong in northern Laos. Although the practice of these traditions (as with other traditions) is in decline, the elders of most Hmong villages in Laos still have a strong belief in them, whereas, in more remote communities, they are often practiced in the traditional way.

Agriculture and the Hmong

Relative to many other ethnic groups that have lived in the upland environment in Laos, the Hmong have practiced a more integrated form of agricultural production, in which livestock have always been an important component, in addition to their crop-

ping activities. In their traditional upland environment, most Hmong households and communities have been relatively self-sufficient. Within their own communities, food self-sufficiency is generally regarded as reflecting diligence and hard work, whereas households with insufficient food are often regarded as being "lazy." In the areas from which they originated in southern China and since their arrival in Laos, the focus of the upland cropping activities of the Hmong has been based on "swidden" cultivation (slash-and-burn, shifting cultivation). Although rice has always been the main crop grown for food production in such systems, other crops are also grown, particularly maize, which is used mainly as an animal feed (being used particularly for pig production). Although in the period since the 1980s, and particularly in the 1990s, there has been resettlement of some Hmong in lowland areas of Laos, as part of the policy of the government to stabilize upland areas where increased population pressure has resulted in past slash-and-burn agricultural practices being no longer sustainable (Roder 1997), in the early 2000s the majority of Hmong in Laos were still engaged in their traditional agricultural production practices in the upland environment.

The Hmong and rice

As with all other ethnic groups of Laos, rice is the primary crop and food of the Hmong. However, unlike most other ethnic groups in Laos, the Hmong have always preferred to grow and consume rice with nonglutinous rather than glutinous endosperm, that is, nonglutinous rice rather than glutinous ("waxy" or "sticky") rice. Rice self-sufficiency within Hmong households is regarded as a reflection of both the industriousness and "wealth status" of a household. Within the Hmong community, a general perception is that those households with insufficient rice to eat are lazy and poor. Unlike in most other ethnic groups in Laos, rice is not only the most important food of the Hmong themselves, it is also an important feed for some animals, particularly poultry and horses (from 5% to 10% of the household's rice can sometimes be used for domestic animals). Rice has also often been used as a form of currency for the Hmong. Of particular importance, rice is also regarded as the basis for unity, harmony, and generosity within and between the Hmong communities. Rice is also an essential component of the various social and animist-based traditions of the Hmong. The average annual per capita rice consumption of the Hmong in Laos is believed to be greater than 300 kg of unmilled rice.

Rice and the traditions of the Hmong

In the traditional upland cropping cycle, from the time of commencement of preparation of the upland rice fields through sowing to the final harvest of the rice crop, unlike many other ethnic groups that live in both the upland and lowland environments of Laos, the Hmong do not adhere to many special traditions and/or beliefs that involve the performance of rituals to ensure the success of the crop. However, following the harvest of the crop and during the period preceding the start of cropping-based activities for the following year, the Hmong follow several traditions and

rituals to ensure the protection and productivity of the next season's rice crop and/or as part of which thanks are expressed to the various spirits for the productivity of the preceding year's crop.

The Hmong believe that the success of their rice crops is dependent on the support of the spirits of their forebears or family members who have passed on—parents, grandparents, brothers and sisters, children, etc. They therefore believe that it is important to offer rice from the first harvest of the rice crop to the spirits of these deceased family members before any living members of the family can consume any grain from the new rice crop. The ceremony of "eating the new rice" is performed when the earliest (first) maturing variety is almost ready for harvest. Initially, 20 to 30 kg of this crop is first harvested for the conduct of the ceremony. The ceremony usually involves only immediate family members, and is conducted by the household head, who, for Hmong households, is normally the oldest male member of the household. The mother of the household first cooks the rice and then places it on a bamboo platter in the center of the main room of the house; a bowl of soup and a piece of meat are placed near the rice. The mother then invites the head of the household to perform the ceremony. He takes up a position near the rice, while also being near the main door of the house. He first takes the piece of meat and, while tearing it into small strips, recites the following words:

> *"Myself and members of my family have harvested new rice to eat; we therefore invite our father and mother to come and eat some of the new rice; we also ask the spirits of our mother and father to protect all living members of the family—to keep them free of all forms of illness and injury."*

After reciting these words in the name of the spirits of the deceased mother and father of the household, the household head will then offer the ceremonial meal of rice to the spirits of deceased uncles and aunts (citing their various names), while at the same time asking the uncles and aunts to provide protection for the living members of the family and to also help ensure bountiful harvests from their crops and animals (following the same format as the request made in the names of the spirits of immediate parents).

Following the invitation to the spirits of the elders to come and eat new rice, separate invitations follow to the spirits at three other levels to participate in the eating of the new rice. These are in the order of

- Level 2: Invitation to older sisters, older brothers, younger brothers and sisters, and any children who have passed on.
- Level 3: Invitation to the household spirits.
- Level 4: Finally, the head of the family will take a spoon of the new rice and walk out of the house through the main door to invite the various spirits that live outside of the house to come and consume some of the new rice.

At all levels, in addition to the invitation to participate in the consumption of new rice, the various spirits are asked to keep members of the household healthy and free of problems, while also ensuring that bountiful harvests from the crops and animals are forthcoming in the following seasons.

The Hmong New Year and rice

The Hmong New Year falls in January of the Lao calendar. Hmong ceremonies associated with the New Year are an integral part of Hmong culture and are celebrated by all Hmong families and communities. As the time of the New Year approaches, each family spends a considerable time in food collection and preparation of sufficient food to last a period of 15 to 20 days of celebration. In addition to the usual nonglutinous rice, some of the food products prepared for this occasion are based on glutinous rice. Although the ceremony is performed as part of the Hmong culture wherever they are, traditionally the ceremony has been to "celebrate" the productivity of the preceding cropping season. The ceremony is also used to call the spirits of departed family members to return to the family home, and to call the spirits for the return of the production of any crops that may have been lost during the preceding cropping season, together with the return to their "pens" of any livestock that may have died or have been sold during the previous year. Individual households may kill a pig or a cow during the ceremonies associated with the New Year in order to properly entertain members of the extended family, as well as close nonfamily friends. However, the timing of the killing of such animals usually follows traditions relating to the offering of chicken sacrifices (the killing of a pig or a cow often has to take place three days after making offerings of chickens to the spirits of the fields, the spirits of the ancestors, etc.). For a three-day period associated with the sacrifice of the chicken, all forms of work have to cease apart from the feeding of the farm animals and food preparation. One or two days before chicken sacrifices are made, the head of the family either leads or has other family members go to the fields that were used for cropping in the previous season. They take with them a chicken and three incense sticks, and perform a ceremony to call "home" any production that might have been lost in the preceding season. In subsequent spirit-related ceremonies held in the home of each Hmong family, the household head undertakes a ritual cleaning of the area around and within the house, while reciting "*today I sweep the dirt away—things which are not good in the year past are also to be swept away*." On completing the ritual cleaning, the various spirits (spirits of the deceased family members, spirits of the animals, and spirits of the various plants that have significance for the family) are called to the home to join the ritual meal. In asking the spirits to join the ritual meal, their protection of the family from illness and misfortune is sought, and assurances are sought for future crop yields and animal production. After these rituals, members of the immediate and extended family, together with close friends, are invited to share a sumptuous meal for which a pig or cow might have been killed.

Finding a location for a new house

The process of locating a suitable site for the construction of a new house for any family is very important and follows strict traditions, in which rice also plays an integral part. After a family head has tentatively selected a piece of land for the construction of a new home, a hole 20-cm deep is dug, and, after flattening the base of the hole, a 2–3-cm wooden peg is placed at the center of the base of the hole. A number of grains of uncooked rice are then aligned with the peg, the number of grains used being the same as the number of members in the household who would be scheduled to live in the house. The hole and its contents are then covered overnight. If, on inspection the following morning, the rice grains have been undisturbed, the site is regarded as being suitable for the construction of the family home. However, if any of the grains are missing or have been displaced overnight, the site is regarded as being unsuitable, and a new site has to be found and the same ritual performed involving the rice grains.

Other traditions and rituals involving rice

Death-related rituals

Apart from the use and involvement of rice in many rituals relating to the well-being of the living, and which have the potential to benefit a family, when a member of a Hmong family dies, rice also plays a prominent role in the rituals related to the deceased family member. In the first of these rituals performed on each of several days before the burial of the deceased family member, a rice meal is prepared and offered to the spirit of the deceased three times each day. Then again following the burial of the deceased, a meal of rice is offered to the spirit of the deceased each morning for three successive days. Then, 13 days after the burial of the deceased, rice and other foods are prepared and again offered to the spirit of the deceased.

Spirit-related offerings

On many occasions during the year, food offerings and sometimes chicken sacrifices are offered to the various spirits that form the basis of the animistic beliefs of the Hmong. Some of these ceremonies and offerings are in honor of family ancestors, while others are in honor of the spirits that are believed to be associated with the various things, living and nonliving, that combined make up the environment in which the Hmong live. Offerings are also often made as part of efforts to cure various ailments and ensure productive crops and healthy animals. In all these rituals, rice is an integral part of the offerings made.

Rice and family goodwill

Rice is also used to reflect good manners, love, and respect among the members of the Hmong community. When family members or friends travel long distances to visit each other, an integral part of the welcome offered is a meal, the main basis of which is rice. If, on the return journey after making such a visit, the visitors have to travel

for 4 hours or more, it is customary to prepare a meal composed primarily of rice, to be consumed on the return journey. Even though the food provided for consumption may be rather simple, the act of providing it is regarded as reflecting a high degree of good manners and respect for visitors.

Rice, for the Hmong, is not only regarded as being important for the maintenance of an individual's health through being the primary component of all food consumed, it also plays an important psychological role, on account of its various spirit-related uses. Further, an abundance of rice within individual households is regarded as an important measure of the industriousness of individual families and the members of that family group.

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CHAPTER 8

Katu traditions and rituals associated with rice

N.A. Costello

The Katu people number 52,000 and are found in Vietnam and Laos. Approximately 14,700 live in Laos, so they represent one of the smaller ethnic groups in the country (Sulavan and Costello 1994). They are currently found in the provinces of Sekong, Saravane, and Champassak. Those in Vietnam are found mainly in the province of Quang Nam, with a small number of villages in Thua Thien Province. The areas where the Katu live in Laos and Vietnam are adjacent. The Katu language belongs to the Katuic branch of the Mon-Khmer language family. The Katu are generally an isolated group inhabiting the more mountainous areas. Formerly, most of the Katu of Laos lived in Kalum District of Sekong Province, in areas inaccessible by road and where it could take up to 8 days of walking to reach their isolated villages. In the early 1970s, under a government policy encouraging a move from swidden agriculture to wet-rice cultivation, thousands of Katu moved to lowland areas in the districts of Thong Vaai, Lamam, and Thatheeng in Sekong Province and Lau Ngaam in Saravane Province. However, by 1979, many had returned to the more mountainous areas on account of not having the resources and knowledge to undertake the wet-rice cultivation required in the lowlands. During the mid-1990s, the government once again encouraged their return to lowland areas in Lau Ngaam in Saravane Province and Thatheeng in Sekong Province. In neighboring Vietnam, during the 1990s, many Katu were also encouraged to move to lowland areas, mainly to the district of Hien in Quang Nam Province, where they currently cultivate a combination of lowland rice (both rainfed and irrigated), upland rice, and coffee.

The Katu have a wealth of customs, traditions, knowledge, and folklore relating to astrology, medicine, and other sciences (Costello 1993, 2003, Sulavan and Costello 1994, 1996). They are animists, and are the only ethnic group in Laos that, in the past, conducted human sacrifices. The whole fabric of Katu society is intermeshed with the environment. The Katu people believe that they must live in harmony with the world around them—other people, animals, birds, trees, stones, water, traditions, and their many spirits. When this harmony is disrupted by the breaking of taboos and traditions, which displeases the spirits, actions have to be initiated to restore the equilibrium with their traditions and the spirits.

Rice is the staple food of the Katu and they have always preferred glutinous rice, consuming nonglutinous rice only when glutinous rice is unavailable. When rice cultivation is undertaken in the traditional swidden upland systems, many traditions and beliefs must be strictly adhered to to ensure good yields, but also in the interests of maintaining the equilibrium between the people and the many factors that the Katu believe influence their daily lives. All Katu traditions, beliefs, and taboos are passed down orally, mainly by the male elders of a village, although less important ones may be passed down by the head of a household. This chapter describes some of the important traditions, beliefs, and taboos that govern how rice is cropped, together with other traditions and beliefs in which rice plays a significant role.

Origins of the Katu

The Katu talk about their origins in Laos in ancient times when the Mon-Khmer people were called Koom (later called Kroom) and had two leaders called Kunmeng and Kunchuong. During that time, the Lao (then called Lava) and Koom people both lived in the lowlands. However, fighting erupted between the two groups of people in which many villages were destroyed in large fires. The Koom (Katu) subsequently fled to the mountains, taking with them their written records on animal skins. The Katu maintain harmony in society through the principle of dominance and compliance, referred to idiomatically as "fire" and "water." In their historical conflict, they refer to the Lava (Lao) taking the part of "fire," while the Koom took the part of "water" (Sulavan et al 1995). To this day, if a group or individual takes the dominant side (fire), the other must be compliant like water. The Katu in Vietnam also believe that their ancestors lived in coastal areas but were driven into the mountains by lowlanders.

Rice cultivation by the Katu

Traditionally, for centuries, the Katu in both Laos and Vietnam practiced swidden cultivation of rainfed upland rice in steep mountainous areas such as those found in Kalum District of Sekong Province in southern Laos (Sulavan and Costello 1994). The traditional swidden can be up to 3 hectares in area for each extended Katu family, and is generally in areas whose fertility is reflected by the presence of large trees. In addition, each extended family will often have a second smaller swidden closer to the village, where smaller trees indicate a prior history of earlier swiddens. The Katu villages are usually located near rivers, whereas the swidden fields may be up to 3 km from the village, depending on the population pressure and earlier history of swiddening. In Kalum District of Sekong Province, the Katu practice swidden cultivation on the banks of the Sekong River, and in areas near the Vietnamese border. The usual practice is to cultivate a field for 2 years before abandoning it. However, in steeper areas (near the Asaap, Trool, Arnge, and Arngoop rivers in the same province), cropping takes place for only 1 year before the fields are abandoned to allow regeneration under a period of fallow. The fallow period can be up to 25 years in duration. Unlike in much of northern Laos, where the period of the traditional fallows has declined to

less than 5 years (Roder et al 1995), the Katu have generally been able to continue to maintain long fallow periods because of their isolation.

In northern parts of Kalum District and also near the Paai River in the same district, where there is flatter ground, wet-rice cultivation and dry-seeded lowland rice cultivation are practiced. In areas of southern Dak Chung District in Sekong Province, the Katu have developed four cropping programs—swiddens, wet rice, permanent dry rice, and gardens. The dry-rice cultivation system of the Katu does not require the use of buffalo or ploughs (both of which are required for wet-rice cropping and which are relatively uncommon in areas that the Katu have traditionally inhabited). Permanent dry-rice fields have been cultivated for generations at the edge of a village, or on flat ground far from a village. In these systems, water is diverted from a waterfall or river to the fields through a series of interconnected bamboo pipes, which can stretch for more than a kilometer, or through hand-dug channels. Another method is to construct a series of terraces in the field, in which the water flows from the top to the lower terraces. In the districts of Thong Vaai and Laman of Sekong Province, where the Katu have resettled in lowland areas in accordance with government policy since the early 1970s, the Katu have more diverse cropping practices. In addition to increased wet-rice cultivation and permanent dry-rice cultivation, they are increasingly involved in coffee production and the cultivation of alternative cash crops such as peanut.

Maintaining harmony with the spirits and swidden rice cultivation

The Katu beliefs and relationships with their many spirits are closely bound up with, and reflected in, the way they undertake rice cultivation in their traditional swidden production systems (Costello 2003, Sulavan and Costello 1994). Maintaining a good relationship with the spirits near rice fields is essential for the harmony of the whole Katu society. This is regarded as being more important than having good crops. Because the traditional rice fields are deep in the forest where many spirits dwell, the Katu are very careful about the way they conduct every aspect of work related to their fields, knowing that they enter the domain of the spirits, who will cause sickness if offended. The people must appease three groups of spirits: (1) the *dyaang* that dwell in the forest, trees, water, and villages, and watch over people and provide for them; if the Katu people do not make sacrifices to them, they do not give good crops or health; (2) the *saq*, which are the local spirits of individual trees, water, and mountains; and (3) the *brau* local spirits and *brau* spirits of the dead, which become displeased when people go near them in the forest. All these spirits, when displeased through the breaking of established taboos, are believed to make people sick by capturing their soul from the top of their head. Animal blood sacrifices are required to appease offended spirits and restore to health persons who have been made ill by displeasing.

Rituals for choosing land for a swidden

Before deciding on a section of forest for a swidden, the Katu must make sure that the *dyaang* spirits are happy for them to work that section (Sulavan and Costello

1994). They clear a small area, about 5 by 20 meters, on which they construct two bamboo arches. Then they dip unbroken kernels of long husked rice into water and ask the spirits not to let the rice kernels break. If they break, the Katu will not make that section of land into a rice field. Following the selection of a piece of land that has not brought the disfavor of the spirits, then they make signs and plant them every 10 meters in the field to claim the land, calling on the *dyaang* spirits to allow them to clear that land. They ask the *dyaang* and *saq* local spirits to give them good dreams. That night, if they dream a good dream, they continue to clear the field. However, if they have a bad dream, they abandon that section of land, afraid that the spirits would capture their souls and make them sick.

The Katu are very careful when clearing a firebreak around a swidden because they are afraid of the fire spreading and burning the forest where there are spirit houses built by the Katu to honor the spirits of the forest, *saq* local spirits in trees, and *dyaang* spirits. Also, the Katu want to prevent the possibility of the fire spreading to the village and the storage houses especially built for the rice at the edge of the village. Under customary law, the burning of other people's property results in a large fine being levied, while offending the spirits in the forest would result in the spirits making the person sick, thereby requiring a sacrifice to be made to restore that person's health.

Taboos associated with the preparation and burning of swidden fields

Burning felled trees for rice swiddens is dangerous work that takes 3 months to complete and is undertaken in the period immediately before the onset of the wet-season rains (Sulavan and Costello 1994). It is taboo to visit other villages during this period, for to do so may result in the breaking of taboos or traditions, which could result in the spirits giving sickness or poor crops. When the people are clearing their fields in preparation for cropping, they are careful to avoid all potential accidents. If a tree should happen to fall on someone, it is regarded as a bad omen and that person must abandon that particular field.

The Katu are continually afraid of burning *dyaang, saq*, and *brau* spirits in the forest. They also have to please *dyaang Abom*, the spirit of the weather, and *dyaang Apool*, who gives good crops. If people have bad dreams during the burning season, they have to appease the spirits they have dreamed about, and they would be afraid to undertake any burning on the following day. They also must be careful that the fire does not spread to other parts of the forest where spirits dwell, and where people have constructed shrines to the *saq* and *brau* spirits, where they make regular offerings. The Katu also observe many other taboos in order to avoid bad luck and the displeasure of the spirits. On the days they burn fields, it is taboo for visitors to enter a house or village where people are burning because they are afraid that, if the visitors travel a long way, the fire will also spread a long way. Any visitors who have entered a village cannot leave during the days of burning.

Following the completion of the burning phase of preparation of the rice fields, certain rituals must be followed to appease the *dyaang* spirits of the sky and the ground, who may have been harmed by the fire. A wood pile is made and fenced in, and a ritual

appeasement of the spirits is made by one person. Every household in the village then brings an iron pot stand and scatters rice, calling on the spirits, begging for favor, and worshipping them. Each household also brings a bamboo tube of steamed glutinous rice that is offered to the *dyaang Apool* spirit to eat. Then the people also eat. One person performs a ritual to *dyaang Apool*. This person pours water on a sample of rice and the people wait to see if the rice swells; if it does, it is regarded as a sign that there will be a good rice crop.

Rituals associated with planting the rice crop

When the Katu finish planting the rice crop, they shout three times, saying, "We are relieved and happy because the work is finished" (Sulavan and Costello 1994). They call on the rice to be relieved and happy and not to become twisted but to sprout well. The whole village then holds a ritual to the spirits, the ritual being called "the ceremony for blessing the fields." People go to the fields, taking with them bamboo tubes of rice fish, and stay in shelters in their rice fields for 10 days. During this time, they make bamboo arches and wooden images of the various *dyaang* spirits, including the spirits of the ground, the forest, and the water. They conduct the same ritual for each spirit, holding the bamboo arch in the left hand, then hitting it on a tree stump while saying to the spirits, "Everything bad avoid us, go away. You spirits who stay in the fields and do not allow the rice to be good, go away." Then they hold the bamboo arch in the right hand and say to the spirits, "Give good corn and rice, do not allow people to be sick. Let people be kindhearted and speak soft words with people and with the rice and corn."

After completion of planting, there is also a ritual to the *dyaang Apool* spirit of corn and rice, called "the ceremony for blessing the village." The whole village catches fish, which they steam in bamboo tubes, and each household puts one tube of glutinous rice inside the communal house for men. The villagers call on the spirit *Apool* to give the village a comfortable life with lots of rice, corn, animals, and riches. Then they cut a piece of bamboo with hanging fronds and dip it into water on a dish. The bamboo is then held in the left hand and shaken, while calling on *Apool* to "Give us everything good to use." The bamboo is then held in the right hand, dipped in water, shaken, and thrown. If the bamboo sticks to something, this is regarded as a good omen and indicates that the spirits are pleased. The people then call out three times, split the tubes of fish and glutinous rice, and divide them among the whole village. They then call on the leaders and elders of the village to eat and drink *phardiin* alcohol together.

Taboos associated with the period of cropping

The Katu have many taboos during the months when they do cultivation work (Costello 2003, Sulavan and Costello 1994). If someone in a village dies while the rice is growing, it is taboo to work in the fields because it is believed that the rice may also die. This taboo applies for 2 to 3 days after the death of a baby, and for 4 days after the

death of an adult. Areas in the forest that are taboo are marked with signs—small trees placed in the walking paths. Taboos are marked near graves, spirit shrines, and sacred areas where spirits dwell so that people will not go near them. When a person disobeys an important tradition or goes near a taboo sign, that person is fined. The fine may be paid with a person given as a permanent servant, or through a payment in kind, such as a water buffalo or pig. A person who does not pay a fine can be killed, thereby showing the importance the Katu place on maintaining harmony with the spirits in the forest where the rice fields are.

Rituals for harvesting

Before beginning harvesting of rice, the Katu observe taboos and traditions to ensure that the spirit of the rice, called the "mother of the rice," will return from the fields to the village, and remain there at the end of the harvest. They do not want her to flee from the fields. On the day the rice harvest is to commence, each family goes to the rice field, taking with them a chicken, a bracelet, a shirt, and a belt to perform a ceremony and offer the clothing items to the spirit of rice to wear. In the field, four rice stalks are bound together, stood up, and offered to the rice spirit. One "back" basket of rice is then harvested and carried back to the village, where the chicken is cleaned and boiled. The shirt is hung up in the top corner of the house. The family then offers the chicken to the spirit of the rice to eat when she comes. There are also taboos to be observed during harvesting. On the first day of harvesting, the people do not bathe and it is taboo for them to look at pregnant women. During the harvest period, it is taboo to kill animals, curse, or hit children. The people cannot collect or work with rice kernels that have fallen or been dropped because they believe that the rice's soul has fled from such rice.

With the end of the harvest, the villagers bring the spirit of the rice back to the village. First, they cut the panicles off the rice stalks they had stacked before the start of the harvest, and return them to the village while at the same time calling on the soul of the rice and the souls of people to also return to the village. These rice panicles are then inserted into the rest of the harvested rice panicles, which are held in large woven baskets in rice stores at the edge of the village. The bracelet that was also offered to the "spirit of rice" at the beginning of the harvest, together with the clothing items that formed part of the offering, is also placed with the rice panicles in the rice store, while at the same time asking that the "spirit of rice" remain with the rice in the store. After that, the whole village holds a ceremony to celebrate the end of the harvest. Each household dries its rice and pounds it. The people dip glutinous rice in water, stir in sesame seeds, and steam it. When it is cooked, they pound it to make rice cakes for 1 or 2 days. They eat one cake in the village and carry the rest to relatives in other villages. All the rice cakes are stored in the men's communal house. They offer the rice cakes to the *dyaang Apool* spirit, then divide them among all the people according to households. Now it is not taboo any more to talk about the harvest, and they are able to visit relatives.

Rituals to restore harmony

All sickness is a result of disharmony with the spirits and is caused when people break traditions or taboos. Harmonious social relationships are very important in Katu society, and breakdowns in relationships between individuals or villages cause disharmony, resulting in sickness. Harmony between people and with the spirits needs to be restored (Costello 2003, Sulavan and Costello 1994, Sulavan et al 1995). A dispute in words or actions between people can only be put right with a ritual to restore a right relationship with the spirits. People call on the shamaness to determine the cause of the sickness. It may have been caused by a wrong committed in trying to meet social obligations. In Katu society, a shamaness is important because she is able to communicate with the various spirits to ascertain which taboo or tradition has been broken, which spirit has been offended, and what fine or sacrifice is needed to appease that spirit. The Katu can have up to three shamanesses in one village. They are usually middle-aged women whom the *dyaang* spirits have possessed so that they can act as intermediaries between people and the spirits. A shamaness performs rituals and divination, and calls on the offended spirits to return the soul of the sick person.

The tradition of visiting relatives

The tradition of visiting relatives is a significant aspect of social interaction in Katu society involving obligations to certain relatives (Costello 2003, Sulavan and Costello 1994, Sulavan et al 1995). Not to carry out the required exchange of gifts is a wrong because the tradition has been broken, causing disharmony resulting in sickness, so a right relationship with the spirits needs to be restored. The shamaness is consulted and tells the people how to restore a right relationship with the *dyaang* spirits and with other people. It is important to maintain the tradition of visiting because, if there is a problem later between the two villages, harmony cannot be restored if the tradition has been broken.

During the season of rice cultivation, it is taboo to visit relatives in other villages to exchange gifts, so it is important for the Katu to be able to visit relatives at the end of the harvest. They catch fish, prepare rice and pigs, and hunt wild animals in order to have food to take to relatives. The visits are also a time to look for wives. Parents who will visit their married children prepare glutinous rice by steaming it in a basket, then wrapping it in packets in banana leaves, preparing 20 or 30 packets. Fish and frogs are also wrapped in packets. There are strict rules about the kind of food that can be given to each relative; for example, parents of girls must eat animals with four feet. Men give gifts to female relatives and women give gifts to male relatives. The people carry unhusked rice and corn, which are left outside the village they are visiting, to appease the local village spirits. People feel bad if they do not have enough food or alcohol to give to visitors.

Divination using rice

Rice also plays a significant role in divination (Costello 2003, Sulavan and Costello 1994, Sulavan et al 1995). When a person is sick, the shamaness tries to find out which taboo or tradition has been broken, and which spirit is displeased and has caused the sickness. Some of the associated rituals are performed with rice. In one such ritual, the household prepares husked rice and incense on a dish, with a sword, a bush knife, some money, and a smoking pipe on a separate tray. The incense is burned and the shamaness is asked to interpret and intercede. She picks up four or five rice seeds and holds them above her head, saying to the spirits, "You *dyaang* spirits come down and see the sick person. Which *brau* or *saq* local spirit caused the sickness?" Then she places rice on the palm of her hand and calls on the *dyaang* spirits to come down and see the rice. She lifts her hand and waits for the spirits to act. If the rice does not fall, she lifts her hand again and asks if different spirits caused the sickness. She keeps doing this until the rice falls, thereby identifying which spirits are displeased. Then she tells the relatives of the sick person which animal needs to be sacrificed to appease the spirits.

Another ritual involves the use of rice and a knife or sword. A shaman performs this ritual. First, he goes into the house and burns incense. He takes some rice and shakes it above his head, saying to the *dyaang* spirits, "Come down on me the leader and see which *saq* local spirit or *brau* spirit made this person sick. The *dyaang* spirits come down onto the shaman and then he holds the sword and divines to determine which spirits made the person sick. He calls out, "You *dyaang* spirits, grab the sword and make it stand up so it will not fall." He jabs the sword into the dish of rice and calls on *saq* spirits of trees to make the sword stand up on its own. He then waits and, if the sword stands on its own, those spirits are identified as having caused the sickness. If the sword falls, he calls on a different spirit. He continues, calling on various local *saq* and *brau* spirits until the sword stands to allow the identification of the cause of the illness.

Impact of changes on rice-related traditions and beliefs

Because the cohesion of Katu society is based on harmony with the spirits in the environment, any change to traditions and beliefs that alters this harmony disrupts the delicate intermeshing between people and the spirits (Costello 2003). The traditional beliefs of the Katu on which the harmony between the people and spirits is maintained have been based on how their lives have evolved in mountainous areas over several centuries. In upland areas where the Katu practice wet-rice and dry-rice cropping, they do not need to perform rituals to the spirits of the forest, but they still need to call on spirits to give them good crops, so they carry out fewer rituals. The relatively recent movement of some of the Katu to lowland areas of Laos has resulted in these groups not knowing how to react to different spirits that dwell in lowland areas. They generally feel strange in the new lowland abode; this is sometimes exacerbated by the gradual loss of their own language as they mix with other major language and ethnic

groups. Sometimes, the vital tradition of visiting relatives to exchange gifts cannot be carried out because relatives have become separated, with some living in the lowlands and some still in the highlands. This worries the Katu because it is believed to reflect disharmony between people, as well as displeasing the spirits. These changes are regarded as a gradual erosion of social cohesion, leading to the breakdown of their harmonious society, which is a harmony maintained by pleasing the spirits by following taboos and traditions.

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Notes

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CHAPTER 9

Diversity within the traditional rice varieties of Laos

S. Appa Rao, J.M. Schiller, C. Bounphanousay, and M.T. Jackson

The development of improved rice varieties in most countries of Asia has generally resulted in their widespread adoption by farmers, with the replacement of traditional varieties, leading to an erosion of the rice germplasm base in these countries. In most Asian countries, this change took place during the 1970s and 1980s. In Laos, however, the period of the Green Revolution had little impact on the way rice was cultivated and, as late as 1990, more than 90% of lowland rice cultivation in the country was still based on the use of traditional varieties. In the rainfed upland environment, almost 100% of production was based on the use of traditional varieties (Schiller et al 2001). Change in rice production in Laos started about 1995, following the 1993 release of the first of a series of improved varieties developed within the country as part of the development of a national rice research program. Anticipating that Lao farmers would quickly adopt these improved varieties, in combination with the adoption of other technical recommendations capable of bringing about a substantial increase in yield, a program to assemble a representative collection of the traditional rice germplasm for long-term conservation began in mid-1995. In a collaborative program with the Lao Ministry of Agriculture and Forestry, the International Rice Research Institute (IRRI) jointly explored most rice-growing areas of the country from 1995 to early 2000. During this period, a total of 13,192 samples of cultivated rice were collected, together with 237 samples of six wild rice species of the genus *Oryza*. This chapter primarily describes the classification of the traditional rice germplasm that was collected and that is now being preserved at the Genetic Resources Center (GRC) of IRRI, as well as being used for the further improvement of varieties being developed by the national rice research program of Laos. More detailed information on the collections is available in records maintained by the GRC, as well as in detailed reports of the collecting missions (Appa Rao et al 1997b, 2002a,b,c).

Laos and the origin of Asian cultivated rice

The genus *Oryza*, to which cultivated rice belongs, has 20 wild and two cultivated species. Of the 20 wild species of *Oryza*, six are found in Laos (Appa Rao et al 1998, Kuroda et al, Chapter 15). Among these, the wild progenitor, *O. rufipogon,* of Asian

rice, *O. sativa,* is found throughout the country and is particularly abundant in the central and southern agricultural regions. Spontaneous interspecific hybrids between the wild and cultivated forms of rice, showing continuous variation from wild to cultivated forms, have also been observed in Laos (Appa Rao et al 1997a, 1998, 2000d). Pottery shards bearing the imprints of the grains and husks of *O. sativa* and that date to at least 2000 B.C. have been recorded at archaeological sites in northeast Thailand, an area with geographic and historic continuity with modern-day Laos (Solheim 1972, White 1997). It is generally accepted that Laos lies within the general area that is accepted as the area of origin of Asian rice, *O. sativa* (Chang 1976, Oka 1988, Khush 1997).

Rice germplasm collected before 1995

Recognizing the diversity and importance of the traditional rice varieties in Laos, a number of rice germplasm collecting missions were undertaken in Laos from 1970 to 1990, being variously supported by USAID, Russia, Japan, and other agencies/ countries (Schiller et al 2001, Inthapanya et al 1997). From 1991 to 1994, a further collection of more than 1,000 samples was made in the upland environment in six provinces of the northern agricultural region of the country in a joint initiative between the Lao Ministry of Agriculture and Forestry (MAF) and a Swiss-supported national rice research program activity implemented through IRRI (Roder et al 1996). However, the passport information on the samples from for these collecting missions was generally incomplete. Further, because of the lack of appropriate storage facilities in the country during that time, the collections were unable to be maintained without annual rejuvenation and, unfortunately, these collections are no longer available.

Rice germplasm collected from 1995 to 2000

The systematic collecting undertaken from 1995 to 2000 was part of a project to collect and conserve the biodiversity of the rice gene pool in 22 countries in South and Southeast Asia, sub-Saharan Africa, and Central America (IRRI 1994). This was carried out with financial support from the Swiss Agency for Development and Cooperation (SDC).

Collection strategy

MAF and IRRI jointly undertook rice germplasm collecting throughout the country. In consultation with the Provincial Agriculture and Forestry Offices (PAFOs) for all provinces of the country, a 5-year collecting program was prepared and agreed upon. The level of genetic erosion occurring in a particular area (as reflected by the rate of adoption of improved varieties), the availability of local support, safety considerations, and accessibility of target areas formed the basis for selecting priority areas for collecting. From October 1995 to April 2000, all 136 districts in 17 provinces and the Saysomboun Special Economic Region (Fig. 1) were explored.

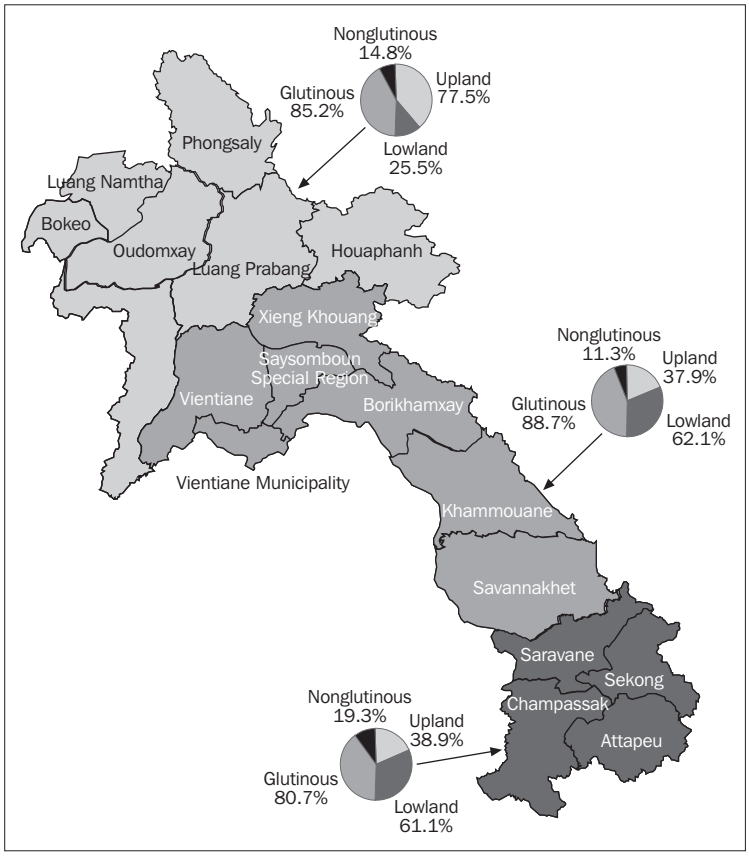

Fig. 1. Rice samples collected from the upland and lowland environments, with glutinous and nonglutinous endosperm, for the agricultural regions of Laos.

Collection procedure

The objective was to collect enough material to represent the maximum diversity with a minimum number of samples. To achieve this, the goal was to collect at least one sample of each variety from each district. While recognizing that farmers sometimes call different varieties by the same name, it was also acknowledged from the outset that different names are used in different areas for the same variety. Collecting started at crop maturity (about 1 week before harvest) and continued until threshing. Though the goal was to obtain most of the samples directly from farmers' fields before harvest (September-December), in areas inaccessible during the wet season, samples were obtained after harvest from the threshing floor or farmers' grain stores, from January to April. Generally, a greater proportion of upland varieties was collected after harvest because of difficulties of access during the growing season.

The collections were made by officials attached to the District Agriculture and Forestry Offices (DAFOs), supported by staff of the Lao national rice research

program and an IRRI germplasm specialist. The district-level staff usually had a good knowledge of local farming practices and could communicate effectively with the farmers. The germplasm samples collected included landrace varieties, slightly improved varieties, intermediate weedy forms that occurred as spontaneous hybrids between wild and cultivated forms, and wild species of the genus *Oryza*. Collecting was done only from wet-season cropping areas, as, at the time of collecting, only improved varieties were being grown in the dry-season irrigated environment.

Sampling technique

The sampling technique depended heavily on the participation of farmers, and was a compromise between collecting individual plants from each field as separate samples and collecting a bulk sample of different types found in a single field. The method involved collecting each distinctive phenotype identified by the farmer, together with any other distinct type(s) identified by the collectors. For example, if five distinct types were identified in a field, all five types were collected as separate samples to facilitate conservation and subsequent characterization and use. When sampling from relatively uniform fields, only one random bulk sample was collected. However, when rare phenotypes were encountered, they were kept as separate samples. In general, an attempt was made to retain the landrace structure in the samples.

Although the goal was to collect one sample of each variety, for a number of reasons, several samples were sometimes collected for certain varieties. As collecting was being undertaken simultaneously in several districts, extension officers collected whatever varieties they found in their respective districts. Hence, duplicate samples (based on variety names) were sometimes collected, with their frequency of collection reflecting their relative abundance in an area. Though some duplicates appeared uniform in relation to grain characteristics, considerable variation was sometimes observed in some duplicate samples, particularly when these samples came from areas with differences in elevation. It is therefore acknowledged that, within the 3,169 different variety names assigned by farmers and recorded during collecting (see Chapter 10), some varietal names represent duplicate samples, whereas, at the same time, many samples that appear as duplicates may in fact be genuinely different varieties.

Apart from some localized areas for which accessibility was restricted, the collection of 13,192 samples of cultivated rice made from 1995 to 2000 is regarded as being representative of the rice genetic resource base of the whole of Laos. It is also regarded as one of the most comprehensive collections of the traditional rice germplasm made for conservation and use, for any single country, and by far the most comprehensive collection made for any country the approximate size of Laos.

Classification of the rice germplasm samples collected from 1995 to 2000

At the time of collecting samples from the farmers, information for up to 36 descriptors was obtained to provide the passport information for each sample, based on guidelines of the IRRI Genetic Resources Center. These descriptors were modified to suit the conditions of Laos by including endosperm type, aroma, and other traits

Table 1. Classification of germplasm samples based on region, ecosystem, and endosperm type.

Region	Total samples		Ecosystem				Endosperm type			
			Lowland		Upland		Glutinous		Nonglutinous	
	No.	%	No.	%	No.	%	No.	%	No.	%
Central	4,625	35.1	2,868	49.3	1,757	23.8	4,102	36.4	523	27.3
Northern	5,915	44.8	1,332	22.9	4,583	62.2	5,037	44.7	878	45.9
Southern	2,652	20.1	1,621	27.8	1,031	14.0	2,140	19.0	512	26.8
Total	13,192	100.0	5,821	100.0	7,371	100.0	11,279	100.0	1,913	100.0

unique to Laos. The passport information collected was largely based on the information provided by the farmers themselves. With the passport information collected, the germplasm samples were classified according to origin (province and district), ecosystem (lowland or upland), endosperm type (glutinous or nonglutinous), and maturity time (early, medium, or late).

The numbers of samples collected from the northern, central, and southern regions were 5,915 (44.8%), 4,625 (35.1%), and 2,652 (20.1%), respectively (Table 1). More samples (55.9%) were collected from the upland environment than from lowland sites (44.1%). Most of the samples (85.5%) had glutinous endosperm. The highest proportion of upland samples was collected from the northern agricultural region (77.5%), whereas about 38% of the samples came from the upland environment in the central and southern regions (Fig. 1). In all three regions, samples with glutinous (waxy) endosperm accounted for the majority of those collected (Fig. 1), with 85.5% of the total samples collected being in this category (Table 1).

The province from which the largest number of samples was collected was Luang Prabang in the northern agricultural region, with 1,243 samples (9.4% of the total), of which 875 (70.4%) were collected from the upland environment (Table 2). Other provinces from which large numbers of samples were collected in the upland environment were Oudomxay (675) and Sayabouly (632). Provinces for which the largest numbers of samples were collected in the lowland environment were Savannakhet (759) and Khammouane (671) in the central agricultural region and Champassak (677) in the southern region.

Diversity in the traditional rice varieties

Diversity of variety names

For the total of 13,192 samples of traditional varieties collected from 1995 to 2000, variety names were recorded for all but 6% (789). The inability to record variety names for these samples reflected the great ethnic diversity that exists in the areas where collections were made (Laos has 48 recognized ethnic groups, ADB 2001), and associated difficulties in translating some of the variety names of some ethnic groups

Table 2. Classification of germplasm samples based on region, province, ecosystem, endosperm type, and maturity.[a]

Region	Province name	Total	Lowland environment								Upland environment							
			Nonglutinous				Glutinous				Nonglutinous				Glutinous			
			E	M	L	Total	E	M	L	Total	E	M	L	Total	E	M	L	Total
Central	Borikhamxay (BK)	594	5	16	4	25	59	151	35	245	7	10	4	21	186	89	28	303
Central	Khammouane (KM)	867	9	30	15	54	147	329	141	617	1	2	3	6	101	62	27	190
Central	Savannakhet (SK)	989	5	36	8	49	130	401	178	709	10	6	2	18	97	65	51	213
Central	Vientiane Municipality (VM)	486	6	35	17	58	115	158	23	296	4	5	0	9	51	66	6	123
Central	Vientiane Province (VP)	787	1	15	15	31	71	183	104	358	14	18	2	34	181	165	18	364
Central	Saysomboun (XS)	342	5	18	5	28	25	62	22	109	11	36	12	59	36	94	16	146
Central	Xieng Khouang (XK)	560	6	25	18	49	47	83	110	240	22	27	33	82	47	107	35	189
Northern	Bokeo (BO)	686	16	10	13	39	34	68	62	164	17	20	39	76	98	161	148	407
Northern	Houaphanh (HP)	631	1	4	12	17	9	57	81	147		32	25	57	58	215	137	410
Northern	Luang Namtha (LN)	858	16	20	14	50	25	76	71	172	12	55	58	125	70	228	213	511
Northern	Luang Prabang (LP)	1,244	2	17	8	27	39	89	50	178	46	66	50	162	309	380	188	877
Northern	Oudomxay (OD)	848	7	5	5	17	11	27	39	77	20	18	42	80	177	201	296	674
Northern	Phongsaly (PL)	664	10	16	20	46	20	75	24	119	11	30	42	83	68	197	151	416
Northern	Sayabouly (SB)	984	6	13	8	27	66	108	78	252	14	23	35	72	127	311	195	633
Southern	Attapeu (AT)	640	20	62	38	120	56	149	72	277	8	26	44	78	67	55	43	165
Southern	Champassak (CS)	842	25	42	12	79	161	364	73	598	2	13	25	40	42	62	21	125
Southern	Saravane (SV)	774	2	24	8	34	90	215	84	389	9	22	12	43	100	146	62	308
Southern	Sekong (SG)	396	4	13	12	29	10	70	15	95	5	42	42	89	59	92	32	183
	Total	13,192				779				5,042				1,134				6,237

[a]E = early maturity, M = medium maturity, L = late maturity.
Source: Appa Rao et al (2002b).

Table 3. Distribution of distinct variety names in regions of Laos.

Region	Total samples collected	Number of samples with names	Number of names
Northern	5,915	5,613	1,120
Central	4,625	4,321	613
Southern	2,652	2,469	583
Total	13,192	12,403	2,316

into the Lao language (and subsequently into English). In addition, some farmers, particularly younger ones, did not know the variety names. Of the 12,403 samples for which variety names were recorded, ethnic names were recorded for 1,414 samples, which were later translated into Lao and English, whereas ethnic names for another 151 samples that were recorded were unable to be translated.

The largest number of names (1,120) was recorded in the northern agricultural region, and least (583) in the southern agricultural region (Table 3). A detailed analysis of the naming of the varieties is reported by Appa Rao et al (2002c) and in Chapter 10.

There was usually greater diversity of names in provinces with the larger areas of upland rice cultivation, reflecting the greater ethnic diversity in such areas, together with the associated diversity of rice preferences with different food quality attributes (see Chapter 10). The northern province of Luang Prabang, which has the largest area of upland rice of any single province in the country, had the highest number (462) of variety names. Although fewer individual varieties were collected from some provinces in the southern agricultural region, several of these provinces had high numbers of unique varieties (a variety was classified as unique to a province when it was recorded as having been collected only in that province). In the southern province of Attapeu, 62.2% of the samples collected and names were classified as being unique. This province, together with others with high levels of unique varieties, is remote and has a high level of ethnic diversity in the population. As might be expected, the number of unique variety names recorded in the lowland rice-growing provinces in the Mekong River Valley was generally lower than in other areas of the country. This reflected the fact that there is generally less ethnic diversity within the population in these areas, together with greater opportunities for variety exchange across provincial boundaries, and greater adoption of introduced varieties in the period before the collecting missions.

Diversity within a population

Traditional lowland varieties are relatively more uniform in terms of maturity, plant height, and grain and panicle characteristics than upland varieties. Upland farmers usually grow upland rice crops, which contain a mixture of several morphological

Table 4. Classification of germplasm samples based on growing environments and maturity.

Ecosystem	Total samples	Maturity[a]: no. (%)		
		Early	Medium	Late
Upland	7,371	2,087 (28.3)	3,147 (42.7)	2,137 (29.0)
Lowland[b]	5,821	1,261 (21.7)	3,066 (52.7)	1,494 (25.7)
Total	13,192	3,348 (25.4)	6,213 (47.1)	3,631 (27.5)

[a]Percentages represent comparisons between maturity groupings within each growing environment. [b]Represents the wet-season lowland environment (mainly rainfed) as the dry-season irrigated environment is planted only to improved varieties.

phenotypes, with variation in flowering, plant height, and panicle and grain characteristics (Photo 9.1). This difference between upland and lowland variety characteristics may be related to the differences in agroclimatic conditions, together with cultural differences and different seed selection practices in the different growing environments. Greater diversity in upland varieties is also probably partly due to the deliberate mixing of several phenotypes, with the hope that some types will perform better in the year-to-year uncertainty of growing conditions that are a feature of the upland environment. In one instance, where collecting was being undertaken in an upland field in the southern province of Champassak, 11 different phenotypes were found to be growing together, with differences in the shape and size of panicles, and in the pigmentation of the grain. In the northern province of Luang Namtha, eight different phenotypes were identified in a single upland field, with differences in the shape and size of panicles, and in the pigmentation of the grain.

Diversity for morphological characters

Landrace cultivars grown in both rainfed upland and lowland ecosystems differ for a range of characters, including crop duration; plant height; tillering; pigmentation on various plant parts; panicle shape and size; grain shape, size, and color; and cooking and eating qualities. The latter represent varietal preferences for different food preparations. A high level of variation was observed for brown rice color, from black to red, and to brown or white. Appa Rao et al in Chapter 12 give a separate description of the "black rice" collected from 1995 to 2000.

Diversity for races

Based on gross morphology of the plant, most upland varieties belong to the javanica group, as they produce thick culms, dark green, long, and wide leaf blades, few but large panicles, and large grain. Most lowland varieties produce narrow and long leaf blades, many thin culms, panicles that are small and numerous, with varying grain size that is typical to the indica race. Only two accessions in the collection belonged to the

japonica group, both of which appear to be recent introductions. Intermediate forms between javanica and indica predominate. Most of the morphological characteristics that are generally considered typical for the tropical japonica are classified as the javanica varietal group. Isozyme analysis was done on 318 entries at IRRI-Los Baños using the methods described by Glaszmann (1987). Enzymatic analysis confirmed that more than 90% of the upland accessions belonged to the tropical japonica group (Roder et al 1995). Varieties belonging to this group often have a superior root system when compared with those of the other groups, and should be better adapted to areas, such as the upland growing environments, that experience periodic moisture stress.

Some characters appear to be associated with the particular ethnic groups found in different parts of the country. For example, farmers in Bolikhan District of Borikhamxay Province grow varieties that produce long peduncles, as the practice is to harvest the panicles with a small iron blade and tie them into bundles. Several ethnic groups in predominantly upland areas hand-strip the grain from a standing crop. These varieties have fewer but larger panicles with larger grains that thresh easily to facilitate easy stripping. The lowland Lao, who live near urban areas and along the border with Thailand, grow aromatic varieties because of the market demand and premium paid for high-quality aromatic grain. Some varieties are suited to specific food preparations; for example, the grain of some varieties of *Khao kam* (black rice) is often cooked with coconut milk to provide a sweetened dessert. The variety *Lep nok* (bird's claw), so named on account of the tip of the spikelet being hooked like a claw, is popular in the districts of Khong and Bachiang in Champassak Province, Phouvong District of Attapeu Province, and Khongsedon District of Saravane Province, all of which are in southern Laos, together with Viengxai District of Houaphanh Province in northern Laos. This variety is used to make the popular Lao confectionary crisp called *khao kiap*. The strong preference for such specialized uses of rice contributes to the overall diversity in grain quality attributes. In many situations, farmers grow specific varieties with specific quality attributes for particular food preparations, rather than select types that are specifically adapted to either the short growing season or the dry mountainous environments.

Diversity for ecosystems

Farmers' varieties grown under rainfed lowland and upland environments differ considerably for morphological, physiological, and grain quality attributes. The morphological differences are so great and distinct that it is often possible to differentiate and identify upland rice plants and/or rice grains from lowland plants or grains (Photo 9.2). The main characteristics used to differentiate between the two types are grain size, aroma, tiller number, and stem diameter. According to the farmers' main selection criteria, typical upland varieties are expected to have large but few panicles, strong thick stems, broad thick leaves, early flowering and maturity, and few but larger panicles with large grains. In contrast, lowland varieties often have many thin culms, narrow thin leaf blades, and many but smaller panicles with small to medium-sized grain.

Farmers normally do not grow upland varieties under lowland conditions and vice versa, unless compelled to do so on account of a lack of sufficient seed of appropriate varieties at sowing time. However, some varieties can be grown in both upland and lowland environments. Variety *Hai na (*upland-lowland) collected in Phoukhout District of Xieng Khouang Province, Xai and Beng districts of Oudomxay, and Fuang District of Vientiane Province is considered suitable for cropping in both environments. Another variety, *Hai na suan* (upland, lowland, garden), is popular in parts of Xieng Khouang Province and, although mainly grown under upland conditions, is also regarded as being suitable for the lowland environment. Usually, this variety is grown on elevated but level land, and is dibble-planted in the usual manner for upland rice. After 3 to 5 weeks, depending on the rainfall, excess seedlings are uprooted and planted in lowlands. Variety *Dok tiaw* (tiaw flower) grown in Saythany District of Vientiane Municipality is mainly grown in the lowland environment but can also be grown in upland conditions. Another variety, *Phae deng* (multi-tillering, red), also found in Saythany District, is normally an upland variety but is also considered suitable for lowland conditions. These varieties are of considerable evolutionary significance as they may represent the transition of the adaptation of varieties from lowland to upland conditions, or vice versa. They may have also developed as a result of spontaneous hybridization between upland and lowland varieties, both of which are sometimes grown in close proximity.

Diversity for crop maturity time

Lao farmers allocate varieties to particular fields based mainly on crop duration and likely duration of available soil moisture. Care needs to be taken in the interpretation of maturity times between environments, for the definition of early, medium, and late varieties by upland farmers can differ from that of farmers in the lowland environment. The information recorded and the classification summarized in Tables 1 and 3 are based on the classification of individual samples provided by farmers who donated seed samples. It is generally accepted that varieties in the rainfed upland environment mature earlier than varieties in the wet-season lowland environment. Although a variety classified as early maturing might ripen in 90 to 120 days in the uplands, such a variety might in fact be harvested 3 or 4 weeks earlier than a variety classified as early maturing in the lowland environment. Despite the difference in harvest time, the actual time to maturity between the two environments might be similar on account of the earlier planting in the upland situation. Similarly, for late-maturing varieties, in the upland environment they would be harvested sometime in October, whereas, in the lowland environment, late-maturing varieties might not be harvested until late November or early December; however, sowing of late-maturing varieties in uplands would usually be considerably earlier than in lowlands. Generally, all the traditional varieties in each maturity category are photoperiod-sensitive, with the later-maturing varieties being more strongly photoperiod-sensitive than the earlier-maturing varieties.

For samples collected in the rainfed upland environment, 42.7% were classified as being of medium maturity, with approximately equal proportions classified

as being early- and late-maturing (28.3% and 29.0%, respectively). For the lowland environment, 52.7% of the samples were classified as being of medium maturity, with a slightly higher proportion of late-maturing relative to early-maturing samples (25.7% and 21.7%, respectively).

Early-maturing varieties in the uplands are generally planted close to households, in low-lying areas or near the foothills of mountain slopes above the valleys, where water accumulates with the first rains. They provide a food source in the period immediately before harvest, when most upland households, in particular, have exhausted their food-grain reserves. In situations where households have significant and chronic rice deficits, early-maturing varieties are sometimes grown in fields that would normally be planted to a medium-maturing variety, the choice of the early-maturing variety being based on the need to obtain grain for consumption as early as possible in the growing season. Harvesting of early varieties often takes place in September, coinciding with the period of heaviest rainfall. After harvesting and threshing, the grain is dried on raised platforms in a shaded location.

Some farmers interviewed planted five different rice varieties. In lowland areas, farmers often grow varieties of different maturity to spread labor requirements, provide stability to offset environmental variation, and produce more. Some farmers interviewed planted five different rice varieties. Early- and medium-maturing varieties are usually grown in the upper parts of terraces where there is a greater likelihood of drought stress immediately after the end of the wet season. Long-duration varieties are mainly grown in low-lying areas on the beds of watercourses or inland valley swamps in areas with variable water levels. These varieties are planted last; they flower at the end of the rainy season (most are photoperiod-sensitive) and mature after more than 145 days. They grow very tall, produce very thick stems and long and broad leaves, are profusely tillering, are synchronous in flowering and maturity, and produce large panicles. The area under late varieties is limited on account of the prevailing low temperatures from December through February in the northern region, which limits crop growth. These varieties usually produce good-quality grain as they mature after November, when the rains stop.

Harvesting methods along with seed selection practices have probably contributed to variety evolution. Lao farmers practice panicle selection and grain stripping, and these stabilize the main seed types and also bring about systematic grouping among off-types. Early-ripening types are harvested as they ripen to secure some grain for consumption in those periods when households have a rice deficit; longer-duration types are left in the field to the gleaners. In this way, over a long period of time, panicle selection might have resulted in the differentiation of varieties into three distinct duration classes.

Diversity for endosperm type

The type of endosperm in the rice grain is related to cooking quality characteristics of rice. Glutinous grains have a higher viscosity than nonglutinous grains when heated, and so this type is popularly called sticky rice. Only after harvest, while drying, does

glutinous rice grain become distinguishable from nonglutinous rice. In the overall collection, glutinous samples accounted for 85.5% of the total, reflecting farmer and consumer preference for this type of rice. Overall, 86.6% of lowland and 84.6% of upland samples collected were glutinous (Fig. 1). The relatively higher proportion of nonglutinous types sampled in the northern region is probably a reflection of the presence of significant numbers of farmers belonging to the Hmong and Yao ethnic groups in this region (UNDP 1998); both these ethnic groups consume nonglutinous rather than glutinous rice. Similarly, the greater number of nonglutinous varieties found in the upland environment (1,134 samples) relative to the lowland environment (779) also reflects the fact that the Hmong and Yao ethnic groups are to be found almost exclusively at higher altitudes in the upland environment.

For a few varieties, the endosperm is intermediate between glutinous and nonglutinous forms. Two such varieties are referred to as *Chao kheng* (nonglutinous, hard) and *Khao ma-yeng* (rice watched by a dog). Samples of *Chao kheng* were collected from Long and Nale districts of Luang Namtha Province, Xai District of Oudomxay Province, and Houayxay District of Bokeo Province, all in northern Laos, and also from Atsaphangthong District of Attapeu Province in southern Laos. *Khao ma-yeng,* on the other hand, was collected mainly from provinces in the central and upper southern regions—Vientiane Municipality and the provinces of Borikhamxay and Savannakhet; it was also collected from three districts of Luang Prabang Province. The eating quality of these intermediate types is considered to be so inferior that even a dog does not like to eat them but prefers to sit and look at them (hence the name *Khao ma-yeng* or rice watched by a dog). This type of rice is not usually grown by farmers but is found occasionally among glutinous varieties. Such types are eliminated during the time of seed selection. The occurrence of these intermediate types might be the result of spontaneous crossing between the glutinous and nonglutinous forms. The type *Chao niaw* (nonglutinous sticky rice), though considered as a nonglutinous variety, becomes sticky after cooking. Some varieties have the word *paeng* as part of their name to reflect their floury or powdery endosperm. A study of the amylose and amylopectin content of these varieties could help provide a better understanding of the evolution of sticky rice.

Varietal diversity at the household level

Lowlands

In the wet season, most lowland farmers grow a group of homogeneous stands of several varieties in small plots as a mosaic in the same field. The varieties grown differ for several characters that include grain quality attributes to suit various types of food preparations and maturity duration—early, medium, and late—besides others. Mixtures of two different varieties are sometimes grown to complement one another, but farmers usually try to keep their varieties separate. Lowland farmers, when growing traditional varieties, usually do not grow more than three (although small areas of speciality rice might also be grown in addition to the main varieties). With the adoption

of the more recently available improved varieties, fewer varieties are generally being grown by individual households.

Uplands

Upland farmers clearly differentiate among early, medium, and later-maturing varieties and most households plant varieties from each group. This allows them to harvest rice for consumption as early as possible, distribute labor requirements for the harvest, and spread risk (Roder et al 1996). In addition, special varieties are sometimes grown for religious ceremonies, nonglutinous varieties for noodle making, and some varieties suited to making alcoholic beverages. Most upland farmers grow three to five varieties, with each variety showing differences in maturity.

Mixing of varieties

In both the upland and lowland environments, farmers sometimes grow a mixture of varieties in one field. This is more often the case in the upland environment, where a heterogeneous mixture of several varieties is sometimes grown. The purpose of such mixtures is to reduce the potential risks associated with single-variety cropping such as drought, pests, and diseases. The variety mixture usually results in greater yield stability. Although less frequent in the lowland environment, planting of varietal mixtures occasionally does take place. For example, in parts of Kham District in Xieng Khouang, a variety called *Mak pho* (banyan fruit), which has good resistance to lodging but has poor grain quality and is susceptible to gall midge, is mixed with another variety, *Khao bong,* which is susceptible to lodging but has good grain quality, is aromatic, has a high recovery after milling, and is resistant to gall midge. Farmers mix *Mak pho* with *Khao bong* at a ratio of about 35:65; the mix results in a crop that does not lodge and that gives a product with good eating quality. The two varieties are of the same height, mature at the same time, and have glutinous endosperm. However, the seed of the two varieties can be differentiated by the color of the glumes. In each of the three northern provinces of Luang Namtha, Oudomxay, and Houaphanh, some districts have varietal mixtures that are also sometimes grown in the lowlands, with the mixtures being believed to give higher yields and greater yield stability than single-variety crops.

In Pakse District of Champassak in southern Laos, farmers sometimes grow a single variety consisting of two morphologically distinct types. This variety, known as *Pua-mia* (husband-wife), appears to be composed of two isogenic lines that differ only in respect to glume color: one line has purple to brown glumes, while the other has green glumes that turn yellow upon maturity. The lines not only are similar morphologically but also flower and mature at the same time; farmers grow them together as if they constituted a single variety. The two types appear to be identical until the time of maturity, when a change in glume color identifies each line.

Varietal diversity at the community level

Lao farmers live in small community villages, with each village usually being inhabited by a particular ethnic group. However, in some areas, particularly resettlement areas in central and southern Laos, a village sometimes contains more than one ethnic group. Although individual farming households may grow only two or three varieties, at a community level there is often much greater diversity, depending on the region, ecosystem, and ethnic group. In the southern region, most communities grow a minimum of three varieties representing three maturity groups—early, medium, and late. However, some communities in Vientiane Province in the central region were found to be growing up to 10 varieties (Appa Rao et al 1997b). In Khamkeut District of Khammouane in the central region, 19 varieties with varying grain characters were collected from a single village. These varieties included rainfed lowland, rainfed upland, glutinous, and nonglutinous types of varying maturity time. In general, diversity at the community level is greater in the northern region than in the southern and central regions. In a single village in the district of Vieng Kham in Luang Prabang, 18 distinct varieties were recorded as being grown. Generally, variety diversity at the community level is greater in upland environments than in lowland areas. This, in turn, reflects the generally greater diversity of both ethnic groups and growing environments in the more mountainous northern areas of the country than in the main lowland rice-growing areas in the central and southern agricultural regions.

Seed selection procedures

The maintenance of the great diversity of traditional rice varieties found in Laos reflects the seed selection practices that have been developed. These practices are often quite different between the upland and lowland environments, with these differences in turn being reflected in the "within-crop" diversity that exists between these environments.

Upland environment

As upland farmers often grow mixtures of different varieties in the same field, as part of their seed selection process, they deliberately collect panicles representative of all types and keep the mixed population for seed purposes. While some households thresh the panicles and store the seed, others tie the panicles into bundles and store them in this form until planting time in the subsequent year. Another technique sometimes used is to hand-strip the grain from the more attractive panicles separately at the time of stripping panicles for grain purposes. Occasionally, farmers collect a small quantity of seed from the bulk-harvested grain for use as seed. However, specific attention is generally given by upland farmers to the selection of seed to be used for the following season's crop. Differences also exist in the seed selection procedures within the diverse ethnic groups found in the upland environment.

Lowland environment

Most lowland farmers select their most uniform and best fields for the purpose of obtaining seed for the succeeding crop; the area selected for this purpose is usually harvested and threshed separately from that which provides grain for consumption. Often, the part of the crop to be used for seed grain is also harvested after the harvest of the remainder of the crop. Before threshing the seed-grain component of the crop, off-type panicles are usually identified and removed, resulting in a crop with more uniform panicles. The seed grain is usually carefully packed and stored separately from the component of the crop used for consumption. Occasionally, to obtain seed grain, farmers may take bulk seed from the threshing floor and then sieve this to eliminate unfilled or partially filled seed and other impurities.

Germplasm erosion

Rice cultivation in both the rainfed lowland and rainfed upland environments of Laos has, until relatively recently, been based on the use of traditional varieties and minimum inputs, using family labor as the most important input. Even in the main lowland rice-growing areas of the Mekong River Valley in the central and southern agricultural regions, until as recently as the early 1990s, it was estimated that more than 90% of rice cultivation was based on the use of traditional varieties. In the upland environment, only traditional varieties were grown. The first improved Lao glutinous varieties were released in 1993 and they proved well suited to the main lowland areas, such that, by 2000, more than 80% of the wet-season rice area in most provinces in central and southern Laos was being cultivated with these varieties. The expanding dry-season irrigated rice environment at that time was being cropped only with improved varieties. The adoption of the improved varieties in the main lowland rice-growing areas of Laos has generally been associated with the discarding of most of the traditional varieties that had been selected by farmers and grown for generations. Many of the varieties collected from the wet-season rainfed lowland environment in the central and southern agricultural regions in the early years (1995 and 1996) of the germplasm collecting and conservation project were no longer being grown or available by the early 2000s. The samples in the germplasm collections being maintained *ex situ* now represent the only source of much of this material. In the northern agricultural region, the traditional varieties have continued to be grown in the rainfed lowland environment in many provinces only because the varieties released for the central and southern agricultural regions were not well suited to cultivation in the northern region. However, in the late 1990s, efforts began to develop improved higher-yielding varieties better suited to the specific growing conditions in the lowlands of the north. It can be expected that, as better-adapted improved varieties become available and are introduced to farmers in this region (and in some elevated lowland areas in more southern provinces), many of the traditional lowland varieties will disappear as fast as has happened in the lowland environment in the southern and central regions. The erosion of the traditional germplasm in most lowland areas of Laos, as a result of the adoption of improved higher-yielding varieties, might therefore be expected to

be almost complete by about 2010. It is probable that only some specialist traditional rice such as black rice (Appa Rao et al, Chapter 12) and some well-known aromatic rice (Appa Rao et al, Chapter 11) will continue to be grown on a regular basis in some lowland farming areas.

In relation to the upland environment, there has not been the same level of focus on the development of improved higher-yielding varieties as for the lowland environment. Upland farmers have, until the early 2000s, continued to grow their traditional upland varieties. However, even in this environment, superior upland varieties have been identified from the evaluation of the collection of upland varieties assembled between 1995 and early 2000. In some areas where variety selections have been introduced to upland farmers in northern Laos, they are already being adopted and are expected to replace many of the varieties that have been grown for many years. It might be expected that, as a result of more active agricultural extension services introducing a few superior upland varieties throughout upland areas, there will be a gradual but significant reduction in the number of traditional rice varieties being grown throughout much of the rainfed upland environment in the north and elsewhere in the country. The erosion of the upland germplasm base might also be accelerated as a result of a gradual decline in the area of upland rice cultivated throughout Laos, in line with government policy to move from annual cropping (rice and other annual crops) to more sustainable agricultural practices in the uplands throughout the country.

Conservation of germplasm diversity

Conservation within Laos

Ex situ conservation of genetic resources in genebanks is the most secure and cost-effective strategy for the long-term preservation of rice germplasm. The country's first national cold storage facility to conserve germplasm was built in 1997 at the National Agricultural Research Center (NARC) at Thadokkham in Saythany District of Vientiane Municipality. The facility was designed for seed storage at 4 °C, at about 50% relative humidity. For long-term conservation, 20-g samples are kept in deep freezers maintained at –18 °C. This germplasm base is available for long-term breeding and evaluation purposes.

Duplicate conservation at the International Rice Genebank

Under an agreement signed between the Lao Ministry of Agriculture and Forestry and the International Rice Research Institute (IRRI), for long-term conservation, a duplicate set of all rice samples collected between 1995 and 2000 is being conserved at the International Rice Genebank (IRG) at IRRI headquarters in the Philippines.

Conclusions

The remarkable genetic diversity of the traditional rice cultivars in Laos jointly reflects the country's rich cultural and geographic diversity together with the country's relative isolation until recent times. The collecting that was undertaken from 1995 to 2000 was

timely in that many of the traditional varieties collected then are no longer available in the farming areas where they were developed and grown, often for many generations. As with most other countries in the Asian region, farmers have been receptive to the adoption of improved higher-yielding varieties that have quickly replaced traditional lowland varieties. In the upland environment, a combination of the evaluation and subsequent distribution of superior upland varieties from among those collected in the latter part of the 1990s, together with a reduction in upland rice cultivation, can also be expected to result in a significant reduction in the diversity of varieties being grown in the uplands. Care needs to be given to ensure the proper maintenance and use of the traditional rice germplasm collections stored *ex situ* in both Laos and at the GRC at IRRI in the Philippines.

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Notes

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Acknowledgments: The authors gratefully acknowledge the farmers of Laos, who provided not only samples of their valuable seed for conservation but also their invaluable knowledge about the traditional rice varieties of Laos. Special acknowledgment is due to the many Lao officials within the Ministry of Agriculture and Forestry for their role in collecting the information reported in this chapter. The financial support of the Swiss Agency for Development and Cooperation (SDC) to the project that undertook the collection of traditional varieties for conservation and preservation is also acknowledged.

CHAPTER 10

Naming of traditional rice varieties by the farmers of Laos

S. Appa Rao, J.M. Schiller, C. Bounphanousay, A.P. Alcantara, and M.T. Jackson

The collection of traditional rice varieties from throughout Laos, together with a summary of the diversity observed and its conservation, has been reviewed in Chapter 9 of this monograph. While undertaking the collection of germplasm samples from 1995 to early 2000, information was collected from farmers on the special traits and significance of the different varieties, including the vernacular names and their meanings. Imperfect as literal translations might be, the names provide an insight into the diversity of the traditional rice varieties of Laos. Furthermore, the diversity of names can, when used with care, act as a proxy for genetic diversity.

When collecting started, variety names were recorded in the Lao language and an agreed transliteration into English was developed. The meanings of the variety names were obtained from all possible sources, but particularly from the farmers who donated the samples, together with Lao extension officers and Lao research staff members who understood both Lao and English. Variety names were translated literally, based on the explanations provided by farmers. For example, the red color of glumes is often described in terms of the liquid from chewed betel leaf, which is dark red. Aroma is sometimes indicated by the names of aromatic flowers like jasmine or the response to the aroma that is emitted by the grain of particular varieties during cooking. This chapter provides a summary of the information collected on the naming of traditional Lao rice varieties. More detailed information is available from records of the collections maintained by the Genetic Resources Center at the International Rice Research Institute (IRRI) and in detailed reports of the collecting missions (Appa Rao et al 2000).

Components of variety names

Most rice variety names in Laos have three elements: a basic name, a root name, and a descriptor. The basic name is *Khao*, which means rice. However, there are several very common root names: *Khao na* (rice, lowland), *Khao hai* (rice, upland), *Khao niaw* (rice, sticky/glutinous), *Khao chao* (rice, nonglutinous), and others. The third element, a descriptor name, allows farmers to further identify particular varieties within groups. For example, the variety name *Khao niaw do* refers to a glutinous early-maturing (*do*)

variety, whereas *Khao niaw kang* indicates a glutinous rice variety of medium maturity (*kang*). Quite often, the word *Khao* is understood rather than being formally included in the name, so the name recorded was only the root name and the descriptor, such as *Khao phae deng* (profusely (*phae*) tillering, red (*deng*) variety).

Variety names with just one descriptor are the most common, but occasionally they may have two descriptors. Some examples of the dual-descriptor names are *Chao oon tam* (nonglutinous, soft, short), *Khaw pom kon dam* (white, globular grain, black apiculus), *Peek khaw gnay* (winged, white grain, big), and *Chao Lao-Soung dam* (nonglutinous, highland Lao, black grain).

Variants within varieties with similar root names

Naturally occurring variants of individual varieties are selected by farmers, tested for their performance, and maintained as new varieties. The number of variant forms varied considerably. For example, the variety *chao* (nonglutinous) has 159 variants (Table 1) as the farmer-consumers of nonglutinous rice use the prefix *chao* for most of the varieties they grow. In general, those traditional varieties that are grown extensively because of their adaptability and/or superior grain and/or eating quality have more variant forms. For example, variety *Khao kay noi* (small chicken rice) is a rainfed lowland glutinous variety valued for its excellent grain quality. It is grown extensively in the provinces of Houaphan and Xieng Khouang in the northern and northeastern regions. Among the collections of this variety, nine different forms were found with differences in glume color and other characteristics, with some of these varieties having additional descriptors in the varietal name to reflect these special traits (Table 2). Similarly, the glutinous variety *Khao sanpatong,* developed in, and introduced from, Thailand in about 1967, is extensively grown under rainfed lowland conditions throughout Laos. Within the collection, nine variants of this variety were identified, with differences in maturity time, aroma, and morphological characteristics (Table 2). Variation in the shape, size, and color of rice grains is often reflected within the root component *med* (grain) of the variety name. One of the most diverse varieties found throughout the country was *phae* (profusely tillering). Found in both upland and lowland environments, 38 different forms of *phae* were identified, with differences in maturity time and several morphological characteristics, such as presence or absence of hairs, color of glumes, and grain size.

Diversity of distinct variety names

For the total of 13,192 samples of traditional varieties collected from mid-1995 to early 2000 (Appa Rao et al 2002, Appa Rao et al, Chapter 9), variety names were recorded for all but 6% (789) of the samples (Table 3). As there are 48 recognized distinct ethnic groups in Laos (ADB 2001), most of whom speak markedly different languages, some of which are not all widely understood, some variety names could not be readily translated into the Lao language (and therefore into English). Some farmers, particularly the younger generation, are not aware of the variety names. Of

Table 1. Number of variant forms for some variety names.

Variety name	Meaning[a]	Variants	Variant groups with which the variety name is associated
Chao	Nonglutinous	159	Ethnic groups, maturity time, plants and animals
Dam	Black	26	Grain size, grain shape, endosperm type
Kam	Black	34	Grain size, maturity time, ecosystem, endosperm type
Khaw	White	40	Endosperm type, ecosystem, maturity time
Deng	Red	67	Size, shape, color, and quality of grain, aroma, maturity, pubescence, awns, yield, ecosystem
Leung	Yellow	29	Spikelet shape, awns, adaptation
Do	Early	105	Ecosystem, endosperm type, adaptation
Dok	Flowers	27	Different traits such as names of flowers, aroma, color
Kai	Chicken	10	Color, shape, and awns of spikelets, cold tolerance
Leb	Nail/toe	13	Bear, bird, dog, dragon, elephant, lady, rhinoceros
Mak	Fruit	114	Various fruits
Pa	Fish	33	Grain size, grain shape, flooding tolerance
Peek	Winged	16	Color, shape, and size of spikelets
Met	Grain	21	Size, shape, and color of grain
Mon	Globular (grain)	11	Maturity, endosperm type
Namman	Fat	11	Cow, crab, duck, sandalwood, sesame
Oon	Soft (grain)	11	Endosperm, grain size
Phae	Many (tillers)	38	Size, shape, color, and quality of grain, aroma, maturity, pubescence, awns, yield, ecosystem
Sanpatong	Sanpatong[b]	9	Maturity time, grain size, aroma

[a]Words in parentheses implied. [b]Sanpatong = name of variety originating from Sanpatong District, Thailand.

the 12,404 samples for which names were recorded, 1,414 were recorded as having ethnic names that were later translated into Lao and English, whereas the ethnic names for another 151 samples recorded could not be translated.

For the 12,404 samples collected for which variety names were recorded (or recorded and translated into Lao), 3,169 names were distinct. The prevalence of distinct variety names varied among the provinces in which collections were made (Table 3). The largest number of names (1,120) was recorded in the northern agricultural region and the least (583) in the southern agricultural region. The northern province of Luang Prabang, which has the largest area of upland rice of any single province, had the highest number (462) of variety names; the largest number of samples (1,244) was also collected in this province. Although fewer individual varieties were collected in some of the southern provinces, some of these had the highest number of unique

Table 2. Variant forms of the varieties *Khao kai noi* and Khao Sanpatong.

Variants of the variety *Khao kai noi* (small chicken rice)				
Lao name of variant	English name equivalent	Character	Source of sample	
			Province	Ecosystem
Khao kay noi	Chicken, small	Standard variety	Northern region	Lowland
Khao kay noi dam	Chicken, small, black	Black glumes	Houaphanh	Lowland
Khao kay noi deng	Chicken, small, red	Red glumes	Houaphanh	Lowland
Khao kay noi khaw	Chicken, small, white	White glumes	Houaphanh	Lowland
Khao kay noi leuang	Chicken, small, yellow	Yellow glumes	Houaphanh	Lowland
Khao kay noi lai	Chicken, small, striped	Striped glumes	Houaphanh	Lowland
Khao kay noi hai	Chicken, small, upland	Adapted to uplands	Houaphanh	Upland
Khao kay noi hom	Chicken, small, aromatic	Aromatic	Houaphanh	Lowland
Khao kay noi hang	Chicken, small, awned	Awned spikelets	Xieng Khouang	Lowland
Khao kay noi/nam yen	Chicken, small, cold water (tolerant)	Cold-tolerant	Houaphanh	Lowland
Variants of the variety *Khao sanpatong*				
Khao sanpatong	Sanpatong	Standard variety	Khammouane	Lowland
Khao sanpatong do	Sanpatong, early	Early maturity	Savannakhet	Lowland
Khao sanpatong do hom	Sanpatong, early, aromatic	Early maturity, aromatic	Vientiane Municipality	Lowland
Khao sanpatong gnay	Sanpatong, big	Large grains	Sekong	Lowland
Khao sanpatong hang dam	Sanpatong, black awned	Black-awned spikelets	Borikhamxay	Lowland
Khao sanpatong kang	Sanpatong, medium	Medium maturity	Sekong	Lowland
Khao sanpatong ngan	Sanpatong, late	Late maturity	Sekong	Lowland
Khao sanpatong noi	Sanpatong, small	Small grains	Vientiane Municipality	Lowland
Khao sanpatong pee	Sanpatong, late	Late maturity	Vientiane Municipality	Lowland

variety names (a variety was regarded as unique to a province when it was recorded as having been collected only in that province). In the southern province of Attapeu, approximately 62% of the samples collected (and named) were classified as unique (Table 3). Other provinces with high levels of unique varieties were Sekong in the south and Phongsaly in the north, for which 54.7% of the samples collected in both provinces were categorized as unique. These three provinces (Attapeu, Sekong, and Phongsaly) are remote and they have high levels of ethnic diversity in their population. As might be expected, the number of different names and the proportion of samples with unique names were lower in Vientiane Municipality and other provinces of the central agricultural region in the Mekong River Valley, whose population has less

Table 3. Distribution of variety names among regions and provinces of Laos.

Region/ province	No. of samples collected	No. of samples with names	Number of names	Number[a] of unique names	Unique[a] names as % total for province	No single-name occurrences	Single-name occurrences as % total for province
Northern region	5,915	5,613	1,120	–	–	968	–
Luang Prabang	1,244	1,162	462	191	41.3	158	21.1
Sayabouly	984	949	416	168	40.4	140	23.7
Luang Namtha	858	798	406	202	49.8	190	27.7
Oudomxay	848	814	343	116	33.8	99	17.4
Bokeo	686	665	299	103	34.4	87	19.8
Phongsaly	664	646	373	204	54.7	177	37.3
Houaphanh	631	579	300	136	45.3	117	29.0
Central region	4,625	4,321	613	–	–	513	–
Savannakhet	989	968	358	148	41.3	117	21.0
Khammouane	867	840	296	102	34.4	86	15.4
Vientiane Province	787	717	331	108	32.6	89	19.8
Borikhamxay	594	560	273	91	33.3	77	19.8
Xieng Khouang	560	535	223	74	33.2	64	17.6
Vientiane Municipality	486	380	197	48	24.4	43	16.1
Saysomboun Special Region	342	321	161	42	26.1	37	17.1
Southern region	2,652	2,469	583	–	–	482	–
Champassak	842	773	283	97	34.3	77	15.8
Saravane	774	741	335	144	43.0	110	26.3
Attapeu	640	596	336	209	62.2	180	42.3
Sekong	396	359	243	133	54.7	115	45.7
Total	13,192	12,403	3,169	2,316[b]	–	1,963	–

[a]Recorded for a single province; a unique name may have been recorded more than once within a province. [b]This is the total number of different names across all provinces (and not the sum of this column); 853 (26.9%) of the names were recorded in more than one province.

ethnic diversity and where opportunities have been greater for the exchange of modern varieties across provincial and national boundaries. The adoption of introduced improved varieties before the collecting missions reported in this chapter has also been greater.

There is greater diversity, and therefore diversity of names, of the varieties grown in the upland environment than in the lowlands. This probably reflects several factors, such as the greater ethnic diversity within the population in the uplands and their associated diversity of preferences for food quality attributes (endosperm type, grain quality, aroma of cooked grain, etc.) in the types of rice they grow. The diver-

sity of upland varieties also probably reflects the greater diversity in the agroclimatic conditions under which these varieties are grown.

Diversity of variety root names

The most common root names reflected the fact that a variety was glutinous or non-glutinous, together with the color of the seed (Table 1). The most common root names recorded were *chao* (nonglutinous) (159 times), *do* (early) (105), *deng* (red) (67), *kam* (black) (34), and *pa* (fish) (33 times) in the collection of 12,404 samples for which names were recorded. Some root names are slightly different in the Lao language but have the same meaning; for example, black (usually referring to the color of the glumes) can be referred to by the root names as either *kam* or *dam.* The root name *peek* (winged or long glumes) was recorded in 16 variety names. Although variety names are mostly distinct, and varieties often have unique characters associated with the name, the same apparent variety is sometimes called by different names by different ethnic groups. Conversely, varieties with different morphological and physiological characters (Photo 10.1) are sometimes given the same name by different groups. For example, the variety *Khao kam* (black rice) differs for a large number of characters, but farmers use the same name as long as the pericarp is black or purple, and generally ignore all other characteristics. Similarly, they use the name *Khao peek* (winged rice) for any variety that has long glumes, ignoring all other characteristics. Hence, there may be more varieties with specific characteristics than the lists of names indicate.

The naming of varieties by Lao farmers

Lao farmers use a functional system to name a variety that is based on useful characters that make it readily identifiable, and sometimes to reflect its more innate characteristics (particularly those relating to cooking and eating quality). Table 4 summarizes the diversity in the common names that were recorded in the collection of 12,404 samples of traditional rice collected in 1995-2000.

Naming of varieties to reflect endosperm type, grain quality, and aromatic characteristics

Lao farmers give names to varieties based on endosperm type: *niaw* (glutinous or sticky) and *chao* (nonglutinous). Some traditional varieties are intermediate between glutinous and nonglutinous forms and their names reflect this characteristic: *Khao chao niaw* (rice, glutinous/nonglutinous). These varieties are regarded (by the Lao farmers who grow them) as nonglutinous, but they become sticky like glutinous rice after cooking. The eating quality of these intermediate types is generally regarded as inferior to that of the recognized glutinous and nonglutinous types. The amylose content of such varieties ranges from 5% to 15% and they are characterized by having grain that remains very hard after steaming (as required for glutinous rice), but which becomes soft after being cooked in the manner of nonglutinous rice. Examples of these intermediate types were found in Kham District of Luang Prabang in the northern

Table 4. The most common names used in the naming of rice varieties by Lao farmers.

Group	Names
Animals	Spider (*beung*), deer (*kouang*), chicken (*kay*), buffalo (*khouay*), rhinoceros (*haed*), monitor lizard (*lan*), dog wild (*ma nay*), brown bear (*mee-uay*), cow (*ngoua*), rat (*nuu*)
Animal blood	Blood of deer (*leuad fan*), blood of rhinoceros (*leuad haed*), blood of bird (*leuad nok*)
Animal nails	Toe of dog (*leb maa*), nail of black bear (*leb mee dam*), toe of Naga (*leb ngeuak*), claw of bird (*leb nok*), toe of elephant (*leb saang*),
Animal organs	Turtle shell (*ket tao*), bone of palat fish (*kang palat*), hair of cow (*khon ngoua*), back of turtle (*lang tao*), cow milk (*nom ngoua*), eyes of frog (*ta khiat*), liver of brown bear (*tab mee-uay*)
Animal tails	Tail of eel (*hang ean*), tail of chicken (*hang kay*), tail of dog (*hang maa*), tail of horse (*hang maa*), tail of otter (*hang nak*), tail of civet (*hang ngen*), tail of cow (*hang ngoua*)
Animal teeth	Teeth of buffalo (*kheow khouay*), teeth of dog (*kheow maa*), teeth of horse (*kheow maa*), teeth of pig (*kheo muu*)
Animal manure	Cow dung (*khii ngoua*), buffalo dung (*khii khouay*)
Birds	Crow (*ka*), parrot (*nok keo*), hill myna (*nok khek*), wild quail (*nok khoum*), owl (*nok khouw*), dove (*nok khoua*), pheasant (*nok kod* and *nok peud*), finch (*nok peed*), quail (*nok tha*)
Ethnic group	Kui, Hmong, Black Hmong, White Hmong, Hor, Katu, Khmu, Kor, Laobid, Laotheung, Lenten, Leu, Museur, Pako, Phay, Phutai, Taliang, Yaheun, Yang, Yao, Yuan
Fish	Goby fish (*pa bou*), giant snakehead fish (*pa do*), perch (*pa kheng*), bitter fish (*pa khom*), scorpion fish (*pa lad*), eel (*pa laay*), improved fish (*pa phan*), rasbora fish (*pa siev*), jullien's mud carp (*pa soi*)
Flowers	Aster flower (*dok chan*), Hien flower (*dok hien*), aromatic flower (*dok hom*), Keaw flower (*dok keaw*), Pandanus, galanga flower (*dok kha*), shorea flower (*dok khagnom*), golden flower (*dok kham*), golden shower tree flower (*dok khoun*), wild sugarcane flower (*dok louw*), yellow flower (*dok leuang*), jasmine flower (*dok mali*), aromatic flower (*dok om*), coconut flower (*dok phao*), gardenia flower (*dok phoun*), blooming flower (*dok tek*), flower (*dok teuy*), drooping flower (*dok teuy*), tiaw flower (*dok tiaw*), orchid flower (*dok pheung*)
Fruits, nuts, and vegetables	Kaffir lime fruit (*mak khie houd*), ley fruit (*mak ley*), cucumber (*mak teng*), fruit of bid tree (*mak bid*), almond (*mak bok*), sponge gourd (*mak bouab*), red fruit (*mak deng*), fruit of banyan tree (*mak hay*), liam fruit (*mak liam*), fruit of lod (*mak lod*), fruit of mulberry (*mak mone*), fruit of mouay (*mak mouay*), fruit of moy (*mak moy*), bottle gourd (*mak nam tao*), lemon (*mak nao*), sesame (*mak nga*), fruit of ngoua (*mak ngoua*), passionfruit (*mak nod*), fruit of phan (*mak phan*), fruit of marian plum (*mak phang*), fruit of coconut (*mak phao*), fruit of bodhi tree (*mak pho*), fruit of phod (*mak phod*), fruit of phoua (*mak phoua*), fruit of jute (*mak po*), fruit of sugar palm (*mak tan*), fruit of tek (*mak tek*), cowpea (*mak thoua*), durian (*mak thoua lien*), ash gourd (*mak ton*), fruit of toun (*mak toun*), fruit of jambolan tree (*mak wa*), fruit of rattan (*mak vay*), star gooseberry (*mak fay*), orange (*mak kieng*)
Country	America, China, Czechoslovakia, Japan, India, Cambodia, Laos, Myanmar, Philippines, Thailand, Vietnam
District (within Laos)	Thakhek, Luang Prabang, Khob, Ngeun, Hongsa, Houyxai, Houn, Viengthong, Khong, Beng, Ham, Kao, Khoua, La, Leuy, Long, Nga, Nong, Sing, Nambak, Ngoy, Pakse, Phonsavan, Pialad, Taoey, Thateng, Vangvieng, Xiengsen

Continued on next page

Table 4 continued.

Group	Names
Provinces (within Laos)	Sekong, Luang Namtha, Samneua, Phongsaly, Saravane, Savannakhet, Sayabouly, Xieng Khouang
Provinces (elsewhere)	Ubon (Thailand), Khon Kaen (Thailand)
Rivers and water	Hi (Nam Hi), Hoy (Nam Hoy), Kai (Nam Kai), Kha (Nam Kha), Khoun (Nam Khoun), Neun (Nam Neun), Nga (Nam Nga), Ou (Nam Ou), Paa (Nam Paa), Pee (Nam Pee), Soua (Nam Soua), Toon (Nam Toon), Xeng (Nam Xeng), Lay (Nam Lay)
Villages	Bong, Deua, Keaw, Kuen, Lem, Pheng, Phon, Pong, Poung, Sok, Tad, Tay, Tem, Bengkham, Hadsa, Nagnang, Nalong, Nangoy, Nadeng, Nagnao, Nangom, Nakan, Nakok, Nalee, Naleng, Napan, Napho, Napoung, Nasala, Nasan, Naso, Nateun, Natong, Thongkham
Names of people	Bouakham, Leng, Kham, Kong, King, Cho, Ke, Koum, Le, Leuam, Lod, Lon, Long, Loua, Louy, Mang, Noi, Oe, Ouy, Phouan, PO, Pouad, Rak, Se, Seng, Soy, Ton, Took, Tou, Vieng, Yee, Khambou, Khamdeng, Khamhok, Khamhoua, Khamlay, Khamlone, Khammalone, Khamphay, Khamphone, Khamsen, Bounlang, Kongchay, Xiengdee, Phan, Ay, Bounma, Choum, Deng, Dom, Gni, Keaw, Khouay, Kon, La, Mao, Som, Tia, Houng, Bay, Tem, Houm, Sy, Thongchanh, Pee

agricultural region, and in Outhoumphone District in Savannakhet in the lower part of the central agricultural region.

One of the most important criteria for selecting a variety is grain quality. Two well-known traditional lowland varieties with excellent grain quality and good aroma are known by the romantic names of *Khao nang nuan* (rice, soft lady) and *Khao hom nang nuan* (rice, sweet smelling, soft lady). At the time the collections were made in 1997, these varieties were being grown extensively in parts of Vientiane Province, particularly in Vangvieng District. The aromatic characteristics of a variety are often likened to well-known aromatic flowers such as the jasmine flower and the strongly aromatic wood, sandalwood (Table 5). Sometimes, the variety name reflects poor grain quality characteristics, as with *Khao hav* (rice, grain cracks) and *Khao pheng* (rice, floury endosperm). The nature of the grain after cooking is also sometimes reflected in the name. One lowland glutinous variety grown in Sayabouly District of Savannakhet with particularly hard grain is called "broken jaw rice" (*Kang loud hak*). The names of other varieties that reflect their good quality include *Leum pua* (forgets husband)—this variety is so aromatic and good to eat that it is likened to a wife who, on eating the rice, forgets that her husband has yet to eat. Another such variety is called *Pha nya leum kheng* (the king forgets his soup)—the king, on eating this rice and finding it so good, forgets to eat his soup. The word *ma* (dog) is often linked to the eating quality of varieties. For example, *Khao mayeng* (a poor-quality variety) means "rice watched by a dog," based on the belief that a dog will eat the grain of this variety only reluctantly, preferring to sit and stare at it. The names *Ma thoun* (dogs wake up) and *Ma keu* (dogs rush) indicate rice of such good quality that dogs will interrupt their sleep or come rushing when they smell the aroma of the grain of these varieties after cooking. A variety collected in Sekong Province is called *Khao leum ma leum meo* (rice,

Table 5. Varietal names reflecting aromatic and eating quality.

Character	Lao name[a]	Literal English meaning of variety name	Source of collection (province and ecosystem[b])	
Aromatic	*Aham*	Aromatic	Savannakhet	UP
	Ahom	Aromatic	Sekong	UP
	Hom	Aromatic	Khammouane	L
	Ba hom	Aromatic rice	Sekong	UP
	Chao hom	Nonglutinous aromatic	Houaphanh	UP
	Chao hom khao	Nonglutinous aromatic and white	Houaphanh	UP
	Chao mali	Nonglutinous jasmine	Khammouane	L
	Chao hom mali	Nonglutinous aromatic jasmine	Vientiane Municipality	L
	Hom mali niaw	Aromatic, jasmine, glutinous	Borikhamxay	L
	Hom mali kang	Aromatic, jasmine, medium (maturity)	Vientiane Municipality	L
	Dok mali	Jasmine flower	Vientiane Municipality	L
	Hom bay	Aromatic leaves	Borikhamxay	L
	Hom chan	Aromatic, sandalwood	Champassak	L
	Hom nuan chan	Aromatic, sandalwood, soft	Vientiane	L
	Naman chan	Sandalwood oil	Luang Prabang	UP
	Hom deng	Aromatic, red	Khammouane	L
	Hom dok dou	Aromatic *Pterocarpus* flower	Vientiane Municipality	L
	Hom keaw	Aromatic crystal	Vientiane Municipality	L
	Hom Nang nuan	Sweet smelling, soft, young lady	Borikhamxay	L
	Hom sam heuan	Aromatic, three houses	Borikhamxay	L
	Hom saa-ngiem	Aromatic, pleasant	Vientiane	L
	Hom saa-nga	Aromatic, highly	Borikhamxay	L
	Hom oudom	Aromatic, highly	Sayabouly	L
	Hom Phama	Aromatic Myanma	Sayabouly	L
	Hom Thai	Aromatic Thai	Savannakhet	L
	Hom seethii	Aromatic rich person	Borikhamxay	L
	Hom ngan	Aromatic, late	Sekong	L
	Intok hom	(From) Intra, aromatic	Champassak	L
	Tok hom	Aromatic from heaven	Champassak	L
	Thoua hom	Leguminous aromatic	Oudomxay	U
	Ma tuen	Dog wakes up	Khammouane	L
	Leum pua	(Woman) forgets husband	Houaphanh	UP
Good eating quality	*Leum ma leum meo*	Forgets the dog and the cat	Sekong	L
	Ma keu	Dog rushes (the rice)	Luang Prabang	UP
	Nam Pheung	(Taste) like honey	Borikhamxay	L
	Namtan	(Taste) like sugar	Vientiane	L
	Nuan	Soft	Sekong	UP

Continued on next page

Table 5 continued.

Character	Lao name[a]	Literal English meaning of variety name	Source of collection (province and ecosystem[b])	
	Nang nuan	Soft lady	Sekong	L
	Nuan chan	Soft aster (flower)	Luang Prabang	L
	Oon dam	Soft and black	Luang Namtha	L
	Phanga leum Keng	King forgets soup	Attapeu	L
	Oon dam	Soft black	Luang Namtha	L
	Oon thong	Soft field	Luang Namtha	L
	Ma ngaeng	Dog stares	Borikhamxay	L
	Khang vay	Broken jaw	Sayabouly	UP
	Khang loud hak	Broken jaw	Sekong	L
	Peng	Floury (endosperm)	Sekong	UP
	Peng hang	Floury (endosperm) and awned	Savannakhet	UP
Poor eating quality	*Hav noi*	Cracks, small	Sekong	UP
	Hav ngan	Cracks, late	Savannakhet	UP
	Hav leum pua	Cracks, forgets husband	Sekong	UP
Poor endosperm quality	*Hav leng*	Cracks, dry	Sayabouly	UP
	Hav do	Cracks, early	Khammouane	UP
	Hav dam	Cracks, black	Borikhamxay	L

[a]Most varietal names are prefixed by the word *Khao,* which means rice. [b]L = lowland, UP = upland ecosystem.

forgets dog, forgets cat) on account of it being so good that, when it is being eaten, it is so tasty that the needs of the dog and the cat are forgotten. The name *Khao sam heuan* (rice, three houses) indicates that the variety is so aromatic that, on cooking, it can be smelled over an area occupied by three houses, not just the house in which it is being cooked (Table 5).

Names reflecting grain characteristics

The names of varieties can often reflect their grain characteristics—size, shape, and color, and combinations of these (Table 6). "Black" rice is usually clearly identified by its name in both upland and lowland environments: *Khao kam* or *Khao dam*. However, other grain colors and grain characteristics often tend to be reflected more in the names of traditional varieties grown in upland areas than those grown in the lowland environment. With the exception of names identifying red pericarp in nonglutinous varieties, names reflecting variation in pericarp color other than red were found only in glutinous varieties. Red pericarp nonglutinous varieties were found in Luang Namtha Province. Fish (*pa*) are consumed regularly (fresh or fermented) by the Lao and are an important part of the diet. Thirty-three of the names recorded were fish-related (Table 3). *Pa siev* (tiny carp) indicates that the grains are long and slender. Similarly, the variety name *Ked tao* (turtle shell) is used to indicate the shape of the grain, but also thick and hard glumes (Table 6).

Table 6. Varietal names reflecting grain characteristics.[a]

Characteristic	Lao name[b]	English meaning	Province, endosperm type, and ecosystem		
Grain size	*Met gnay*	Big grain	Vientiane	G	UP
	Do met noi	Early (maturity), small grain	Champassak	NG	L
	Kang met gnay	Medium large grain	Vientiane	G	UP
	Kang noi	Medum small grain	Sekong	G	L
	Chao met noi	Nonglutinous, small grain	Champassak	NG	L
Grain color	*Dam pi*	Very black	Sayabouly	G	UP
	Dam lay	Black striped	Xieng Khouang	NG	UP
	Dam soung	Black, tall	Sayabouly	G	UP
	Dam peek	Black, winged	Luang Namtha	G	UP
	Khaw phoy	White, brittle	Luang Prabang	G	UP
	Khaw nok met dam	White glumes, black grain	Houaphanh	G	UP
	Khao pee	White, late (maturity)	Luang Prabang	G	UP
	Khao soung	White, tall	Champassak	G	L
	Leuang nga	Yellow ivory	Sekong	G	L
Grain shape	*Met gnao*	Long grain	Sayabouly	G	L
	Chao mon	Nonglutinous, globular	Borikhamxay	NG	UP
	Chao met pom	Nonglutinous, globular	Sayabouly	NG	L, UP
	Lang tao	Back of turtle	Luang Namtha	NG	UP
	Ket tao	Shell of turtle	Khammouane	G	UP
	Ket tao	Shell of turtle	Champassak	G	L
	Pa siev	Carp, tiny	Attapeu	NG	L
	Pa siev	Carp, tiny	Borikhamxay	G	UP
Grain color and size	*Dam met gnay*	Black, large grain	Luang Prabang	G	UP
	Dam noi	Black, small grain	Xieng Khouang	NG	UP
	Khao noi	White, small grain	Borikhamxay	G	UP
	Leung met noi	Yellow, small grain	Luang Prabang	G	UP
	Met gnao khaw	Long grain, white	Borikhamxay	G	UP
Grain color and shape	*Dam met gnao*	Black, long grain	Phongsaly	G	L
	Kam met pom	Black, globular (grain)	Vientiane	G	UP
	Khao pom	White, globular	Borikhamxay	G	UP
	Met gnao khaw	Grain, long, white	Borikhamxay	G	UP
	Khao pom kon dam	White, globular, black apiculus	Houaphanh	G	UP
	Lueng pom	Yellow, globular	Luang Namtha	G	UP

[a]G = glutinous, NG = nonglutinous, L = lowland, UP = upland. [b]Many of these names are preceded by the prefix *Khao*, meaning rice.

Naming of varieties to reflect their stress tolerance

Lao farmers have selected varieties that have resistance to some of the commonly occurring stresses such as drought or flooding. Drought is an important production constraint in both the rainfed lowland and rainfed upland environments (Schiller et al 2001). Drought tolerance of varieties is reflected in the use of a range of root names such as *Bo ngo nam* (does not care for water), *Do nam pa* (early maturing, water vanishes, it can escape drought), *Khok* (upper terrace, which is the most drought-prone lowland

Table 7. Varieties named to reflect particular characteristics of stress tolerance.

Stress tolerance	Lao variety name[a]	English meaning	Province and ecosystem	
Drought	*Beua nam*	Does not need water	Luang Namtha	L
	Heng	Dry	Sekong	UP
	Na leng	Dry paddy field	Sayabouly	L
	am heng	Without water	Phongsaly	L
	Peud nam	No need for water	Savannakhet	L
	Thon leng	Drought-tolerant	Luang Prabang	L
Flooding	*Long Kong*	Flows in the Mekong	Bokeo	L
	Louk pa	(Like a) fish fingerling	Vientiane	L
		(Like a) fish swimming	Vientiane, Sekong	L
Low temperature	*Nam yin*	Cold water (tolerant of low temperature)	Xieng Khouang	L
Lodging	*Aev*	Bends (but does not break)	Bokeo	UP
	Aev dang	Bends and whitish	Bokeo	L
	Aev deng	Bends and red	Luang Prabang	UP
	Aev gnay	Bends, big	Luang Prabang	UP
	Aev noi	Bends, small	Luang Prabang	UP
	Baang lom	Protects from wind	Oudomxay	L
	Pan lom	Protects from wind	Vientiane	L
	Tam Cheen	Short Chinese	Luang Prabang	L
	Bong	Bamboo (strong stemmed)	Houaphanh	L
	Kok lek	Iron stemmed	Luang Namtha	L
	Kok lek	Iron stemmed	Houaphanh	
Pest tolerance				
Birds	*Li nok*	Avoids birds	Bokeo	UP
Weeds	*Phae nga*	Competes with weeds	Sayabouly	L
Other pests	*Ea Pouak*	Resists termites	Champassak	L
Broad adaptability	*Bo hina*	Does not refuse any field	Sekong	L

[a]Many of the names have the prefix *khao* (meaning rice). [b]L = lowland, UP = upland.

area), *Ea phon* or *Phon* (ant hill), and many others (Table 7). Flooding commonly occurs along the Mekong River and its tributaries. Variety root names that indicate an adaptation to flooding in such areas include many such as *Loy pa* (floating fish) and *Louk pa* (fish fingerling) that reflect an ability of rapid stem elongation. Many of the traditional varieties grow very tall and lodging is a major constraint. Varieties that do not lodge are called by names such as *Kok lek* (iron stem), *Bong* (bamboo stem), *Aev* (flexible stem), and *Tia* or *Tam* (short plant), for example. Names can also indicate adaptation to poor soil conditions, such as *Bo hina* (any field). High-altitude areas in the northern region can encounter low temperature toward the grain-filling stage. A variety reported to be adapted to these conditions was collected in Xieng Khouang Province, known locally as *Khao nam-yen* (rice cold water). Resistance to biotic stresses such as birds is indicated by the name *Li nok* (hidden against birds; for this variety, the panicle is "protected" by the upper erect leaves of the plant and

Table 8. Names given to reflect the high yield potential of varieties.

Lao variety name	Literal English meaning of name	Province, endosperm type, and ecosystem[a]		
Khao baa li	Yield so great that it breaks the shoulders of the carrier	Vientiane	G	L
Khao lave tek	Yield so great that the rice store collapses	Luang Namtha	NG	L
Khao ye tek	Yield so great that the rice store collapses	Luang Namtha	G	L
Khao leua lave	Yield exceeds the capacity of the rice store	Borikhamxay	G	L
Khao leua na	Production exceeds the capacity of the field	Borikhamxay	G	L
Khao lod kwien	Yield so great it exceeds the capacity of the cart to carry the grain (rice drops from the cart)	Khammouane	G	L
Khao meun lan	12:1,000,000 (12 seeds planted give 1 million grains)	Luang Prabang	G	UP
Khao jet roy	700 (one seed planted gives 700 grains)	Borikhamxay	G	L
Khao phokha leum khuay	Yield is so great that the merchant forgets the buffalo	Vientiane Municipality	G	L
Khao loong ban	The yield is so great and the owner so overwhelmed that he/she forgets the path to his/her home	Luang Prabang	G	UP
Khao loong ban keut	The yield is so great that the owner forgets the road to the village of his/her birth	Sayabouly	G	L
Khao mae hang leum pua	The yield is so great that the divorced woman forgets her husband	Khammouane	G	L
Khao mae hang tob euk	The yield is so great that the divorced woman beats her chest	Borikhamxay	G	UP
Khao ngod nang	The yield is so great it is like a "superwoman"	Vientiane	G	UP
Sao leum ngang	The crop is so bountiful that the young girl forgets to continue her walk	Vientiane	G	L

[a]G = glutinous, NG = nonglutinous, L = lowland ecosystem, UP = upland ecosystem.

so is less obvious to birds). *Phae nya* (win over weeds) indicates good competition with weeds (Table 7).

Names reflecting yield potential

When a variety is regarded as having a high yield potential, this is often reflected in its name (Table 8). These names often reflect the difficulty in transporting the grain produced back to the village or problems in storing the large quantity of grain produced: *Baa lii* (broken shoulders, the yield is so heavy that it breaks the farmer's shoulders when the grain is being carried to the village) and *Lod kwien* (falls from the cart, the yield exceeds the capacity of the cart to carry it and so some falls from the cart) reflect the difficulty in transporting all the grain produced by these varieties, whereas the names *Lave tek* (broken store) and *Leua lave* (exceeds the store) reflect the storage difficulties associated with the high yields of these varieties. The high yield potential of some varieties is sometimes associated with women such as with the varietal names *Gnod nang* (super woman), *Mae hang* (divorced woman), and *Mae hang leum pua*

Table 9. Variety names that reflect the "foreign" origins of varieties.[a]

Lao varietal name	English equivalent	Endosperm type	Source of collection (ecosystem and province)	
Khao Philippine	Philippine rice	NG	Attapeu	L
Khao Amelika	American rice	NG	Attapeu	L
Khao India	Indian rice	G	Sayabouly	L
Khao Do Phama	Myanmar early rice	G	Champassak	L
Khao Hom Phama	Myanmar aromatic rice	G	Sayabouly	L
Khao Czek	Czechoslovakia rice	NG	Xieng Khouang	L
Khao Do Yuan	Vietnamese early rice	G	Khammouane	L
Khao Viet	Vietnamese rice	NG	Sekong	L
Khao Do Viet	Vietnamese early rice	G	Champassak	L
Khao Kang Viet	Vietnamese medium rice	G	Attapeu	L
Khao Thai	Thai rice	G	Luang Prabang	UP
Khao Kampouchia	Cambodian (Kymer) rice	NG	Attapeu	L
Khao Khamenh	Cambodian (Kymer) rice	NG	Attapeu	L
Khao Kamenh Do	Cambodian early rice	NG	Attapeu	L
Khao Cheen	Chinese rice	NG	Bokeo	L
Khao Tam Cheen	Chinese dwarf rice	G	Luang Prabang	L

[a]NG = nonglutinous, G = glutinous, L = lowland, UP = upland.

(divorced woman forgets husband); the latter two names relate to the yields of these varieties being so bountiful that, in the first case, the woman is so busy harvesting that her impatient husband leaves her, whereas, in the second case, the woman is so busy with her crop that she forgets her divorced husband. In the reverse sense, the variety *Mae maay* (widow) is so named because it often produces some unfilled grain and empty spikelets. The use of such varietal names also reflects the fact that many of the rice farmers in Laos are women.

Variety names reflecting the place of origin of varieties

Some names indicate a variety's country of origin (Table 9), such as *Khao Phama* (rice, Myanmar), *Khao Thai* (rice, Thailand), *Khao Viet* (rice, Vietnam), *Khao Kampuchea* (rice, Cambodia), *Khao Nippon* (rice, Japan), *Khao Czek* (rice, Czechoslovakia), *Khao India* (rice, India), *Khao America* (rice, America), *Khao Philippine* (rice, Philippines), and others. However, the country identity of such varieties sometimes refers to the country identity of the organization or agency that made a variety available rather than the variety actually originating from the country identified in the name. The variety names *American rice* and *Philippine rice* were designated by farmers for varieties introduced and distributed by the Philippine Brotherhood Movement and USAID, respectively, during the latter part of the 1960s and early 1970s. However, in many instances the varieties bearing country names relating to China, Vietnam, Cambodia, and Thailand were collected from Lao provinces adjacent to or near those countries, suggesting that these varieties were introduced from those countries (pos-

sibly by farmer-to-farmer exchange across country borders rather than being officially introduced) and given names to reflect the country of origin. Some variety names also reflect other historical factors relating to the source of the variety. For example, the variety called *Khao intok* (rice from heaven) collected in Champassak District of Champassak Province and Mahaxai District of Khammouane (in the southern and central agricultural regions, respectively) reflects the fact that its cultivation was based on seed collected after rice was dropped into the area by USAID-sponsored flights, during the late 1960s and early 1970s, in an effort to alleviate the severe rice deficits that existed in many upland areas as a result of disruption to the normal cropping cycles during a period of internal conflict within Laos.

In addition to names that reflect the "foreign" origins (or association) of a variety, many varieties have names that refer to their more local origins—province, district, village, river, and person. These are listed in Table 4. Those names with a geographic connotation generally indicate that the variety came from that particular location. Names identified with people can mean that a particular individual (after whom the variety was named) was responsible for developing the variety, or can sometimes indicate that the person after which the variety has been named was responsible for introducing it to a particular area as a "new" variety. Similarly, many varieties carry the names of particular ethnic groups within Laos (Table 4); the naming of such varieties in this way generally indicates that the variety has been sourced from a village of a particular ethnic group, and has then been grown elsewhere by another ethnic group, with the latter giving the variety a name to reflect the origins or source of the seed.

Conclusions

The richness and the diversity of the characteristics in the traditional rice varieties of Laos are clearly demonstrated in the names given to them by Lao farmers. Within this context, the importance of the quality of the rice grown and consumed by the people of Laos is manifest in the way many of the varieties have been named to reflect various quality characteristics of glutinous and nonglutinous grain, in both its cooked and uncooked forms, and in both the upland and lowland environments. The analogies of the superior qualities of some varieties with the qualities of women (as reflected in the names of some varieties with superior aromatic and eating quality) might be interpreted as representing a solid imagination as well as the elevated status of women in Lao society.

In most instances, the variety names given reflect desirable qualities such as yield potential, stress tolerance, good grain quality, aroma, and others. It might therefore be regarded as surprising that some of the varieties collected (and being maintained by rural households) have names that reflect relatively undesirable qualities such as hard grain, a tendency for cracking, floury endosperm, etc. It might naturally be assumed that, given the importance that the rice farmers and consumers of Laos place on desirable qualities, those varieties with undesirable qualities would normally be discarded in the process of farmer selection for desirable characteristics. That these varieties are retained probably indicates that they possess other desirable qualities (such

as adaptation to climatic stresses, tolerance of pests and diseases, or perhaps they are retained for specialist consumption purposes) that are not revealed in the name.

The diversity of imaginative names given to the traditional rice varieties of Laos reflects the potential value of the indigenous knowledge relating to the history of these varieties, thereby highlighting the importance of proper documentation of this knowledge, at the same time that efforts are made to preserve and conserve the traditional rice germplasm. This knowledge will inevitably be lost as the traditional varieties are replaced by improved varieties and as the current generation of farmers is replaced. In the main rainfed rice-growing region of the Mekong River Valley, it has already been noted (Schiller et al 2001) that, within a period of about 7 years after about 1993, the area sown to traditional varieties had dropped from in excess of 90% to less than 20% (and less than 10% in some provinces).

The record of variety names, when used in association with other passport data for the traditional rice germplasm samples collected and preserved, has the potential to be of considerable value when looking for specialized traits for incorporation into a future variety improvement program, to provide varieties with special characteristics for the different growing environments throughout the country.

The diversity of names presented in this chapter does not reflect the full diversity within the country. Language problems with some of the 48 ethnic groups within the country made it difficult to translate some variety names into Lao and English.

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Notes

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Acknowledgments: The authors gratefully acknowledge the support provided by the Swiss Agency for Development and Cooperation for the rice biodiversity conservation project. This project was implemented by the International Rice Research Institute in collaboration with the Lao Ministry of Agriculture and Forestry. Particular acknowledgment is given to the farmers of Laos, who so freely provided the information that has formed the basis of this chapter, together with the many Lao officials who assisted with the data collection.

CHAPTER 11

The aromatic rice of Laos

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A unique feature of many of the traditional glutinous and nonglutinous rice varieties from Laos is their aromatic character. For centuries, there has been conscious selection for this aromatic character within varieties grown and consumed by many of the 48 ethnic groups that constitute the population of Laos. The leading aromatic fine-quality rice of international markets, the basmati rice of the north and northwestern parts of the Indian subcontinent and the jasmine rice (*Khao dok mali*) of Thailand, is very well known. The internationally known aromatic rice is generally all nonglutinous. The aromatic rice varieties of Laos are little known outside the country, despite a diversity that is probably unsurpassed for any single country. The Lao aromatic varieties have both glutinous and nonglutinous endosperm and can be found in both upland and lowland environments.

From 1995 to 2000, a program of rice germplasm collecting was undertaken jointly between the Lao Ministry of Agriculture and Forestry (MAF) and the International Rice Research Institute (IRRI). From this program, 13,193 samples of cultivated rice were collected throughout the country (Appa Rao et al 2002a), and one of the characters recorded was the aromatic character in some of the traditional varieties. This chapter describes the diversity that was recorded for the Lao aromatic rice varieties collected during that program.

The chemical basis of aroma

Aromatic rice varieties differ in their degree of aroma and are broadly classified as strongly, moderately, and weakly scented types (Singh et al 2003). The pleasant aroma associated with aromatic varieties is not only associated with cooked rice but is also often emitted by these varieties in the field at the time of flowering (Weber et al 2000, Widjaja et al 1996). Aroma is caused by an extremely small amount of volatile compounds, which are contained as a complex mixture. The number of compounds that constitute aroma reported by different researchers varies considerably and no individual compound has been identified or can be attributed to be responsible for the aroma of cooked scented rice. Rather, a blend of a number of volatile compounds is believed to impart the characteristic aroma and flavor to the aromatic rice. Among

these, 2-acetyl-1-pyrroline (2-AP) is considered by some researchers to be the most important (Buttery et al 1988, Weber et al 2000).

The genetic basis of aroma

Aroma is a complex character that is genetically determined but whose expression is also strongly influenced by environmental factors. Researchers differ in their assessment of the number of pairs of genes believed to control the inheritance of aroma in rice, with one to four pairs being reported (Dhulappanavar 1976, Tripathi and Rao 1979, Berner and Hoff 1986, Lin 1991, Pinson 1994, Brijal and Gupta 1998). Khush and De La Cruz (1998) believe that aroma is a quantitative character, as segregants with varying levels of aroma have been observed in crosses between aromatic and nonaromatic varieties. They further suspect one major gene to be responsible for aroma and several modifiers or quantitative trait loci (QTLs) also to be involved.

The expression of aroma

Although the genetic background of a variety is very important in determining its aromatic character, several other factors are well known to affect the expression of aroma, such as temperature during the latter stages of crop growth, soil type and related crop nutrition, agricultural factors, and grain storage and processing. The potential effects of many of these factors on the expression of aroma and other grain characteristics have been reviewed by several authors (Goodwin et al 1994, Khush and De la Cruz 1998, Singh RK et al 2000, Singh US et al 2003).

Temperature

Quality traits of aromatic rice are known to be influenced by temperature, particularly at the time of flowering, grain filling, and maturity. It is generally acknowledged that aroma formation (and retention) in grain is better at lower temperature during the grain-filling stage (Singh et al 2003). For example, Juliano (1972) reports that the retention of aroma in basmati rice is best when, during crop maturity, relatively cool day/night temperatures of 25/21 °C are experienced. Cooler temperatures in the period after flowering and during the grain-filling stage are one of the reasons why north and northeast Thailand are regarded as being suited to the growing of the well-known Thai jasmine rice (Sarkarung et al 2000).

Soil factors

Soil factors are known to affect aroma and other quality characteristics in ways not properly defined but that are believed to be related to the interaction of nutrients with aroma-related volatile compounds (Singh et al 2003). Lighter soils and upland conditions are generally perceived to favor aroma formation, with soils low in nitrogen producing better-quality grain (Singh RK et al 2000, Singh US et al 2003). The application of nitrogen fertilizer is also known to adversely affect cooking and eating quality (including aroma) of rice, with the grain quality of the well-known Thai

jasmine rice variety *Khao dok mali 105* (KDML 105) varying inversely with the N content of the grain (Suwanarit et al 1996). On the other hand, potassium and sulfur fertilizers are known to favorably influence the cooking and eating quality of rice, including aroma (Singh et al 2003, Suwanarit et al 1997a,b). Diminishing soil moisture during the grain-filling stage is also believed to significantly affect the expression and accumulation of aroma, and is believed to be important in the expression of aroma by the jasmine rice of Thailand when grown under rainfed lowland conditions rather than in the irrigated environment (Sarkarung et al 2000).

Cropping factors

Time of harvest is also recognized as another factor that could influence aroma and other quality traits in rice. In the case of the photoperiod-sensitive Thai variety KDML 105, Suwanarit et al (2001) demonstrated that increasing maturity time (through earlier planting) significantly improved the quality characteristics of the grain, including aroma. However, a delay in harvesting after maturity is known to reduce aroma and influence the eating quality of aromatic rice (Rohilla et al 2000).

Storage and processing

In most countries, rice is stored and transported as paddy. Rice storage for a few months is usually regarded as having a positive influence on quality. However, storage for longer periods can result in a significant loss of aroma. Stored rice is known to cook relatively drier than freshly harvested rice, which becomes soft, moist, and sticky after cooking. During storage, there is an increase in grain hardness and gelatinization temperature, which enhances the swelling and elongation of rice grain during cooking (Singh et al 2003). The changes that take place in the grain during storage are not well understood.

The origins of aromatic rice in Laos

As with the diversity of traditional cultivated rice in Laos as a whole (Appa Rao et al 2002a), the diversity of the country's aromatic varieties reflects a combination of factors: (1) the ethnic diversity that exists in the country—48 distinct ethnic groups are recognized, all of which grow and consume rice as their staple food, and almost all of them have diverse and specialist uses for rice; (2) the diversity of the growing environments; (3) a past lack of infrastructure throughout the country that limited the movement of varieties (both introduced and traditional); and (4) the Green Revolution of the 1970s and 1980s, which had little impact on Laos and, until the mid-1990s, most rice cultivation throughout the country was still based on the use of traditional varieties with low levels of purchased inputs (UNDP 1998), and this remained the situation in the upland environment in the early 2000s.

Reference is made to the aromatic character of Lao rice as early as the middle of the 17th century, with French and Italian records published in 1663 and 1666 referring to the rice of Laos during that time in the following terms: "*The staple rice is*

Table 1. Descriptor names of ethnic groups indicating that a variety is aromatic.

Resemblance to root name *Hom*	Ethnic group	Descriptor name for aroma
Similar to the most common root name	Laven	*Hoom*
Similar to the most common root name	Yaheun	*Oom*
Similar to the most common root name	Phunoi	*Ahom*
Includes name of ethnic group in variety name	Kor	*Ahom kor*
Includes name of ethnic group in variety name	Kui	*Kui hom*
Has a prefix similar to common root name	Triv	*Thao hum*
Has a prefix similar to common root name	Taoey	*Pa hom*
Has a prefix similar to common root name	Taliang	*Soi hum*
No resemblance to common root name	Pako	*Keepua*
No resemblance to common root name	Katu	*Thamu*
No resemblance to common root name	Katang	*Mahuam*
No resemblance to common root name	Ngae	*Tasang*

Source: Appa Rao et al (1997).

incomparable there and it has a characteristic odor and wildness that is specific to all that grows in this eastern part of the kingdom" (de Marini 1998).

The naming of aromatic rice in Laos

Most rice variety names in Laos have three elements: the basic name, the root name, and a descriptor name (Appa Rao et al 2002b). The basic name *khao* indicates rice; the most common root name for aroma is *hom* (aromatic). All varieties with the root name *hom* are aromatic. The third component, the descriptor name, allows farmers to further identify particular rice varieties within different groups. For example, *Khao hom do* is an aromatic, early-maturing (*do*) variety. Likewise, the variety name *Khao niaw hom do* has two descriptor names: *niaw* means that the variety has glutinous endosperm and *do* again refers to its early maturity.

Among the different ethnic groups in Laos, there is often variation in the word *hom* to indicate that a variety is aromatic (Table 1). Slight variations in the root name *hom* are used by some ethnic groups in Laos to indicate that a variety is aromatic. The Laven use the word *hoom*, whereas the Yaheun use the word *oom.* The Phunoi use *ahom* to indicate an aromatic variety. The name of the ethnic group is also sometimes associated with slight variations of the word *hom* such as in *Ahom kor* by the Kor, *Kui hom* by the Kui, *Soi hum* by the Taliang, and *Thao hum by* the Triv. Other ethnic groups sometimes use names that have no resemblance to the common root name, such as *thamu* by the Katu, *keepua* by the Pako, and *tasang* by the Ngae.

Consumption of aromatic rice in Laos

Aromatic rice, whether glutinous or nonglutinous, is a normal component of the diet of almost all ethnic groups in Laos. Although the names of many traditional varieties may not reflect their aromatic character, the basis for their selection and adoption has usually always included attention to characteristics related to the consumption or quality. This attention to quality is not unique to Laos, but is common in many countries in Southeast Asia. It is also one of the main reasons why the higher-yielding varieties that were originally released by the International Rice Research Institute in the latter part of the 1960s and during the 1970s as part of the Green Revolution were not readily accepted in some countries of the region despite their recognized high yield potential. Rather, the yield potential and other traits of these modern varieties were usually later blended with the quality characteristics of the traditional varieties in national breeding programs to produce improved "national" varieties that had more general acceptability. In the case of Laos, the early introductions of "modern" varieties in the late 1960s and early 1970s by organizations such as the Philippines Brotherhood Movement and USAID resulted in very little farmer adoption. However, this was not only because these varieties lacked the "quality characteristics" of traditional varieties but also because the early improved high-yielding varieties were almost exclusively nonglutinous, whereas more than 90% of the rice being consumed in the country at that time was glutinous or "waxy" rice. Similarly, in the latter part of the 1970s and early 1980s, when several varieties were introduced from Vietnam in an effort to improve yields and help achieve national rice self-sufficiency, the only variety to be grown to any significant degree was the nonglutinous variety CR203 (which also has IRRI parentage). However, even for this variety with its recognized high yield potential relative to most of the traditional lowland varieties being grown in Laos at that time, its acceptance was not based on its acceptability for general consumption, but rather its suitability for noodle and alcohol production. The aromatic character that is a characteristic of most traditional Lao rice varieties is expected to remain the basis for acceptability of most improved varieties that might be developed within the Lao National Rice Research Program.

Representation of aromatic rice in the germplasm base for Laos

At the time of collecting samples of traditional varieties for conservation and use in 1995-2000, information on up to 36 descriptors, which also included aroma of cooked rice, was obtained from the farmers who provided samples. Aromatic varieties were identified based on the name of the variety and information provided by the farmers. Agricultural extension officers and Lao scientists who had knowledge of the traditional rice varieties supplemented this information. All the collected samples were classified according to ecosystem, endosperm, and maturity type, in addition to the district and province from where each sample was collected.

Geographic distribution of aromatic varieties

Out of the 13,193 samples collected during 1995-2000, variety names were available for 12,411 samples (Appa Rao et al 2002). Among these, 477 samples (3.84%) had names identifying them to be aromatic. These samples were collected in all 136 districts of the country where collecting was done. However, variation was considerable among regions, provinces, and districts in the number and proportion of aromatic samples collected (Table 2). Among the provinces, Houaphanh in the northern region had the highest number (51 samples), followed by the provinces of Vientiane (46) and Khammouane (44) in the central agricultural region. Among regions, the central agricultural region had the highest proportion (47%) of aromatic varieties collected, followed by the northern region (38%). The proportion of aromatic varieties was greatest among samples collected from the rainfed lowlands (66.6%), suggesting a greater preference for aromatic varieties by lowland farmers and consumers.

More glutinous samples were aromatic (79.7%) than nonglutinous samples (20.3%). This is consistent with findings reported by Champagne et al (2004), who found that grain flavor and aroma of rice varieties are often correlated highly and negatively with amylose content; glutinous (or waxy) varieties are more likely to display more grain flavor. This, in turn, is reflected in the fact that the Hmong ethnic group, the primary consumers of nonglutinous rice in Laos, appear to be less concerned with aroma as a sought-after characteristic in the varieties they grow.

Distinct variety names for aromatic varieties

Among the 477 aromatic samples collected, 98 distinct variety names designating aroma were used by Lao farmers (Table 3). Besides the use of designations specifically indicating aroma, Lao farmers use a range of other names to indicate that a variety has aromatic qualities. These names may include reference to aromatic flowers or plants, country of origin, endosperm type, maturity time, and other grain and plant characters, singly or in combination. Names used to indicate aroma relating to plants include aromatic jasmine (*Hom mali*), jasmine flower *(Dok son*), and Arabian jasmine flower (*Dok phut*). Some variety names relate to aromatic plants, such as sandalwood (*Hom chan*) and sandalwood oil (*Namman chan*). Grain size is also sometimes reflected in combination with the aromatic character—aromatic large grain (*Hom gnay*) and aromatic small grain (*Hom noy*). The soft texture and aroma of the grain after cooking are also sometimes referred to in a romantic way—*Hom nang nuan* (sweet-smelling soft lady, Photo 11.1) and *Hom nuan* (sweet and soft). Aroma is also linked to grain color—red aromatic (*Deng hom*), white aromatic (*Hom khaw*), and aromatic striped (*Hom lay*). Aromatic names can also be linked to agronomic traits—aromatic and excessively tillering (*Hom phae phalo*) and dwarf aromatic (*Hom tam*). The name may also indicate the country from where a variety was introduced—aromatic Myanmar *(Hom Phama*), aromatic Thailand (*Hom Thai*), and aromatic Cambodia (*Hom Kampuchea*). The intensity of aroma is reflected by names such as highly aromatic (*Hom oudom)* and mildly aromatic (*Hom noi*). It is interesting to note that some aromatic rice varieties exhume aroma not only from grains but also from culms and leaves. This is also sometimes reflected in the name—*Hom thong* (aromatic field) and *Hom bay (*aromatic leaf).

Table 2. Geographic distribution and classification of aromatic samples collected in Lao PDR from 1995 to 2000.[a]

Region and province	Samples (total)	Samples (aromatic)	Aromatic		Lowland					Upland				
			% Total	% Aromatic	G	N	E	M	L	G	N	E	M	L
Northern region	5,919	181	44.9	37.9	87	19	17	34	55	47	28	27	27	21
Bokeo (BO)	689	17	5.2	3.6	7	2	2	3	4	3	5	2	1	5
Houaphanh (HP)	631	51	4.8	10.7	36	1	0	6	31	7	7	1	8	5
Luang Namtha (LN)	857	19	6.5	4.0	8	5	4	4	5	5	1	2	3	1
Luang Prabang (LP)	1,243	29	9.4	6.1	7	6	2	7	4	8	8	10	5	1
Oudomxay (OD)	849	12	6.4	2.5	3	1	2	2	0	7	1	7	0	1
Phongsaly (PS)	667	20	5.1	4.2	5	2	1	4	2	11	2	2	6	5
Sayabouly (SB)	983	33	7.5	6.9	21	2	6	8	9	6	4	3	4	3
Central region	4,623	224	35.0	47.0	164	20	34	103	47	36	4	23	15	2
Xieng Khouang (XK)	561	30	4.3	6.3	28	0	0	10	18	1	1	0	1	1
Borikhamxay (BK)	595	36	4.5	7.5	24	2	7	18	1	9	1	9	1	0
Khammouane (KH)	866	44	6.6	9.2	41	2	10	26	7	1	0	0	1	0
Savannakhet (SV)	988	26	7.5	5.5	21	3	3	17	4	1	1	1	0	1
Vientiane M. (VM)	485	36	3.7	7.5	15	11	6	15	5	10	0	5	5	0
Vientiane P. (VP)	787	46	6.0	9.6	31	2	5	17	11	12	1	7	6	0
Saysomboun (SB)	341	6	2.6	1.3	4	0	3	0	1	2	0	1	1	0
Southern region	2,651	72	20.1	15.1	37	9	5	35	6	23	3	8	14	4
Attapeu (AT)	639	6	4.8	1.3	1	5	0	4	2	0	0	0	0	0
Champassak (CS)	842	28	6.4	5.9	20	4	3	20	1	3	1	0	4	0
Sekong (SK)	396	12	3.0	2.5	4	0	1	3	0	6	2	5	2	1
Saravane (SV)	774	26	5.9	5.5	12	0	1	8	3	14	0	3	8	3
Grand total	13,193	477	100.0	100.0	288	48	56	172	108	106	35	58	56	27

[a]G = glutinous, N = nonglutinous, E = early, M = medium, L = late.

Table 3. Distinct aromatic variety names in Laos and their classification.[a]

Variety name	Meaning of variety name	Coll. no.	LG no.	Ec	En	Mt	Pv
Hom mali (L/N)	Aromatic jasmine	LR-1375	108	L	N	L	AT
Chao hom (L)	Nonglutinous aromatic	LR-1384	117	L	N	M	AT
Dokson	Jasmine small	LR-2115	220	L	G	M	CS
Deng dok chan (L/G)	Red aster	LR-2139	244	L	G	M	CS
Intok hom	From heaven aromatic	LR-2307	276	L	G	M	CS
Hom chan (L/N)	Aromatic aster	LR-2611	365	L	N	M	CS
Tok hom	Aromatic from heaven	LR-2635	389	L	G	M	CS
Kang hom	Medium aromatic	LR-2813	467	L	G	M	CS
Chao mali	Nonglutinous jasmine	LR-21003	482	L	N	M	CS
Do ngieng	Early aromatic	LR-21030	509	L	G	E	CS
Dok ket	Pandanus flowers	LR-21031	510	L	G	M	CS
Chao hom (U)	Nonglutinous aromatic	LR-3213	537	U	N	E	SG
Ea hom (L)	Aromatic	LR-3216	540	L	G	M	SG
Ahom (U)	Aromatic	LR-3225	549	U	G	E	SG
Ahom (L)	Aromatic	LR-3226	550	L	G	M	SG
Ea hom (U)	Aromatic	LR-3354	619	U	G	E	SG
Hom thong (L/G)	Aromatic field	LR-4105	635	L	G	M	SV
Niaw mali	Glutinous jasmine	LR-4411	661	L	G	L	SV
Hom mali niaw	Aromatic jasmine glutinous	LR-4442	692	L	G	L	SV
Hom do (L)	Aromatic early	LR-5109	856	L	G	M	SK
Ken chan	Seed of aster	LR-5515	959	L	G	M	SK
Hom (L/G)	Aromatic	LR-5518	962	L	G	M	SK
Hom noi	Aromatic small	LR-5736	1053	L	G	M	SK
Hom ngan	Aromatic late	LR-5763	1,080	L	G	L	SK
Hom vieng	Aromatic vieng	LR-5807	1,089	L	G	M	SK
Hom phae (L)	Aromatic many tillers	LR-5816	1,098	L	G	M	SK
Om lay	Aromatic striped	LR-6126	1,235	L	G	M	KM
Om noi	Aromatic small	LR-6127	1,236	L	G	M	KM
Do hom (L)	Early aromatic	LR-6337	1,311	L	G	E	KM
Hom khav	Aromatic white	LR-6468	1,385	L	G	M	KM
Hom lay (L)	Aromatic striped	LR-6516	1,399	L	G	L	KM
Ma teun (L)	Dog wakes up	LR-6805	1,452	L	G	M	KM
Hav hom	Cracks aromatic	LR-6867	1,514	U	G	M	KM
Kay noi (L)	Chicken small	LR-7103	1,529	L	G	M	BK
Kay noi (U)	Chicken small	LR-7118	1,544	U	G	E	BK
Hom bay	Aromatic leaves	LR-7324	1,589	L	G	M	BK
Hom do (U)	Aromatic early	LR-7350	1,615	U	G	E	BK
Hom Nang nuan	Sweet-smelling soft lady	LR-7506	1,655	L	G	M	BK
Hom sed thi	Aromatic rich man	LR-7519	1,667	L	G	M	BK
*Dok phoud**	Arabian jasmine	LR-7611	1,700	L	G	M	BK
Hom (U/G)	Aromatic	LR-8121	1,740	U	G	E	LP
Phae hom (U)	Many tillers, aromatic	LR-8301	1,891	U	G	E	VP
Hom phae phalo	Aromatic, too many tillers	LR-8666	1,996	L	G	M	VP
Hom chan (L/G)	Aromatic aster	LR-8809	2,012	L	G	M	VP
Hom nuan chan	Aromatic soft aster	LR-8821	2,024	L	G	M	VP
Sanpatong do hom	Sanpatong early aromatic	LR-9302	2,055	L	G	L	VM
Hom Phama	Aromatic Myanmar	LR-9805	2,112	L	G	L	VM

Continued on next page

Table 3 continued.

Variety name	Meaning of variety name	Coll. no.	LG no.	Ec	En	Mt	Pv
Hom mali (L/N)	Aromatic jasmine	Hv-19	2,341	L	G	M	HP
Dok hom	Flower aromatic	Bkt-03	2,473	U	G	E	BK
Nam yen/kay noi	Cold water/chicken small	Lac-229	2,692	L	G	L	HP
Kay noi deng	Chicken small red	H-14	2,727	L	G	L	HP
Cham hom	Nonglutinous aromatic	H-20	2,733	L	N	L	HP
Kay noi leuang	Chicken small yellow	Hs-13	2,746	L	G	L	HP
Kay noi dam	Chicken small black	Hs-22	2,755	L	G	L	HP
Chao hom khav	Nonglutinous aromatic white	Lac-278	2,808	U	N	L	HP
Khai hom	Hairy aromatic	Lac-260	2,851	L	G	M	HP
Hom keaw	Aromatic bottle	Kmm-14	2,918	L	G	M	KM
Khav hom	White aromatic	Ll-53	3,322	L	G	M	LP
Nuan chan	Soft aster	Ln-62	3,419	L	G	L	LP
Hom dang	Aromatic variable	Lac-153	3,442	U	G	E	LP
Namman chanh	Sandalwood oil	Lp-02	3,480	U	G	E	LP
Hom (L/N)	Aromatic	Lp-24	3,502	L	N	E	LP
Hom oon	Aromatic soft	Lac-945	3,808	U	G	M	LN
*Mak khen**	Fruit of khen	Nl-13	3,823	U	G	L	LN
Thoua hom	Cowpea aromatic	*On-23*	*4,089*	*U*	*G*	*E*	*OD*
Hom kang (U)	Aromatic medium	Lac-628	4,191	U	G	M	PL
Mak khen dam*	Fruit of khen black	Pb-27	4,227	U	G	L	PL
Mak khen khav*	Fruit of khen white	Pb-28	4,228	U	G	L	PL
Ahom ko	Aromatic ko	Lac-583	4,282	U	G	L	PL
Hom nga	Aromatic sesame	Pp-18	4,396	U	G	M	PL
Deng om	Red aromatic	Sp-21	4,503	U	G	E	SB
Hom oudom	Aromatic highly	Lac-1021	4,534	L	G	E	SB
Om (U)	Aromatic	Lac-1070	4,591	U	G	E	SB
Ba hom	Rice aromatic	Lac-1607	4,707	U	G	L	SG
Ea ham	Ea ham (ethnic name)	Lac-1557	5,250	U	G	E	SV
Kou hom	Kou aromatic	Lac-1504	5,350	U	G	M	SV
Aham	Aromatic	Svs-08	5,422	U	G	M	SV
Hom dok dou	Aromatic flower dou	L-134	5,532	L	G	M	VM
Hom mali deng	Aromatic jasmine red	Vmk-03	5,568	L	N	M	VM
Hom mali kang	Aromatic jasmine medium	Vmk-10	5,575	L	N	M	VM
Hom phae (U)	Aromatic many tillers	L-121	5,607	U	G	E	VM
Ma teun (U)	Dog wakes up	Ns-42	6,001	U	G	M	LN
Kay noi hay	Chicken small, upland	Abc-377	6,742	U	G	M	HP
Kay noi hang	Chicken small, awned	Abc-440	6,798	L	G	M	XK
Do hom (U)	Early aromatic	Abc-643	6,989	U	G	E	OD
Hom thong (L/N)	Aromatic field	Abk-1233	7,514	L	N	L	VM
Hom saa ngiem	Aromatic pleasant	Abv-1241	7,521	L	G	L	VP
Hom huan	Aromatic huan	Abv-1243	7,523	L	G	E	VP
Hom thong khav	Aromatic field white	Abv-1268	7,548	L	G	L	VP
Hom gnay	Aromatic big	Abv-1328	7,602	L	G	M	BK
Hom ka	Aromatic crow	Abv-1401	7,671	L	G	M	KM
Deng dok chan (L/N)	Red aster	Csb-18	8,958	L	N	M	CS
Deng hom (L)	Red aromatic	Kmg-14	9,175	L	G	M	KM
Do om	Early aromatic	Sk-27	9,616	L	G	L	SB

Continued on next page

Table 3 continued.

Variety name	Meaning of variety name	Coll. no.	LG no.	Ec	En	Mt	Pv
Om do	Aromatic early	Sn-23	9,661	L	G	M	SB
Hom Thai	Aromatic Thai	Svl-22	9,970	L	G	M	SV
Kay noi khav	Chicken small white	Xt-09	10,134	L	G	L	XK
Hom lay (U)	Aromatic striped	Xsh-34	10,162	U	G	E	XS
*Do dok phoud**	Early Arabian jasmine	Sp - 43	10,211	L	G	E	SK
Ma kheu	Dogs rush	Abs-201	10,417	U	G	E	BO
Dok keaw (L)	Keaw flower aromatic	Abs-718	10,910	L	G	E	XS
Om (L)	Aromatic	Abp-1089	11,251	L	G	L	SB
Kay noi hom	Chicken small aromatic	Abs-05	11,742	U	G	E	BK
Dok om	Flower aromatic	Bop-81	12,010	L	G	M	BO
Hom deng (U/N)	Aromatic red	Lnl-64	12,269	U	N	M	LN
Hom kang (L)	Aromatic medium	–	12,359	L	G	M	LN
Do mali gnay	Early jasmine big	svp-111	12,822	L	G	E	SV
Chao hom mali	Nonglutinous jasmine	vmt-113	12,842	L	N	M	VM
Deng hom (U)	Red aromatic	vpm-107	12,868	U	G	E	VP
Phae hom (L)	Many tillers aromatic	vpm-112	12,873	L	G	M	VP
Dok keaw (U)	Flower of keaw	vpn-125	12,907	U	G	M	VP
Hom sam heuan	Aromatic three houses	boo-147	12,997	L	G	E	BO
Chao lay hom	Nonglutinous striped aromatic	boo-150	13,000	U	N	L	BO
Hom saa nga	Aromatic highly	bkv-109	13,224	L	G	M	BK
Mali do	Jasmine early	bkv-134	13,249	L	N	E	BK
Mali	Jasmine	bkv-135	13,250	L	N	L	BK

[a]Coll. no. = collector number, LG no. = Lao genebank accession number, Ec = ecosystem, L = lowland, U = upland, End = endosperm, G = glutinous, N = nonglutinous endosperm, Mt = maturity, E = early, M = medium, L = late, Pv = province from where the variety was collected (refer to Table 2).

Distinct aromatic variety names

Among the 477 aromatic samples, Lao farmers give 98 distinct variety names for aroma (Table 3). Among them, in 87 cases, all the samples with a particular variety name have similar characters, such as adaptation to the ecosystem or endosperm type. However, in 11 cases, they differ for either the ecosystem or endosperm or both. Since these two characters are very important, such varieties should be considered as different; if so, there are 120 distinct variety names.

The highest number of 21 aromatic varieties was found in Borikhamxay and Vientiane provinces, followed by 19 in Khammouane and 18 in Sayabouly provinces and Vientiane Municipality (Table 4). This high frequency of aromatic varieties in these provinces may be because of easy access to markets in the neighboring country and the high premium price commanded by them. During crop maturity of aromatic varieties, combines are commonly found in these areas. In the northern region, the maximum number of varieties found was 18 in Sayabouly and 13 in Phongsaly. In the southern region, the maximum number of aromatic varieties found was 16 in Saravane and 15 in Champassak. Relatively more aromatic varieties were found in the lowlands than in the uplands. This may be because lowland farmers grow aromatic varieties for

Table 4. Diversity of characteristics within the collection of named aromatic rice varieties.

Trait	Minimum	Maximum	Mean
Seedling vigor[a]	2	9	3.5
Days to flowering	79	145	107.5
Culm length (cm)	50	210	113.9
Panicle length (cm)	3	9	4.7
Panicles per hill	15	31	24.0
Plant aspect score[a]	3	8	5.2
100-grain wt (g)	1.8	7	6.2

[a]Visual score of 1–9.

marketing, whereas most upland farmers produce for domestic consumption. However, Phongsaly grows the highest number of 8 upland varieties probably because of the strong preference for aromatic varieties. In the southern region, though the farmers have a commercial outlook, improved varieties with higher yield potential are grown. From the Saysomboun Special Region, only one aromatic variety was collected probably because the collection is not complete in this area. Other factors responsible may be inaccessibility to large markets, the lack of an urban population that can buy, and the recent migration of most of the people from other areas. The rainfed lowlands have 55 varieties, 46 glutinous and 9 nonglutinous. The uplands have 27 varieties, 24 glutinous and 3 nonglutinous. As expected, glutinous varieties outnumber nonglutinous ones because of the strong preference for such types. The number of variety names is only a proxy for varietal diversity. Though the names of varieties are mostly distinct and unique characters are associated with the name, we have also found varieties that appear identical but are named differently by different ethnic groups. Conversely, varieties that are clearly distinct morphologically and physiologically are called by the same name by some other ethnic groups. It is also recognized that there is a need for further confirmation of the aromatic varieties as they were selected based on the names given by the farmers.

Relation between number of distinct varieties and number of samples

In general, there is a very close relation between the percentage of samples and varieties collected (Table 2). The total samples collected and the number of aromatic samples and varieties differed considerably. For instance, out of the 36 samples, 21 distinct variety names were found in Borikhamxay and 12 varieties out of 17 in Bokeo, whereas in Houaphanh only 14 varieties out of 51 were found and 3 out of 6 samples collected from Attapeu. There seems to be no relation between the total samples and aromatic samples and varieties. Out of the 1,243 samples from Luang Prabang, the largest number collected, only 29 were aromatic samples, consisting of

only 13 varieties, whereas, in Borikhamxay, out of the 595 total samples, 36 samples were aromatic, consisting of 21 varieties.

Characterization of the diversity within Lao aromatic rice varieties

During the 1999 wet season, aromatic varieties were characterized at the Agricultural Research Center (ARC) in Vientiane Municipality. For characterization, both lowland and upland varieties were grown under good management conditions. Data were recorded according to the standard evaluation system for rice (IRRI 1996) or descriptors for rice (IRRI and IPGRI 1980). It is acknowledged that some of the characteristics of the varieties recorded under these conditions could have differed from when the same varieties were grown in the environment where they were collected (for example, in addition to the evaluation being made under a favorable moisture regime, the prevailing temperature may have been higher, particularly at the end of the growing season, relative to that which prevailed in the "home" environment, particularly for upland varieties grown at higher elevations and in more northern areas). Even for lowland varieties, it has been shown that varieties normally grown in lowland areas of the Mekong River Valley can take up to 3 or 4 more weeks to mature when grown in more northern areas, the difference being largely a reflection of the influence of lower temperatures, particularly at the end of the growing season.

Considerable variation was observed among the 370 samples evaluated from different provinces: days to flowering varied from 83 to 135, culm length from 62 to 147 cm, panicle number from 3 to 7, and 100-grain weight from 2.3 to 4.2 g. Variation was similar in many other varieties. This observed variation within a variety might be due to changes brought about by the environmental conditions under which the variety was grown. It would be interesting to determine whether there are differences in aromatic characteristics among different samples of this variety and other samples. In some varieties, the more limited variation may be due to adaptation to specific environmental conditions. Grain size, which is a highly heritable character also, showed considerable variation among different samples.

Considerable diversity was observed for all the characters studied (Table 4), for example, days to flowering varied from 79 to 145, with a mean of 108. However, most of the accessions flowered within 120 days. In general, upland varieties flowered earlier than lowland varieties probably because of adaptation to available soil moisture conditions. Culm length ranged from 50 to 210 cm, with a mean of 114 cm. Most accessions grew very tall, and only nine accessions were shorter than 70 cm. Very late and strongly photoperiod-sensitive varieties grew taller than the early-maturing varieties. The number of productive tillers varied from 3 to 9 per hill. In general, upland varieties produced fewer tillers as it is a normal practice to dibble up to 15 seeds per hill. Flowering was synchronous and the number of productive tillers was more in the photoperiod-sensitive varieties. Panicle length varied from 15 to 31 cm, with a mean of 24 cm. Grain size, as inferred by the weight of 100 grains at around 11% moisture content, varied from 1.8 to 7.0 g. Considerable variation was observed for spikelet characters such as shape, length, width, and thickness; color of glumes; and pericarp

color. However, the expression of upland varieties is not realistic and possibly may be different when they grow under upland conditions. Many of the glutinous aromatic varieties are globular in shape, which is in contrast to other aromatic varieties reported that have slender long grain with enormous elongation after cooking (Khush and de la Cruz 1998).

Aromatic varieties with nonaromatic names

As the Lao aromatic varieties reported in this chapter were identified, based on variety name, we recognize that probably a significant number of aromatic varieties in the 13,139 samples (for which names were recorded) collected throughout Laos in 1995-2000 have names that do not reflect their aromatic character. For example, variety *Khao kai noi* (small chicken rice) has a name that reflects its small grain size and globular shape rather than the aromatic character for which it is particularly well known. The 3.84% of the collection identified as aromatic is therefore probably a significant underestimate of the number of aromatic samples in the collection.

Future use of aromatic rice of Laos

Using results from the characterization of the aromatic varieties undertaken at the Agricultural Research Center in Vientiane Municipality in 1999, the Lao rice improvement program has already selected several accessions for use in the varietal improvement program. These include accessions that are particularly vigorous and have early flowering, short stature, a high tillering capacity, and a desirable phenotypic acceptability, long panicles, and heavy grains. These accessions will undergo further assessment for either direct introduction to farming areas and/or use in the ongoing breeding program.

By 2002, Laos was close to achieving rice self-sufficiency. In the near future, it may have a rice surplus, which could mean potential for export (Schiller et al 2001). However, it is recognized that it may be difficult for Laos to compete on the export market with other significant rice-exporting countries in the region, particularly Thailand and Vietnam. In particular, it is unlikely that Laos would be able to produce premium nonglutinous rice for the general export market and be able to compete with the well-known jasmine rice of Thailand and the basmati rice of the Indian subcontinent. It may be more appropriate for the country to develop export markets for "boutique" rice (Schiller et al 2000). In pursuing such an objective, the breeding program would need to largely focus on the development of aromatic nonglutinous rice rather than the more common aromatic glutinous rice collected from 1995 to 2000 (Appa Rao et al 2002a,b). The information contained in the variety names, including the aromatic varieties, would assist in the more effective use of traditional varieties in the Lao breeding program. It is generally acknowledged that the potential export market for glutinous rice is limited, largely on account of a lack of awareness in potential importing countries of the various ways in which glutinous rice can be prepared for consumption.

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Acknowledgments: The authors gratefully acknowledge the farmers of Laos, who provided not only samples of their valuable seed for conservation but also their invaluable knowledge about the traditional rice varieties of Laos. Special acknowledgment is due to the many Lao officials within the Ministry of Agriculture and Forestry for their role in collecting the information reported here. The financial support of the Swiss Agency for Development and Cooperation (SDC) to the project, which undertook the collection of traditional varieties for conservation and preservation, is also acknowledged.

CHAPTER 12

The colored pericarp (black) rice of Laos

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Rice varieties with colored pericarp (other than white and red) are usually called "black rice" by the farmers of Laos. Black rice varieties have been reported from many countries of Asia, including China (Zhang et al 1995, Hoahua et al 1996, Gu and Xu 1992), India (Sastry 1978), Japan (Natsumi and Noriko 1994), and Vietnam (Quan 1999). Chaudhary and Tran (2001) also report on black rice from Sri Lanka, Indonesia, the Philippines, Bangladesh, Thailand, and Myanmar. Although the black rice of Laos does not constitute a significant proportion of the total rice production, it is widely grown throughout the country and is grown by most ethnic groups. For some ethnic groups, the way black rice is grown is strongly influenced by their traditions and beliefs. The consumption of black rice varieties is usually in the form of specialty foods (and alcoholic drinks) rather than as a staple food in the same way white rice is consumed.

Among the 13,192 samples of cultivated rice germplasm collected within Laos from 1995 to 2000 (Appa Rao et al 2002a), based on the information provided by the farmers at the time of collection, 459 accessions (3.5% of the collection) were classified as having colored pericarp (Appa Rao et al 2003). Although many of these varieties with a colored pericarp are called black rice (*Khao kam* or *Khao dam*) by Lao farmers, the color of the pericarp of most of these varieties varies from dark purple to light brown, rather than being black.

There has been little documentation of black rice in Southeast Asia generally, and for Laos there is almost no documentation of the presence and diversity of the black rice in the country. This chapter describes the diversity of the black rice collected in Laos from 1995 to 2000 (Appa Rao et al 2000), together with its characterization postcollection and some aspects of its production and use.

The planting of black rice in Laos

Black rice is grown in Laos under rainfed conditions in both upland and lowland environments. However, the reasons for growing black rice often differ between these two environments, reflecting differences in the ethnic composition of the populations between these environments. For ethnic groups in the Mon-Khmer language grouping

that are found mainly in the upland environment of the northern agricultural region, black rice is grown almost exclusively for use in spirit-related rituals. The black rice used in the various spirit-related ceremonies is usually true black rice (with a dark purple pericarp), rather than other forms of rice with a colored pericarp, such as "red" rice. There are also some rituals for which the use of black rice is specifically not acceptable, such as in commemorative ceremonies on behalf of the dead (for which sometimes a "false" black rice is used, produced by the blackening of white rice with charcoal dust). In most upland areas of Laos, small amounts of black rice are used for alcohol production, and often this alcohol is also used for spirit-related rituals.

In the lowland environment, black rice is more often grown to produce alcohol rather than for use in rituals and, relative to the upland environment, a much smaller proportion of lowland households grows black rice. In the lowland environment, there is also more direct consumption of various black rice-based products than is the case with communities in the upland environment. However, even in the lowland environment, where a high proportion of the population is Buddhist, there are taboos relating to the use of black rice in some Buddhist-related ceremonies. For example, black rice is never used in offerings to Buddhist monks or in making offerings in Buddhist temples. Such taboos do not extend to some of the other "colored" rice such as red rice. In both the upland and lowland environments, the older members of the different ethnic communities usually believe that alcohol made from black rice is far superior to alcohol made from white rice.

In both upland and lowland farming areas, only small areas of black rice are grown by individual households, and not all households in a community or village grow black rice. For some ethnic groups in the upland environment, it is often only the relatively more affluent families that celebrate various spirit-based rituals that grow black rice. Although small in area relative to the white-rice crop, in areas where black rice is predominantly used in spirit-related rituals, black-rice crops are regarded as being very important for the community, which collectively ensures that such crops are protected and thrive. For some ethnic groups for which black rice is used in animistic rituals, the village shamans who lead these rituals are often prohibited from both growing and consuming black rice and black-rice products.

The black rice of Laos, in both upland and lowland environments, almost exclusively has glutinous or waxy endosperm; Chaudhary and Tran (2001) report that most black rice found in other parts of Asia also has waxy endosperm. The usual quality characteristics that are the basis of the selection and consumption of white rice varieties (aroma and taste) are not always reflected in the black rice varieties of Laos, many of which are generally regarded as being inferior to white rice. In the uplands, the black rice varieties are usually all of relatively early maturity. Unlike the traditional white rice varieties, for which several varieties are often grown by individual households, usually no more than a single variety of black rice is grown.

Although included within the "colored pericarp rice," "red" rice is usually not associated with spiritual taboos that exist for black rice in some ethnic communities. Red rice, unlike black rice, can be used when making food offerings to Buddhist monks and in Buddhist temples. Red rice, on milling, usually has a "colored" pericarp and

Table 1. Distribution of black rice samples collected from different growing environments and regions in Laos.[a]

Region	Wet season[b]				Dry-season irrigated	Total samples	
	Upland		Lowland				
	No.	(%)	No.	(%)		No.	(%)
North	189	(41.2)	19	(4.1)	0	208	(45.3)
Central	110	(24.0)	66	(14.4)	0	176	(38.4)
South	35	(7.6)	40	(8.7)	0	75	(16.3)
Total	334	(72.8)	125	(27.2)	0	459	(100.0)

[a]All the black rice samples collected have glutinous endosperm. [b]Numbers in parentheses represent percentages (of total number of black rice samples).

is regarded as having superior eating quality to black rice. Also, the red rice found in Laos has both glutinous and nonglutinous endosperm. Sometimes the term "red rice" is also used to refer to the wild or intermediate (between wild and cultivated rice) forms of rice that can occur as weeds in cultivated rice fields.

Identification and classification of the black rice varieties of Laos

Using the passport data obtained at the time of collecting, and based on the information provided by farmers (up to 36 descriptors were used), the black rice collected from 1995 to early 2000 (Appa Rao et al 2000) was classified according to geographic distribution among the different provinces of Laos, production systems, maturity time, and endosperm type. Subsequent to being collected, it was also characterized for morphological and agronomic characteristics.

Representation of black varieties in the collection and among growing environments

Out of the 13,192 samples of traditional rice collected from 1995 to 2000, variety names are available for 12,411 samples (Appa Rao et al 2002b). Among these, 459 samples had names identifying them as black. Most (72.8%) black rice samples were collected from the upland environment, with the northern agricultural region accounting for 45.3% of the total (Table 1). No samples of black rice were collected in the dry-season irrigated environment, where 100% of the rice area is usually cultivated with improved white-rice varieties. The predominance of black-rice samples collected from the upland environment partly reflects the fact that, in the early 2000s, almost 100% of the upland rice area was still being sown to traditional rice varieties. However, at about the same time, for the wet-season rainfed lowland environment in the main rice-growing areas in the Mekong River Valley of central and southern Laos, improved varieties were being grown on 70% to 80% of the rice area. The largest number of black rice samples collected in the lowland environment came from the

Table 2. Distribution of black rice samples collected among ecosystems and provinces of Laos.[a]

Province/region	Total samples	Lowland ecosystem		Upland ecosystem	
		Samples	%	Samples	%
Central region	142	63	13.7	79	17.2
Borikhamxay (BK)	23	5	1.1	18	3.9
Khammouane (KH)	25	21	4.6	4	0.9
Savannakhet (SV)	21	15	3.3	6	1.3
Vientiane Province (VP)	25	4	0.9	21	4.6
Vientiane Municipality (VM)	10	5	1.1	5	1.1
Saysoumboun (SB) Special Region	14	2	0.4	12	2.6
Xieng Khouang (XK)	24	11	2.4	13	2.8
Northern region	245	24	5.2	221	48.2
Bokeo (BO)	37	5	1.1	32	7.0
Houaphanh (HP)	23	5	1.1	18	3.9
Luang Namtha (LN)	37	4	0.9	33	7.2
Luang Prabang (LP)	44	2	0.4	42	9.2
Oudomxay (OD)	27	0	0	27	5.9
Phongsaly (PL)	31	4	0.9	27	5.9
Sayabouly (SB)	46	4	0.9	42	9.2
Southern region	72	38	8.3	34	7.4
Attapeu (AT)	18	11	2.4	7	1.5
Champassak (CS)	17	12	2.6	5	1.1
Saravane (SV)	25	12	2.6	13	2.8
Sekong (SK)	12	3	0.7	9	2.0
Total	459	125	27.2	334	72.8

[a]All samples had glutinous endosperm and all were collected from wet-season cropped areas in the lowland (predominantly rainfed) and upland (rainfed) environments.

central agricultural region (66 samples, representing 14.4% of the collection). The smallest number of black rice samples from the lowland environment came from the northern agricultural region (19 samples, representing 4.1% of the collection).

Geographic distribution of black rice

Black rice samples were collected from all provinces and from all 136 districts of Laos (Bounphanousay et al 2004, Appa Rao et al 2004) (Table 2). Among the provinces, Sayabouly had the highest number of samples in the collection (46), followed by Luang Prabang (44), Bokeo (37), and Phongsaly (37). All of these provinces are in the northern agricultural region, and for all four black rice prevailed in the upland environment rather than in the lowland environment. The provinces with the largest numbers of black rice samples collected from lowlands were Khammouane (21) and Savannakhet (15) in the central agricultural region and Champassak (12), Saravane (12), and Attapeu (11) in the southern agricultural region. The smallest numbers of samples were collected from Vientiane Municipality (10), Sekong (12), and the Saysoumboun Special Region (SR) (14). One reason for the relatively small number of black rice

samples collected from the Saysoumboun SR was that one of the dominant ethnic groups in this area, the Hmong, has a preference for the consumption of nonglutinous rice and has little interest in glutinous black rice. Although Vientiane Municipality is a significant market for black rice, there is a preference for growing improved white rice varieties in this and nearby areas (where there are significant areas of irrigated production) on account of the high yield potential of the improved white rice varieties. Most traditional black rice varieties are relatively low yielding. The black rice sold in markets of the capital, Vientiane, is mostly imported from other provinces.

Naming of black rice varieties

As reported by Appa Rao et al (2002b) and in Chapter 10, most names of traditional rice varieties in Laos have three elements: the basic name, the root name, and a descriptor. The basic name *khao* indicates rice; the most common root name for black rice is *kam* or *dam* (black). Most of the varieties with the root name *kam* or *dam* have this unique characteristic. The descriptor allows further identification of a particular variety within the different groups. For example, *Khao kam do* is a black (*kam*), early (*do*) maturing variety. The population of Laos constitutes 48 recognized ethnic subgroups (ADB 2001). Some of these ethnic groups sometimes use names other than *kam* or *dam* to indicate that a variety has purple (black) pericarp.

Within the 459 samples of rice that were collected and that had names indicating they had colored pericarp, the most common name was *Khao kam* (346 samples). However, not all samples with the root names *kam* or *dam* possess purple pericarp; in some instances, only the glumes were colored. In addition to the use of names that indicate directly that a variety is "black rice," Lao farmers also use a range of other names to indicate that a variety has a colored pericarp. These names include reference to black birds (the crow), insects, animal dung, and other colorful names (Appa Rao et al 2000b) (Table 3).

Lao farmers used 72 distinct variety names for the 459 samples of rice that were collected and classified as black rice (Appa Rao et al 2004, Inthapanya et al 2003) (Table 3). All but four of these varieties were grown exclusively in either the upland or lowland environments; four varieties were being grown in both environments. Varieties with the same distinct name were sometimes collected from more than one district and/or province (as reflected in the data tabulated for individual provinces in Table 4), reflecting the relative numbers of black rice samples collected between the upland and lowland environments, and between agricultural regions and provinces. The largest number of distinct variety names was recorded in the upland environment, with the largest number in the northern agricultural region, in Luang Namtha, Luang Prabang, Phongsaly, Houaphanh, and Sayabouly.

Diversity within black varieties

Pericarp color of black rice varieties in Laos is generally not black, but varies from dark purple to various shades of purple, and to brown (Photo 12. 1). For most varieties, the purple pericarp color is sometimes associated with purple pigmentation on vari-

Table 3. Distinct black rice variety names and their classification and characteristics.[a]

Sample no.	Variety name of black rice	English meaning of name	LG no.	GC	PC	Ec	En	Mt	Pv
1	*Ba haheuy*	Purple pericarp	8334	20	80	U	G	L	AT
2	*Baksa (*Kam)	Purple pericarp	4823	20	80	U	G	M	SG
3	*Ble dou*	Black pericarp	7472	52	88	U	G	L	OD
4	*Ble sa*	Purple pericarp	12339	20	88	U	G	L	BO
5	*Dam beung*	Black spider	1827	20	88	U	G	M	VP
6	*Dam* (U)	Black	3567	91	80	U	G	L	LP
7	*Dam* (L)	Black	13083	20	80	L	G	M	XS
8	*Dam dang*	Black, variable	2166	20	88	L	G	M	AT
9	*Dam do*	Black, early (maturity)	12312	90	80	U	G	M	LP
10	*Dam ka*	Black, crow	2757	20	88	L	G	M	HP
11	*Dam kieng*	Black, glabrous	13025	91	8	U	G	L	SB
12	*Dam med gnao*	Black, long grain	4346	20	88	L	G	M	PL
13	*Dam mo*	Black	13014	20	88	U	G	L	SB
14	*Dam noi*	Black, small	12936	20	88	U	G	L	XK
15	*Dam nuk*	Black glumes	3924	91	88	U	G	M	OD
16	*Dam pee*	Black, late (maturity)	12311	20	80	U	G	M	LP
17	*Dam peek* (L)	Black winged (L)	131	20	80	L	G	L	AT
18	*Dam peek* (U)	Black winged (U)	7332	20	80	U	G	L	LN
19	*Dam py*	Very black	13023	20	88	U	G	L	SB
20	*Deb kom*	Purple pericarp	5442	91	88	U	G	M	SV
21	*Deb ram*	Purple pericarp	5494	91	80	U	G	E	SV
22	*Do dam*	Early (maturity), black	12832	91	88	U	G	E	VM
23	*Ea dam*	Black	12780	91	80	L	G	M	SK
24	*Ea kam* (L)	Black pericarp	474	20	88	L	G	M	CS
25	*Ea kam* (U)	Black pericarp	8945	20	88	U	G	E	CS
26	*Gnon na* (kam)	Purple pericarp	11643	91	88	U	G	L	BO
27	*Hiang*	Purple pericarp	11479	20	88	U	G	L	LN
28	*Hodo/kam peek*	Purple pericarp, winged	2360	20	88	U	G	E	BO
29	*Hodoko/Kam*	Purple pericarp	4295	91	88	U	G	M	PL
30	*Kaateu*	Purple pericarp	8780	20	88	U	G	M	AT
31	*Kam* (L)	Purple pericarp	112	20	88	L	G	M	AT
32	*Kam* (U)	Purple pericarp	529	91	80	U	G	M	SG
33	*Kam bo mee khon*	Purple, glabrous	6648	90	88	U	G	L	HP
34	*Kam do*	Purple pericarp, early	3646	20	88	U	G	E	LP
35	*Kam gnay*	Purple pericarp, big	12217	20	88	U	G	L	LN
36	*Kam hang*	Purple pericarp, awned	6651	20	88	U	G	L	HP
37	*Kam hai*	Purple pericarp, upland	3763	100	88	U	G	L	LN
38	*Kam kab khaw*	Purple pericarp, glumes white	1386	20	88	L	G	M	KM
39	*Kam kang*	Purple pericarp, medium	5681	91	80	U	G	M	VP

Continued on next page

Table 3 continued.

Sample no.	Variety name of black rice	English meaning of name	LG no.	GC	PC	Ec	En	Mt	Pv
40	*Kam khaw*	Purple pericarp, white	10522	20	80	U	G	E	LP
41	*Kam khie*	Purple (dung) pericarp	6700	42	50	U	G	L	HP
42	*Kam khie ngoua*	Purple (cow dung) pericarp	130	20	88	L	G	M	AT
43	*Kam khon*	Purple pericarp, hairy	10355		88	U	G	E	BK
44	*Kam kieng*	Purple pericarp, glabrous	9055	20	88	U	G	L	HP
45	*Kam lay*	Purple pericarp, striped	8648			U	G	M	HP
46	*Kam leuang hang*	Purple pericarp, yellow awned	9757	20	88	U	G	M	SB
47	*Kam med gnao*	Purple pericarp, long grain	1853	91	80	U	G	M	VP
48	*Kam med pom*	Purple pericarp bold grain	1851	91	88	U	G	M	VP
49	*Kam mee khon*	Purple pericarp, hairy	6647	20	88	U	G	L	HP
50	*Kam na*	Black pericarp, lowland	13192			L	G	L	KM
51	*Kam noi*	Purple pericarp, small	12237	91	88	U	G	M	LN
52	*Kam peek*	Purple pericarp, winged	7156	20	80	U	G	E	PL
53	*Kam peng*	Purple pericarp, floury	6740	42	88	L	G	L	HP
54	*Kam peuak dam*	Purple pericarp, glumes black	9477	91	88	U	G	E	PL
55	*Kam peuak dam*	Purple pericarp, glumes black	11994	100	80	L	G	M	BO
56	Kam peuak deng	Purple pericarp, glumes red	11995	54	80	L	G	M	BO
57	*Kam peuak khaw*	Purple pericarp, glumes white	9478	20	88	U	G	L	PL
58	*Kam peuak khaw*	Purple pericarp, glumes white	11996	20	88	L	G	M	BO
59	*Kam pon*	Purple (mixed) pericarp	12709			U	G	M	SB
60	*Ko sareuay*	Purple pericarp	5467	100	88	U	G	M	SV
61	*Koda*	Purple pericarp	4323	91	80	U	G	M	PL
62	*Kok kam*	Plant black	9737	91	88	U	G	M	SB
63	*Kou cha*	Purple pericarp	5423	52	88	U	G	M	SV
64	*Mak eu*	Pumpkin fruit	5461	91	88	U	G	E	SV
65	*Nia*	Purple pericarp	12417	90	88	U	G	E	PL
66	*Niaw dam*	Glutinous, black	6874	91	80	U	G	M	XK
67	*Pa siev dam*	Tiny carp, black	11812	20	88	U	G	E	SB
68	*Pee dam*	Late black	12904	91	80	U	G	L	VP
69	*Peek dam*	Winged black	7401	91	80	U	G	L	LN
70	*Po*	Purple pericarp	8286	91	80	U	G	L	CS
71	*Se phong kanto*	Purple pericarp	4425	20	88	U	G	L	PL
72	*Tou valien*	Purple pericarp, awned	5419	20	88	U	G	M	SV

[a]LG no. = Lao Germplasm Bank no., GC = glume color, PC = pericarp color, EC = ecosystem, L = lowland, U = upland, En = endosperm type, G = glutinous, Mt = maturity, E = early, M = medium, L = late, Pv = province (refer to Table 2).

Table 4. Distribution of black rice (Khao kam) variety names in different ecosystems and provinces in Laos.

Region/province	No. of samples		Distinct black rice variety names		
	Total collected (no.)	Black rice samples (no.)	Total names	Number of names	
				Lowlands	Uplands
Northern region	5,915	142	67	12	55
Bokeo	686	23	9	4	5
Houaphanh	631	25	11	3	8
Luang Namtha	858	21	10	1	9
Luang Prabang	1,244	25	10	1	9
Oudomxay	848	10	5	0	5
Phongsaly	664	14	11	2	9
Sayabouly	984	24	11	1	10
Central region	4,623	245	33	14	19
Xieng Khouang	561	37	6	2	4
Borikhamxay	595	23	4	1	3
Khammouane	866	37	5	4	1
Savannakhet	988	44	3	2	1
Vientiane Mun.	485	27	4	2	2
Vientiane Prov.	787	31	8	1	7
Saysoumboun Special Region	341	46	3	2	1
Southern region	2,652	72	24	8	16
Attapeu	640	18	7	4	3
Champassak	842	17	5	2	3
Sekong	396	25	3	1	2
Saravane	774	12	9	1	8
Total	13,190	459	124	34	90

ous plant parts, such as the glumes, leaf blade, leaf sheath, midrib, peduncle, panicle (Photo 12.2), and spikelets (Photo 12.3). However, not all varieties with purple coloring in various plant parts have grain with colored pericarp. Similarly, for varieties in which the pericarp is colored, other plant parts, such as glumes and leaves, may not be purple. Black rice is found in both indica and japonica groups (Choudhary and Tran 2001). Roder et al (1996) reported that enzymatic analysis of part of a collection of traditional upland varieties obtained in northern Laos in 1991-93 indicated that more than 90% of the entries belonged to the japonica group. Although black rice was not specifically identified as part of this collection, it is unlikely that the black upland varieties of Laos would differ from the majority of the other upland varieties.

Characterization of black varieties

Out of the 459 accessions classified as having a purple pericarp, 241 were grown in the 1999 wet season at the Agricultural Research Center (ARC) in Vientiane Municipality for characterization and classification of their morphological and agronomic

characteristics. For this characterization, both lowland and upland varieties were grown under good management conditions, including irrigation.

Data were recorded according to the standard evaluation system for rice (IRRI 1996). For a sample of 241 varieties, days to flowering ranged from 86 to 145, with a mean of 110; however, most accessions flowered within 120 days and, in general, upland varieties flowered earlier than lowland varieties. This earlier flowering (and subsequent earlier maturity) probably reflected specific selection and adaptation to the uplands, where the soils can rapidly dry out with the end of the wet-season rains, and where most varieties have to be harvested before the majority of lowland varieties. Culm length ranged from 61 to 155 cm, with a mean of 95 cm. Most accessions were very tall, with only nine being shorter than 70 cm. The later-maturing, strongly photoperiod-sensitive varieties were generally taller than the early-maturing varieties. The number of productive tillers varied from 2 to 11, with a mean of 5.5 per hill. In general, upland varieties usually produce fewer tillers than most lowland varieties. When dibble sowing rice in the upland environment, more seed is usually sown per hill than plants transplanted per hill in the lowland environment. Flowering within varieties was synchronous, with the number of productive tillers being greater in the more photoperiod-sensitive, later-maturing varieties. Panicle length varied from 15 to 33 cm, with a mean of 24 cm. Considerable variation was observed for spikelet characteristics such as shape, length, width, and thickness, and color of glumes (Photo 12.3) and pericarp. Steamed black rice was dark purple in color and was shining brightly, giving an appearance of "black pearl" (Photo 12.4). Grain size, a highly heritable character, also showed considerable variation among different samples. For a sample of 198 varieties, 100-grain weight was 2.3 to 4.4 g, with a mean of 3.1. Many of the glutinous black varieties have grains that are globular in shape. In a 2002 wet-season assessment of yield for 45 Lao black rice varieties, yield ranged from 1.4 to 3 t ha^{-1} (Inthapanya et al 2003).

Nutritional value of black rice

Black rice generally draws the attention of rice consumers because of its unusual color. However, in Laos, there is a general perception that black rice is inferior in quality to white rice. This contrasts with the situation in parts of southwest and central China, where black rice varieties have been developed that are reported to be of good quality and high yielding, and have multiple resistance (Chaudhary and Tran 2001). Some of these Chinese black rice varieties are reported to have higher protein, higher fat, and higher crude fiber contents than the common or white rice varieties as well as being rich in lysine, vitamin B_1, calcium, iron, zinc, and phosphorus (Chaudhary and Tran 2001, Gu and Xu 1992). However, it is acknowledged that the higher values for some of these characteristics may not necessarily always be genetically based but may also reflect processing (such as milling) methods. In Laos, black rice is often manually pounded to remove the glumes and consumed after minimum polishing or without polishing (Photo 12.1). As the aleurone layer where the vitamins and minerals, besides protein and fat, are located is not completely removed in black rice, the resulting product is often of higher nutritional value than polished white rice. It has also been

reported (Quan 1999) that beverages made from black rice produced after fermentation can sometimes be of high quality. In Laos, black rice is also sometimes used for commercial production of fermented alcoholic beverages, and its older consumers regard it as a superior product to that produced from white rice.

Inheritance of colored pericarp

The intensity of pericarp color in rice depends on the presence of various kinds of pigments and their proportions in the pericarp. Among the several pigments present in the pericarp, glycoside cyanidin is the major one (Haohua et al 1996). These pigments have been found to be quite stable under normal temperature, light, and processing conditions (Haohua et al 1996). Reports on the mode of inheritance of pericarp color in black rice are few. Sastry (1978) reported that crosses between white and red pericarp parents produced F_1 plants with a red pericarp, revealing that red pericarp color was dominant over white. In the F_2 generation, the plants segregated in a ratio of 3 red to 1 white, suggesting that a single dominant gene controls red pericarp color in rice. On the other hand, crosses involving several parents with varying amounts of pigments (varying intensity of purple color) have showed that the intensity of color in the plants varies, depending on the number of genes present in the F_1 plants, the alleles for high pigment content being dominant to those for low pigment content, indicating additive-dominance (Zhang et al 1995). These authors report that two pairs of genes were found to control pigment content in the pericarp, with high pigment content (colored pericarp) being dominant to low pigment content (light-colored pericarp). The deep purple pericarp was expressed as dominant over purple, with the light purple pericarp being dominant to nonpigmented (white), indicating that two pairs of dominant genes control black pericarp pigmentation. As either one or two dominant genes control intensity of pericarp color in rice, it is easy to transfer colored pericarp character into high-yielding modern varieties.

Future use of the black glutinous varieties of Laos

As a result of the rice germplasm collecting and conservation program undertaken in Laos from 1995 to 2000, the country has one of the most extensive collections of traditional black rice germplasm of any single country where germplasm collecting and conservation have been done. Preliminary evaluation of some of this black rice germplasm base also indicates that there is significant diversity in many characteristics within the collection. Accessions have been identified that are extra vigorous, early flowering, and short-statured; some also have high tillering capacity, long panicles, and heavy grains, in addition to having a generally desirable phenotypic acceptability. However, this initial assessment is preliminary and was made under lowland conditions (whereas most of the varieties in the collection were collected in the rainfed upland environment). Considerable work remains to be done in properly evaluating and characterizing the Lao black rice germplasm collection in the environment in which it has traditionally been grown.

Despite projections of a future significant increase in rice needs (and therefore production demand) to meet the increasing population in 2020 (when projections of 7.7 million suggest that rice consumption requirements will need an annual production of at least 2.6 million tons of rice paddy), this increased demand will be mainly for white rice, perhaps with an increased proportion of nonglutinous rice relative to the early 2000s. The consumption of black rice within Laos will likely continue to be for the specialty foods for which it is currently grown and used. Perhaps, with greater urbanization of the population, consumption in traditional areas of production might decline. The export market for black rice is very specialized and also limited in size for the boutique rice in whose category black rice falls. It will be important for Laos to maintain the genetic resource base of black rice that it has. However, there may be little potential return from a significant allocation of limited research resources for the development of specialized black rice varieties through breeding. Rather, the full characterization of the collection, and subsequent evaluation in appropriate environments, to allow the identification of varieties that best fit specific growing conditions and environments in Laos should bring the greatest benefits.

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Notes

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Acknowledgments: The authors gratefully acknowledge the farmers of Laos who provided not only samples of their valuable seed for conservation but also their invaluable knowledge about the traditional rice varieties of the country. Special acknowledgment is due to the many officials within the Ministry of Agriculture and Forestry of Laos for their role in collecting much of the information reported in this chapter. The financial support of the Swiss Agency for Development and Cooperation (SDC) to the project that undertook the collection of traditional varieties for conservation and use is also acknowledged.

CHAPTER 13

Development of traditional rice varieties and on-farm management of varietal diversity in Laos

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Present-day cultivated cereal crops have evolved from their wild relatives through natural selection of spontaneously occurring mutations, migration, and recombination of genetic variation (Harlan et al 1973). Cultivated crop varieties, often called landraces, primitive varieties, and farmers' varieties or traditional varieties, differ from their wild relatives mainly in relation to the nonshattering nature of physiologically mature grain, which has facilitated the harvesting of ripe grain for human consumption and animal feed. Farmers have, in turn, undertaken further selection within the naturally occurring variability to develop varieties that are suited to the prevailing agroclimatic conditions, provide stable yield and give varying taste, and possess a range of other associated characteristics desired by both the growers and consumers of these crops (Ford-Lloyd and Jackson 1986, Brush and Meng 1998, Harlan 2002). Though there is an awareness of the numerous traditional varieties of crop plants that have evolved over centuries through natural and human selection, records are relatively few of examples of the history of the development of varieties by farmers in any crop.

During the course of rice germplasm collecting missions undertaken from 1995 to 2000 in the Lao People's Democratic Republic (Laos) jointly by the Lao Ministry of Agriculture and Forestry (MAF) and the International Rice Research Institute (IRRI), many farmers were encountered who were able to describe the history of development of some of the varieties for which seed samples had been collected for conservation and use (Appa Rao et al 1997). This information was documented as far as was practicable, within the context of the program of germplasm collecting. The history of the varieties developed and the methods followed to develop them or select for special traits are fascinating in their own right and provide examples of the uniqueness of the indigenous farmers' knowledge that exists in many parts of Laos. It is expected that this knowledge might be lost if not documented, as agricultural practices are quickly changing with development throughout the country. Although the origin of the varieties described has been relatively recent, the records provide an insight into the way new varieties are identified and developed. The records also help document examples of the rationale used by Lao farmers when selecting the unique names for varieties that are described separately in Chapter 10.

In addition to collecting information from areas where the varieties were being grown at the time of germplasm collecting, all of the varieties described in this chapter were also grown and studied in the 1999 wet season at the National Agricultural Research Center near the capital, Vientiane. The purpose of growing the varieties under experimental conditions was to properly characterize and validate many of their attributes. In addition to documenting the history of a number of Lao traditional rice varieties, this chapter also describes how Lao farmers generally manage diversity and maintain these and other varieties in both lowland and upland situations.

The farmers' research environment

During the cropping season, Lao farmers build a small rest-house near the fields they cultivate. They use this rest-house as a base during the cropping season, tending their crops until the produce is harvested, threshed, transported, and stored in granaries in or near their villages. This intimate involvement with all growth stages of the crop provides farmers with an opportunity to observe varieties very closely as they grow. Farmers develop an intimate knowledge of each variety and its unique characteristics, based on which individual varieties are identified. Any plants that express differences in traits relative to those regarded as normal for any variety are usually quickly noted and special care is often taken of such plants, with their growth being closely monitored to maturity. Farmers often select such distinct morphological variants and then harvest, dry, thresh, and store them separately. The variants are then often planted separately in the following season, with careful observations being made in small plots for their morphological and other agronomic characteristics, to evaluate their potential for further multiplication and subsequent identification as a new variety to which is assigned a new variety name that often reflects some aspect of the history of the variety (Appa Rao et al 2002a,b). In this process of evaluation and assessment of variants, farmers apply their own criteria. Sometimes farmers deliberately look for variants that are needed to meet specific requirements or alleviate particular production constraints or because a variant possesses unique morphological traits that are a curiosity.

The origins of selected traditional Lao varieties

Khao ko diaw (single-hill rice)

Variety *Khao ko diaw* (single-hill rice) is a lowland glutinous variety that was reportedly developed through pure-line selection by a farmer (Mr. Sulan) in Pakuvai village in Xaibothong District of Khammouane Province in the Mekong River Valley. As reported by his family members, Mr. Sulan found a single rice hill growing in a shallow pond near his field in 1986. Mature seeds of that single hill were selected and tested in subsequent years. Satisfied with the grain yield and grain quality, the family then multiplied the seed and starting growing it as one of their regular varieties. Neighbors in the same village were also impressed with the variety and started growing it. It was later adopted by farmers in other villages in the same area. At the time of first noticing the variant, Mr. Sulan was impressed with the morphological characters in the single

hill he selected for testing; he subsequently named it as *Khao ko diaw* (single-hill rice) and started growing it. This variety is characterized by profuse tillering and synchronous flowering and maturity, and it possesses many large, attractive drooping panicles and large grain free of any disease and insect damage.

When grown under experimental conditions in Vientiane Municipality, the variety was characterized by producing many tillers (up to 15), possessing long drooping panicles on maturity. The grains are large, well filled, and heavy. It has a maturity time of about 150 days. Like almost all traditional varieties, it is photoperiod-sensitive. It is adapted to being grown under conditions of minimum inputs. Many farmers grow this variety in an isolated area in and around Xaibothong District of Khammouane.

Khao ko diaw could have originated because of segregation from a spontaneous intervarietal hybrid. As rainfed lowland farmers in the Xaibothong area grow several varieties together in small adjacent plots, a spontaneous intervarietal hybrid between two cultivated varieties might have occurred and a more vigorous recombinant might have arisen with the preferred combination of characters. A second possibility is that of a spontaneous interspecific hybrid between cultivated and wild rice. In the same general area, *Oryza rufipogon* and *O. nivara* grow abundantly and flower at the same time as some of the cultivated forms (Appa Rao et al 1997). A spontaneous interspecific hybrid between cultivated and wild rice might have occurred and subsequently segregated. The interspecific hybrid must have been more vigorous to be able to compete with other weeds, and wild and intermediate forms of rice, gradually becoming a nonshattering type and losing its awns because of recombination and natural selection. It must have survived some environmental stress, whereas other segregating plants were lost as they could not survive and establish. This unique recombinant might have reached the pond where it was found through flowing water. A third possibility is that seeds of a cultivated form might have been transported from elsewhere through floodwater, animals, or birds. It might have established in the pond where it attracted the farmer's attention (and he subsequently selected it), as it differs morphologically from other locally grown varieties in the same area.

Khao phae dam (tillering black rice)

Variety *Khao phae dam* (tillering black rice) was developed by Ms. Lasoy (Photo 13.1) of Muang La District in Oudomxay in northern Laos; the variety was developed from another upland variety, *Khao phae deng* (tillering red rice), which is a medium-maturing glutinous variety. When she grew *Phae deng* in 1997 on an area of about 1,500 m^2, she found five panicles, which were lax and longer than the rest, and spikelets that were larger with black (purple) glumes and for which the brown rice was longer, white, shiny, and attractive. The original variety, *Phae deng*, produces grain with red glumes. According to Ms. Lasoy, as there were no other varieties with such black glumes and attractive grain characteristics, she grew it in 1998 to further test it, and then multiplied its seeds. Impressed by its novelty, she started cultivating it on a regular basis. In turn, her neighbors obtained seed of the variety and started growing it as a new variety, which was not found in other nearby villages.

Khao hom do (aromatic early-maturing rice)

In 1984, a farmer (Mr. Bee, Photo 13.2) in the village of Sine-Sai in Bounthai District of Phongsaly in northern Laos obtained seeds of the lowland glutinous variety *Khao hom kang* (aromatic medium-maturity rice) from a neighboring village. When he grew this variety in his own village, he found some plants that flowered and matured a month earlier than the original variety (which matures in about 4 months). He harvested all the early-maturing panicles, bulked them, and grew the seed the following year. After testing in subsequent years, he found the selection to be superior to the original variety in relation to several characters, but particularly for early maturity, a character that he had been looking for. As claimed by Mr. Bee, *Khao hom do* matures in 90 days (30 days earlier than *Khao hom kang)*, produces dark green leaves and larger and longer panicles, and is higher yielding than the original variety. The grain is more aromatic, with good eating quality. Because of its early maturity, aroma, and other desirable characters, the new variety quickly spread among farmers in the village and then to neighboring villages, becoming very popular in the district within a relatively short time.

The early-maturing plants that formed the basis for the new variety, *Khao hom do,* might have arisen as a spontaneous mutation, or the seeds Mr. Bee grew initially might have been a physical mixture of early- and medium-maturing varieties, both of which were aromatic, allowing him to select and later multiply the shorter earlier-maturing plants.

Khao keut (created or born rice)

Variety *Khao keut* (created or born rice) was developed in 1993 by Mr. Khamphet, a farmer from Hin village in Kham District of Xieng Khouang in northeastern Laos. It was developed from a traditional variety called *Khao bong* (bamboo rice), whose culms are thick, strong, and long, resembling those of bamboo. When Mr. Khamphet grew the locally popular variety *Khao bong*, he found five plants that differed from those of the original variety. The variant plants were taller and produced large, long, and loose panicles. These off-type panicles were selected by Mr. Khamphet, with the seeds being kept separately for further testing in the following year, when it was found that they produced plants that were superior to the original variety. On cooking, it was also found that the grain of the new plants was soft and had very good eating quality. Mr. Khamphet and other farmers in the village then started growing the new variety on a regular basis, naming it *Khao keut* (created or born rice). Both the original variety, *Khao bong*, and the newly developed variety, *Khao keut,* are rainfed lowland glutinous varieties that are transplanted twice during the cropping cycle (a practice in some lowland areas of northern Laos) and mature in about 5 months. The off-type panicles that formed the basis of the selection for the new variety, *Khao keut,* might have arisen as a spontaneous mutation or segregation from a spontaneous intervarietal cross, with the segregating plants being subsequently easily noticed as a result of being conspicuous by their height and loose panicles.

Khao pong deng (regenerated red rice)

Variety *Khao pong deng* was developed in Ban Song village in Khun District of Xieng Khouang in northeastern Laos. Floods are very common in this area and can sometimes completely submerge and destroy the rice crop. During one such season of prolonged flooding, when almost the entire rice crop in the area was destroyed, a single plant was found in an otherwise destroyed rice field, and it survived to produce some grain. The farmer who found the plant, believing it to be a significant omen, gave the rice seeds that were produced to a local monk, who then multiplied the seed, testing the plants under field conditions, and subsequently distributed the seed to local farmers. The variety was named *Khao pong deng* (regenerated red rice) to reflect the belief that it was the regeneration of the rice destroyed by the flood.

A second version of the story relates to the origins of the variety. This version says that a local farmer found a single rice plant that had survived the flood and was growing in a local forest. Believing that plant had been created by "the spirits," the farmer gave it to the village monk, who grew it, multiplied the seed, and distributed the seed to local farmers. Variety *Khao pong deng* grows very tall, tolerates submergence for a considerable time, is late maturing, and has glutinous endosperm. Probably the single plant that was the basis of the variety was a spontaneous mutant that has the ability to regenerate, but the trait was expressed only when the flood stress was imposed, enabling it to express its unique capacity for regeneration.

Khao khen sua (shirt-sleeve rice)

Variety *Khao khen sua* was introduced to Pek District of Xieng Khouang (in northeastern Laos) from Khun District in the same province during the early 1950s. A farmer from Pek, when visiting a farmer's field in Khun, selected an attractive panicle from the latter's rice field and hid it in his shirt sleeve for the trip back to his own village. On the return journey, the farmer reportedly encountered a French soldier, who shot him. The injured farmer was able to reach the provincial capital, Phonesavan, where he died. Following his death, an old woman noticed the rice panicle hidden in the sleeve of the farmer's shirt. Believing it to be of significance, she took the panicle to her own home, where she kept the seeds and grew them the following season. The woman noted several attractive attributes in the resulting plants, whereupon she further multiplied the seed and distributed some to other households in the village. The resulting variety was given the name *Khao khen sua* (shirt-sleeve rice) to reflect where the woman had obtained the panicle on which the variety was based. Following extensive farmer-to-farmer and village-to-village exchange, the variety is currently widely grown in Pek District of Xieng Khouang. It is a medium-maturity glutinous variety grown under wet-season lowland conditions.

Khao bong do (early bamboo rice)

In the 1960s, a farmer from Nambak District in Luang Prabang in northern Laos visited Xieng Khouang in the northeastern part of the country. During the visit, he saw variety *Khao bong* (bamboo rice) growing in a field and, being impressed by it, took a small quantity of seed with him on his return to Nambak. The variety was

evaluated in Nambak and then multiplied, with seed being distributed among other households and villages. It became known as *Khao bong do* (early-maturing bamboo rice). When grown in Nambak, it was reported to mature in 4 months, 1 month earlier than when grown in Xieng Khouang. Farmers reported that it matures 1 month earlier in Nambak than in Xieng Khouang; it was also reported to have larger panicles with well-filled heavy grains when cultivated in Nambak. The earlier maturity when grown in Nambak could have one or more reasons. In Xieng Khouang, this variety is usually grown following a double transplanting practice that is sometimes adopted in northern Laos, whereas in Nambak a single transplanting is adopted. However, the more likely reason is an effect of temperature on maturity time. The area of Xieng Khouang where the variety is grown has an elevation of about 900 m, compared with an elevation of about 350 m for Nambak. The higher elevation in Xieng Khouang is probably associated with significantly lower temperatures in the latter part of the growing season, relative to Nambak, thereby extending the maturity time of most rice varieties. This phenomenon is often observed when varieties developed for the main rice-growing areas in the Mekong River Valley are grown in some areas of northern Laos (Schiller et al 2001). *Khao bong do* has become popular in the Nambak area, not only on account of its relatively early maturity but also because of the ease with which it can be threshed combined with its glabrous leaves, which allow farmers to handle it easily during weeding, harvesting, and threshing. In Nambak and surrounding areas, it is also known as *Khao Xieng Khouang do* (Xieng Khouang early rice).

Khao kai noi (small chicken rice)

This variety was first introduced to the northern Lao province of Houaphanh from neighboring Vietnam, and later introduced to Xieng Khouang to the south of Houaphanh. It is currently grown extensively in both Houaphanh and Xieng Khouang. There are different suggested origins for the naming of *Khao kai noi* (small chicken rice). One belief is that it was so named on account of its small grain size, small enough to allow it to be fed to chickens without first being ground or broken. Others attribute the name to the perception that, if the grain is broken in the process of dehulling, the broken pieces of grain are so small as to have little use, even for feeding chickens. A further story about the origin of the name (and the variety) is that a woman in Seula Province of Vietnam found undigested rice grains in the gullet of a chicken. As the grains were small and globular, and differed considerably from the existing varieties, it aroused her curiosity and she then grew plants from these undigested grains. After further seed multiplication, the resulting crop was regarded as having good yield potential, a very high milling recovery, and good eating quality.

Khao kai noi is a rainfed lowland, glutinous, late-maturing rice variety. The grain is strikingly different from that of most other varieties, being short, rounded, and almost globular in shape. The unique feature of the variety is its high milling recovery (about 80%, compared with about 65% for most other varieties). The grain is nonshattering and is difficult to thresh. However, despite this difficulty, it is very highly regarded for its aromatic character and excellent eating quality, on account of which it is sometimes eaten alone without the usual side-dishes. It was reported to be

Table 1. Variant forms of variety Khao kai noi (small chicken rice) and source of collection.

Lao name of variant	English name equivalent	Character	Source of sample	
			Province	Ecosystem
Khao kay noi	Small chicken rice	Standard variety	Northern region	Lowland
Khao kay noi dam	Black small chicken rice	Black glumes	Houaphanh	Lowland
Khao kay noi deng	Red small chicken rice	Red glumes	Houaphanh	Lowland
Khao kay noi khaw	White small chicken rice	White glumes	Houaphanh	Lowland
Khao kay noi leuang	Yellow small chicken rice	Yellow glumes	Houaphanh	Lowland
Khao kay noi lai	Striped small chicken rice	Striped glumes	Houaphanh	Lowland
Khao kay noi hai	Upland small chicken rice	Adapted to upland environment	Houaphanh	Upland
Khao kay noi hom	Aromatic small chicken rice	Aromatic	Houaphanh	Lowland
Khao kay noi hang	Awned small chicken rice	Awned spikelets	Xieng Khouang	Lowland
Khao kay noi/nam yen	Cold (water)-tolerant small chicken rice	Cold-tolerant	Houaphanh	Lowland

Source: Appa Rao et al (Chapter 10).

high yielding under the low-input conditions that prevail in most areas of Laos, with yields of 3 to 4 t ha^{-1} in parts of Xieng Khouang in the northeast and 4–5 t ha^{-1} in Houaphanh in northern Laos.

Based on glume color and other characteristics, nine variant forms of the variety have been identified, with some of the varieties having additional descriptions in the varietal name to reflect some characteristics (Table 1). Variety *Khao kai noi lai* (striped small chicken rice) has glumes with longitudinal red and yellow alternating stripes; *Khao kai noi leuang* (yellow small chicken rice) has yellow glumes, whereas *Khao kai noi deng* (red small chicken rice) has red glumes. *Khao kai noi hang* (awned small chicken rice) has awned spikelets. Of the nine variant forms, *Khao kai noi leuang* is regarded as being the most aromatic. The brown rice of all the variants is generally similar in appearance. In most fields, only one of the forms is grown. In gross morphology, *Khao kai noi* appears to be intermediate between the indica and tropical japonica (javanica) groups.

Khao poum pa (fish stomach rice)

Variety *Khao poum pa* (fish stomach rice) was developed in Sing Sai village in Khoua District of Phongsaly in northern Laos. The origin of this variety is reported to be similar to that of *Khao kay noi*, but with *Khao poum pa* being developed in Laos from rice grains found in the stomach of a fish rather than in the stomach of a chicken as for *Khao kay noi*. The undigested grains were planted and multiplied, with the resulting crop being found to give a superior yield relative to other varieties being grown in the area. Through farmer-to-farmer and village-to-village exchange, *Khao poum pa* is now a well-known variety among farmers and villages near its area of origin in Phongsaly Province. The variety is also known as *Khao khay pa* (fish egg rice), both names reflecting the source of origin of the seed, which formed the basis of the variety.

Khao holo (holo tree rice)

The origins of this variety were reported by farmers to have been based on a single rice plant that a local farmer found growing under a "holo" tree in the village of La Kao in Phongsaly District of Phongsaly Province, one of the most remote northern provinces of Laos. The holo tree is used by one of the ethnic groups of Phongsaly Province, the Phu Noi, as an indicator of relatively high soil fertility and a basis of selection of upland areas for rice cultivation. After seed multiplication and field testing, the single rice plant collected formed the basis of a new traditional variety, which was named *Khao holo*. This variety is still very popular in Phongsaly District where it was developed. It is an upland glutinous aromatic variety of medium maturity.

Farmers' seed multiplication practices for maintenance of varietal purity

Lao farmers produce their own seed of traditional and recently developed modern varieties. For seed purposes, farmers in the lowland environment usually select fields where the crop is growing well, is phenotypically uniform, and, where possible, has not been stressed during growth. Mature grain to form the seed of each variety is harvested separately, bundled, and carried to the threshing floor, where the sheaves of each variety are also kept and threshed separately. After threshing, the seed of each variety is stored in separate containers. As the farmers are able to readily identify the varieties based on their seed characters, they usually do not need to label the containers in which the seed is kept.

Farmers usually rogue off-types on the threshing floor and select uniform panicles for sowing in the subsequent year. The farmers have a clear idea and mental picture of unique varietal characteristics and avoid off-types. Avoiding off-types in the process of panicle harvesting or subsequently on the threshing floor is almost equivalent to mass selection. Lowland farmers repeat the seed selection process once every three years, as they believe that varietal characteristics will be lost and new types will appear if they do not maintain a routine of seed selection.

At harvest time, during the process of panicle selection for seed purposes, upland farmers usually tie a basket around their waist and select large and attractive panicles of distinct types, which are placed in the same basket (Photo 13.3). Some highland farmers harvest panicles along with peduncles; on returning to their house, farmers usually tie the panicles into bundles, dry them in the sun, and then keep them carefully in the house, often hanging them from roof rafters, with particular care being taken to protect them from being damaged by grain moth. Some farmers (particularly those belonging to the Hmong ethnic group) keep the panicles above the kiln, where the smoke keeps away the grain moth. In some areas, the grain of selected panicles is stripped after selection, with the bulk of the panicles being left in the field.

Lao farmers, particularly in the uplands, deliberately maintain a degree of diversity within a particular landrace to provide production stability. Variable populations in upland varieties are maintained by selecting different plant and panicle types found in a single field.

Management of varietal diversity

Enormous varietal diversity existed in Lao rice varieties before the mid-1990s (Schiller et al 2001). This diversity was largely based on the indigenous traditional varieties that had evolved over centuries within Laos, farmer-to-farmer exchange within the country, the introduction of exotic varieties by farmers from neighboring countries, and the introduction of varieties by foreign agencies and institutions (Schiller et al, Chapter 2), combined with the development of new varieties by Lao farmers. Varietal diversity in the indigenous traditional varieties has evolved and accumulated, as rice has been grown under increasingly diverse agroclimatic conditions and ecosystems, and to meet an increasing range of food quality preferences of the diverse range of ethnic groups found in many areas of Laos.

The strategies for farmer management of varietal diversity under upland and rainfed lowland conditions differ considerably. Upland farmers grow varieties that are composed of several phenotypes but that have similar height and phenology. Lowland farmers usually grow several uniform varieties of varying maturity, mainly to distribute the labor requirement, with each variety being grown in individual small plots. Growing several varieties also assists in providing greater production stability by reducing the risks of the impact of climate (mainly drought), pests, and diseases if only one or two varieties are grown. Lao farmers have an extensive and intimate knowledge of different varieties and their characteristics, adaptation, and quality attributes.

Lao rice farmers have not only maintained a wide variety of landraces, but have also continuously evaluated and improved their planting material and exchanged it with others. The tradition of farmers developing and maintaining diversity can still be found in many areas of Laos, particularly in the rainfed upland conditions of northern Laos.

The present management system has been changing fast, particularly since 1993, following the release of the first of a number of improved Lao varieties developed for the lowland environment for the main lowland rice-growing areas in the Mekong River Valley. The release of these "modern varieties" has been associated with the development of agricultural extension services, which, combined, have aimed at quickly achieving national and household rice self-sufficiency, together with improvements in individual rural household income through agricultural diversification. These initiatives have already resulted in rapid and marked changes in rice diversity throughout most of the main rice-growing areas in the Mekong River Valley. By 2000, less than 20% of the main wet-season lowland rice area in this valley was grown with traditional varieties compared with about 95% as recently as 1993, the year in which the first batch of improved Lao lowland varieties was released. Although traditional varieties continue to be used in lowland areas of northern Laos, the erosion of the remaining diversity can be expected as new higher yielding varieties are developed for these areas. Similarly, in upland areas, the diversity can also be expected to be eroded as a result of a combination of the implementation of the national policy for more sustainable agricultural practices in the uplands and the identification of upland varieties with broad adaptability.

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Notes

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Acknowledgments: Special acknowledgment is due to the rice farmers of Laos, who provided the information on which the content of this chapter has been based. Thanks are also due to the officials of the Lao Ministry of Agriculture and Forestry, who assisted with the gathering of the information collated and reported. The financial support of the Swiss Agency for Development and Cooperation (SDC) to the project, which allowed the collection of the information as part of a broader rice biodiversity conservation project, is also gratefully acknowledged.

CHAPTER 14

Glutinous rice in Laos

J.M. Schiller, S. Appa Rao, P. Inthapanya, and Hatsadong

Laos has the highest per capita production and consumption of glutinous rice in the world. Laos and its people also have a particularly strong cultural affinity for glutinous rice. Although accurate data on planted area and production of glutinous rice are not available (IRRI 2002), it is estimated that, in the 2004 production year, about 85% of the rice produced in Laos was glutinous (Fig. 1, Table 1). Differences exist, between regions and between production systems, in the relative significance of glutinous rice production. These differences reflect a combination of (1) regional differences in the ethnic composition of the population and related differing rice consumption preferences, (2) differences in the relative importance of the different ecosystems in the different regions of the country, and (3) the impact of the relatively recent introduction and adoption of new and improved rice varieties in the different rice-based ecosystems.

The highest proportion of glutinous rice (about 91%) is grown in the dry-season irrigated environment (Table 1); this environment almost exclusively uses improved glutinous varieties released by the Lao National Rice Research Program (NRRP) since 1993. The lowest proportion of total rice cultivation that is glutinous (60%) is in the rainfed upland environment in the northern agricultural region; the lower level of glutinous rice production in this ecosystem reflects the relatively large populations of the Hmong and Mien (Yao) ethnic groups in this region and production ecosystem, both of which produce and consume mainly nonglutinous rice.

Of the 48 recognized ethnic groups in Laos (UNDP 2002), most are predominantly consumers of glutinous rice (Table 2). The Tai-Lao linguistic group, the largest, accounts for more than 65% of the population (Table 3). They largely migrated from southern China, settling in the Mekong valley before the thirteenth century (Hamada 1965, Batson 1991, Simms and Simms 1999). As a group, they are also the largest consumers of glutinous rice, which accounts, on average, for about 90% of their rice intake. The ethnic groups regarded as indigenous to Laos, the Mon-Khmer people (including the Khmu and Lamet in the north, and the Kasseng, Loven, Souay, Katu, and Bru in the south), are all predominantly consumers of glutinous rice. Some of the smaller ethnic groups in the Mon-Khmer language group have the highest levels (about 95%) of glutinous rice consumption in the country. The Tibeto-Burmese groups (Akha,

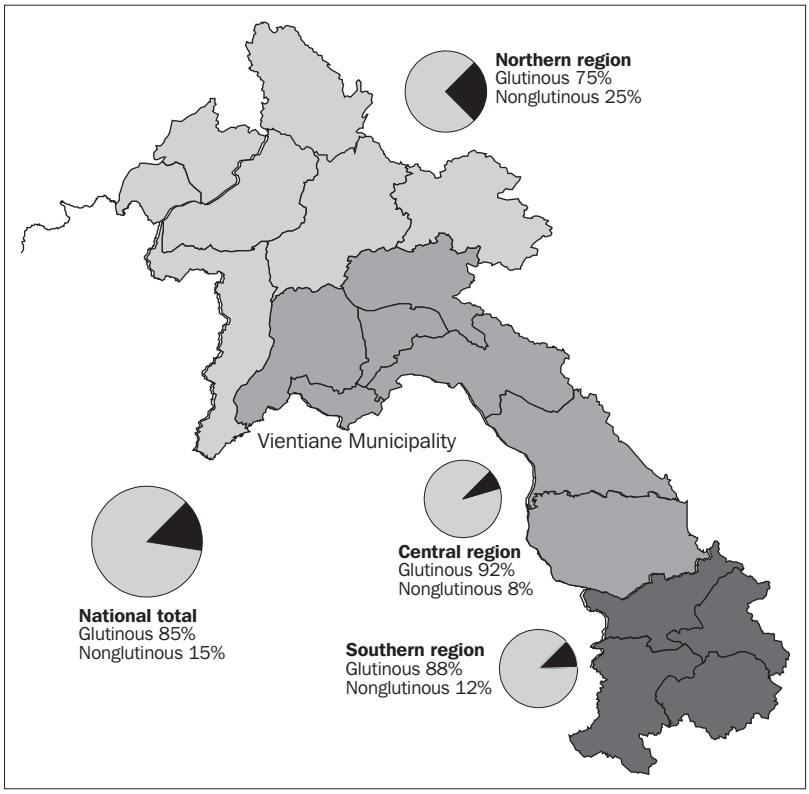

Fig. 1. Relative significance of glutinous and nonglutinous rice production in the different regions of Laos.

Table 1. Relative significance (%) of production of glutinous and nonglutinous rice among the agricultural regions and production environments of Laos.[a]

Production environment	Central region		Southern region		Northern region		Total	
	G	NG	G	NG	G	NG	G	NG
Wet-season lowland[b]	85	15	80	10	80	20	87	13
Rainfed upland	88	12	95	5	60	40	80	20
Dry-season Irrigated	92	8	92	8	90	10	91	9
Total	88	12	92	8	75	25	85	15

[a]Estimates not based on accurate production data, as separate statistics on glutinous and nonglutinous rice production are not collected. G = glutinous, NG = nonglutinous. [b]Part of this area is irrigated during the growing season.

Table 2. Ethnic groups of Laos and their distribution and rice preference.[a]

Ethnic group (general name)	% population (see Source)	Geographic distribution (provinces)[b]	Rice preference (% glutinous)
Lao-Tai (Tai-Kedai) language family (8 groups)			
Lao	52.31	Country-wide	90
Phou Thay	12.30	PhL, LTh, UD, BK, LP, HPh, XKh, VT, VTm, SB, BX, KM, SV, SR, ChS	70
Tai Lue	2.86	UD, LTh, BK, PhL, SB, LP, VTm, VT, XKh	80
Nyouan	0.92	LTh, SB, LP, BK, VT, UD	90
Yang	0.09	PhL, LTh, UD, BK	30
Sek	0.06	KM, BX	70
Tay Neua			
Mon-Khmer language family (32 groups)			
Khmu	10.87	PhL, LTh, BK, UD, SB, LP, HPh, XKh, VT, VTm, Ss, BX, KM	90
Katang	2.01	SV, SR, ChS, KM, VTm, SK	80
Makong	1.96	SV, KM, BX, VT, VTm	80
Souay	1.36	SV, SR, ChS, SK, VT, VTm	95
Jrou	0.73	ChS, SR, AtP, SK, VTm	95
Ta Oy	0.68	SR, SK, AtP, ChS, SV	95
Triang	0.66	AtP, SK, SR, SV	95
Tri	0.58	SV, KM	90
Phong	0.50	HPh, XKh, BX, KM, VT, VTm	90
Lavi	0.45	AtP, ChS, SV, VTm	80
Katu	0.40	SK, SR, ChS, SV	90
Lamet	0.40	UD, LTh, BK, HPh	80
Pray	0.38	SB, LP, XKh	80
Halak	0.66	XKh, AtP, ChS, SR, VTm	80
Pacoh	0.36	SR, SV	80
Kriang	0.24	XKh, SR, ChS	90
Cheng	0.12	AtP	–
Nya Heun	0.11	AtP, ChS	70
Ngouan	0.09	AtP, XKh	70
Sam Tao	0.06	LTh, BK	70
Ksingmoun	0.06	HPh, VT, BX	70
Bit	0.04	PhL, LTh, UD	90
Brao	0.01	SK	–
Khmer	0.004	ChS	–
Oy	–	AtP, ChS	80
Sadang	–	AtP	–
Meuang	0.02	HPh, XKh, VT	70
Toum	0.02	KM, BX	80
Yè	–	KM, BX	90
Kri	–	SB, KM, BK	–
Oe Du	–		
Thene	–		

Continued on next page

Table 2 continued.

Ethnic group (general name)	% population (see Source)	Geographic distribution (provinces)[b]	Rice preference (% glutinous)
Sino-Tibetan language family (7 groups)			
Akha	1.40	PhL, LTh, UD, BK	70
Singsily	0.66	PhL, UD, LTh, BK, LP, VT, VTm	90
Lahu	0.45	BK, LTh, UD	90
Sila	0.08	PhL, LTh	90
Lolo	0.03	PhL	85
Hanyi	0.02	PhL	90
Ho	0.10	LTh, PhL, UD, LP, HPh, XKh, VT.VTm, KM, ChS	85
Hmong-Mien language family (2 groups)			
Hmong	3.17	SK, VT, HPh, UD, PhL, BK, SB, LTh, Ss, VTm, KM	40
Mien (Yao)	0.30	PhL, LTh, UD, BK, HPh, XKh, SB, LP, VT, VTm	40

[a]Based on linguistic groupings of UNDP (2002): Lao PDR Human Development Report 2001. [b]PhL = Phongsaly, LTh = Luang Namtha, UD = Oudomxay, BK = Bokeo, LP = Luang Prabang, HPh = Houaphanh, XKh = Xieng Khouang, VT = Vientiane, VTm = Vientiane Municipality, SB = Sayabouly, BX = Borikhamxay, KM = Khammouane, SV = Savannakhet, SR = Saravane, ChS = Champassak, SK = Sekong, AtP = Attapeu, Ss = Saysoumboun Special Zone.
Source: Lao Front for National Construction, Department of the Ethnic Group Social Class, July 1999 (*1985 population census, the last for which the breakup of ethnic groups has been published).

Table 3. Population by ethno-linguistic groupings.

Ethnic grouping	Percentage
Tai-Lao (Tai-Kadai)	
Tai and Neua-Phouan	36.5
Lao	30.0
Austroasiatic (Mon-Khmer)	23.5
Hmong-Mien (Yao)	7.5
Sino-Tibetan	
Tibeto-Burmese	2.5
Chinese Ho	0.2

Source: UNDP (2000).

Lahu, Lolo, Singsily [or Phunoi]) who arrived in Laos via Yunnan or Myanmar, and who now live in areas of Laos bordering Myanmar and China, also mainly consume glutinous rice (Dobby 1958). As noted above, the two main ethnic groups in Laos that are consumers of nonglutinous rice are the Hmong and Mien (Yao). Originating from the Kewichow area of southern China, they migrated to Laos in relatively recent times, during the 19th and early 20th centuries (Batson 1991, UNDP 1997). Before their arrival, probably almost 100% of the rice produced and consumed in the country was glutinous.

Quality characteristics of traditional glutinous rice

Cooking and eating characteristics are largely determined by the properties of the starch that makes up 90% of milled rice, with most of these characteristics being influenced by the ratio of two kinds of starch in the rice grain, amylose and amylopectin (Dela Cruz and Khush 2000). Amylose is the linear fraction of starch, whereas amylopectin is the branched fraction. Amylose content strongly affects the cooking and eating qualities of rice—its cohesiveness, tenderness, color, and gloss (Mackill et al 1996). The terms usually used to reflect the amylose content of rice grain (Dela Cruz and Khush 2000) are

waxy	0–2%
very low	3–9%
low	10–19%
intermediate	20–25%
high	>25%

Amylose is almost absent from glutinous (or waxy) rice. A characteristic of these varieties is that they absorb little water during soaking and steam cooking, and therefore have low volume expansion. The grain of most high-amylose rice varieties shows high volume expansion (up to 400%) during cooking (but not necessarily elongation). Low-amylose rice is moist, sticky, and glossy when cooked (Dela Cruz and Khush 2000, Mackill et al 1996). The texture of the cooked rice is affected by gelatinization temperature (the temperature at which starch starts to soften and starch granules swell irreversibly). Rice that gelatinizes at high temperatures (>74 °C) takes a long time to cook and, when finally cooked, is excessively soft; it also disintegrates when overcooked. Such rice generally requires more water and time for cooking than does rice that has low (<70 °C) or intermediate (70–74 °C) gelatinization temperatures. Such rice is undesirable in all rice markets (Mackill et al 1996). Low gelatinization temperature is the most common property of the preferred waxy rice varieties.

Another characteristic feature of glutinous rice that distinguishes it from the nonglutinous form is that, if the moisture content of the glutinous form is reduced to about 15%, the endosperm becomes opaque and its color changes to milky white or paraffin-like (Watabe 1967). This white appearance comes as a result of the way light is differentially refracted in the starch crystals in the absence of amylose. In nonglu-

tinous rice, the endosperm remains translucent regardless of the moisture content of the grain.

There appears to be relatively little specific information available relating to the relative nutritional value of glutinous and nonglutinous rice. It has been suggested that the higher amylopectin content of glutinous rice and the associated larger molecular size and its branched molecular structure result in it staying longer in the digestive system than nonglutinous rice. This, in turn, is reflected in the belief by glutinous rice consumers that they only feel "full" when they consume glutinous rice; they complain that the consumption of nonglutinous rice results in their becoming hungry again within a short period of time. The volume expansion of glutinous rice relative to nonglutinous rice on being cooked, and the resulting higher weight:volume ratio of glutinous vs nonglutinous rice on consumption, probably explains the effects of perceived differences in "fullness and hunger" between the two types of rice. It is sometimes observed that "the eater of glutinous rice consumes about 25% more rice per day (in calories and weight) than those who eat nonglutinous rice." However, it is also suggested that this relatively higher intake of glutinous rice is associated with a proportionately lower intake of meat and vegetables (reflecting the economic status of many of the glutinous rice consumers) (Ngaosyvanthn and Ngaosyvanthn 1994).

Grain quality characteristics of Lao traditional rice varieties have been studied and reported by Juliano and Villareal (1993). The relative proportions of amylose and amylopectin were found to vary among and within both glutinous and nonglutinous varieties. Among the glutinous varieties, amylose ranged from 2.6% in *Mae hang* (divorced woman) to 4.8% in *Pa lat* (lat fish). The nonwaxy or nonglutinous varieties were found to have an intermediate amylose content, ranging from 21% in *Po kha* (merchant) to 24.5% in *Lep nok* (bird claw), the latter being formerly extensively grown for noodle production in the southern province of Champassak. The glutinous varieties have very low amylose content, ranging from 2.6% to 4.8%. Protein content was found to vary from 6% to 9%, with a mean of 7.4%. In general, glutinous varieties were found to have a lower protein content than nonglutinous varieties. These analyses were undertaken on a very small sample of the great range of germplasm that exists in Laos.

Lao consumers, both urban and rural, are very conscious of the quality of cooked rice. Based on the texture of the cooked grain, farmers classify it as soft or hard; there is a distinct preference for grain that is soft after cooking. The character of the grain after cooking is sometimes reflected in the name given to a variety, such as *Khao gne* (sand rice) and *Khao khang lout hak* (broken jaw rice), both of which suggest that other qualities have been the basis of their selection and maintenance as varieties. Appa Rao et al (2002b) have reviewed how farmers have named their varieties to reflect their different quality characteristics in an extensive collection of traditional varieties made from 1995 to 2000. Keeping quality of rice after cooking is another important attribute, as rice cooked in the morning is often taken to the field in woven bamboo baskets to meet household needs during the working day.

Some traditional varieties are intermediate between glutinous and nonglutinous forms. The eating quality of these intermediate types is considered inferior. Occasion-

ally, these varieties are given names to reflect their poor eating quality: *Khao mangyeng* (rice watched by a dog) was so named because of the belief that even a dog does not like to eat it, but will sit and stare at the rice before eating it reluctantly). One type of nonglutinous-sticky rice (*Khao chao niaw*), although regarded as nonglutinous, becomes sticky after cooking. Other varieties carry in their name a reflection of the floury or powdery nature of the endosperm. Studies of the amylose and amylopectin content of such varieties have yet to be undertaken. Varieties with brittle endosperm, liable to crack on milling, also exist and have names to reflect their characteristics (Appa Rao et al 2002b).

The genetics of glutinous endosperm

Yamanaka (2001) has reviewed the genetics of glutinous endosperm of rice and other cereals. The two major endosperm types, waxy (glutinous) and nonwaxy (nonglutinous), are controlled by a gene at a single locus. This waxy locus is responsible for amylose synthesis and shows tissue-specific expression in the endosperm and pollen. The waxy allele, which is responsible for amylose synthesis, is regarded as the wild type and is genetically dominant. Glutinous rice has naturally occurring mutants, in which the mutant form is the waxy gene. The mutation appears as a deletion in the gene, which results in no amylose being synthesized. The waxy (glutinous) allele, which is associated with a lack of amylose, is regarded as a spontaneous mutant and is genetically recessive. The waxy mutation has been recognized in seven cereals: rice (*Oryza sativa*), maize (*Zea mays*), barley (*Hordeum vulgare*), foxtail millet (*Setaria italica*), Job's tears (*Coix lacryma-jobi*), common millet (*Panicum miliaceum*), and sorghum (*Sorghum bicolor*). These waxy mutants are found specifically in Asia and are believed to have been preferred selections during domestication (Yamanaka 2001).

DNA analysis of collections of traditional glutinous cultivars made during the 1990s from both the upland and lowland environments of Laos has indicated that most traditional glutinous cultivars in the country belong to the tropical japonica varietal group (Glaszmann 1987, Roder et al 1996, Ishikawa et al 2002). In contrast, many of the improved glutinous varieties recently introduced to the main lowland rice-growing area in the Mekong River Valley have been shown to belong to the indica varietal group (Yamanaka 2001). The parentage of of these improved glutinous varieties grown in Laos is based on genetic material from sources other than Laos (Inthapanya et al, Chapter 21).

Origins and diversity of glutinous rice in Laos

It is generally accepted that Laos lies within the primary center of origin and domestication of Asian rice (*Oryza sativa* L.). Within this general region, it is also recognized that the center of origin of glutinous rice is Laos and northeast and northern Thailand (Watabe 1976). Other areas of significant glutinous rice cultivation are also found in the region, such as Shan and Kachin states of Myanmar, the Kwangsi Chuang and Yunnan regions of China, parts of Cambodia that border Thailand and Laos, and mountainous

areas of Vietnam that border Laos. Glutinous rice is generally found in those Asian countries with a long history of rice cultivation (Dobby 1994). Several hypotheses have been proposed to explain the origin, spread, and persistence of glutinous rice as a staple crop in this region (Dobby 1958, Watabe 1967, 1976, Golomb 1976, Khush 1997, Yamanaka et al 2001). There is archaeological evidence of early domesticated rice cultivation in northeast Thailand from at least 2,000 BC (Khush 1997, White 1997); this early cultivation is believed to have been based on glutinous genotypes. It is also believed that all early rice cultivation throughout Thailand was based on glutinous genotypes. The gradual shift to nonglutinous rice cultivation and consumption is thought to have commenced at about the beginning of the 15th century (Ngaosyvanth and Ngaosyvanth 1994). This change initially took place in the lower basin of the Chao Phraya River in the area immediately north of the capital, Bangkok. The transition from glutinous to nonglutinous rice consumption was completed for the Central Plains region and part of northeast Thailand by the 18th century. Although Golomb (1976) has proposed that nonglutinous rice preceded glutinous rice in much of the "glutinous zone," little evidence supports such a theory. It is generally acknowledged that the Tai people who moved from their area of origin in southern China had already developed a preference for glutinous rice before moving to what is now Thailand and Laos. However, it remains a matter of conjecture whether this preference for glutinous rice was on account of the superior adaptation of glutinous rice to the cooler growing conditions (and shorter growing period) in the area of origin of the Tai people, as argued by Golomb (1976), or conscious selection based on a taste preference, as proposed by Watabe (1967). The preference of nonglutinous rice by the Hmong and Mien ethnic groups, who also generally live in the more mountainous (and cooler) parts of the region, also contradicts the argument of Golomb of "superior adaptability of glutinous rice to highland environmental conditions." Archaeological evidence (Khush 1997) suggests that glutinous rice was grown extensively throughout the region, including in the lowland environment, and it is probable that the current "glutinous rice zone" is a contraction of the much broader use of glutinous rice in the region, as suggested for Thailand by Ngaosyvanthn and Ngaosyvanthn (1994).

Regional cultural significance of glutinous rice

The change from growing glutinous rice to nonglutinous rice in the central region of Thailand has been associated with certain social or cultural traditions; these have been reviewed by Ngaosyvanthn and Ngaosyvanthn (1994). The early shift from the consumption of glutinous rice was usually associated with the "affluent classes and intelligentsia." Glutinous rice then became regarded as "the staple food for the poor people," and, in parts of Thailand, its consumption often became regarded as "an affirmation of a person's social status and/or regional identity." At one time, government officials were served glutinous or nonglutinous rice in accordance with their rank: lower-ranking officials received glutinous rice, while higher-ranking officials were served the nonglutinous form.

An aversion to the consumption of glutinous rice of those who had made the change to nonglutinous rice is reflected in Thai chronicles of 1827, when the Thai

army was marching toward Vientiane to suppress what was regarded as a "renegade neighbor." Ngaosyvanthn and Ngaosyvanthn (1994) report that, in a dispatch to the Royal Court of Bangkok at that time, the following was recorded: "The armies found plenty of glutinous rice along their route to Vientiane, but desperately complained that it was inedible, and a request was made to Bangkok for 'white rice' (nonglutinous rice) to be sent to maintain the fighting strength of the army. Strong ingrained psychosomatic ideas prevented them from consuming glutinous rice, which they blamed for causing constipation, drowsiness, and even laziness. This contrasts with the people in the 'glutinous rice zone,' who have a self-image of being 'hard-working and more solid than nonglutinous rice eaters.' They believe that there is no way a working man could possibly sustain himself on a diet of ordinary rice."

The people of Laos have the highest per capita consumption of glutinous rice in the world. The annual per capita consumption of milled rice in Laos during the 1990s was about 174 kg (IRRI 2002). For the majority of Laotians, more than 90% of the rice consumed is glutinous rice. The people of Laos proudly regard the consumption of glutinous or "sticky" rice as part of their cultural identity. The Lao language expression "to eat" not only means "to eat rice" as in the language of their Thai neighbors, but "to eat glutinous rice." The cultural and national association with glutinous rice is also sometimes reflected in the people of Laos saying that if they did not eat glutinous rice, they would not be Laotian. This identification of the Lao with glutinous rice has often been retained by those Lao who have migrated elsewhere. Ngaosyvanthn and Ngaosyvanthn (1994) report that one of the most popular Lao music bands in the United States was known by the name *Khao niaw* (sticky rice).

Collections and diversity of glutinous rice

Recognizing the great diversity of traditional rice varieties in Laos, particularly glutinous rice, there have been attempts to collect and conserve this rice germplasm. The collecting and conservation attempts can be divided into two periods.

Collections before 1995

From 1970 to 1990, collecting missions supported by USAID, Russia, Japan, and other agencies gathered more than 3,000 samples of cultivated traditional rice (Inthapanya et al 1995). Most of those collections constituted traditional glutinous varieties. However, on account of a lack of appropriate storage facilities in the country, most of the germplasm collected in that period is no longer available. From 1991 to 1994, a further 1,000 samples were collected, mainly from the northern provinces of the country in a joint collecting program of IRRI and the Lao Ministry of Agriculture and Forestry. Although these later collections contained a large proportion of glutinous varieties, they were inadequately documented with passport data.

Collections from 1995 to 2000

Systematic collection of the rice germplasm in Laos began in 1995 in a collaborative project between the Lao Ministry of Agriculture and Forestry (MAF) and the Genetic

Table 4. Relative distribution between environments in Laos of glutinous and nonglutinous samples of traditional germplasm collected between 1995 and 2000.

Endosperm category	Upland environment		Lowland environment		Total	
	No.	%	No	%	No.	%
Glutinous	6,237	84.6	5,042	86.6	11,279	85.5
Nonglutinous	1,134	15.4	779	13.4	1,913	14.5
Total	7,371	100.0	5,821	100.0	13,192	100.0

Source: Appa Rao et al (2002a).

Resources Center (GRC) of IRRI in the Philippines. Between October 1995 and April 2000, a total of 13,192 samples of cultivated rice and 237 samples of six wild rice species were collected throughout the country (Appa Rao et al 2002a). Glutinous rice made up 85.5% of this collection. Overall, 86.6% of the samples collected in the lowlands and 84.6% of the samples collected in the uplands had glutinous endosperm (Table 4). Relatively more nonglutinous types were sampled in the northern agricultural region than in other regions (Fig. 1), reflecting the preference for nonglutinous rice by the Hmong and Yao ethnic groups there (Table 2).

Processing and consumption of glutinous rice

Processing

Traditionally, individual households dehull rice grain manually by pounding sun-dried grain in a wooden mortar using a wooden pestle. In some areas, a foot-operated pestle is used. These techniques still prevail in upland areas and some more remote lowland areas. However, roller mills are now used for dehulling in urban areas and in most lowland villages, particularly in the main rice-growing areas of the Mekong River valley. One or several such mills might serve the needs of an entire village, depending on the size of the village; small individual household mills are not in use.

Normal preparation for consumption of glutinous rice involves soaking the white rice overnight (or for up to 10 hours), followed by steam cooking in the early morning for 30–40 minutes in a woven bamboo basket. Usually, the household consumption needs for the day are met through this single early-morning preparation. More than 95% of the glutinous rice consumed is prepared in this way.

Consumption

The consumption of glutinous rice by the ethnic Tai-Lao of Laos and northeast Thailand has traditionally been associated with the consumption of a pickled raw fish paste called *padek*. The cultural association of the Lao with this traditional food combination is reflected in a popular song called “To eat glutinous rice and padek” (Ngaosynvanthn

and Ngaosyvanthan 1994). Although the consumption of rice noodles is popular in urban areas, noodle production is generally based on the use of nonglutinous rather than glutinous grain.

Although probably more than 90% of the glutinous rice consumed is in the form of steamed rice, eaten with one or more side-dishes, a large range of other forms of rice preparation for consumption have been adopted by the people of Laos, with different ethnic groups having their own specialized preparations. Some of the better known of the glutinous rice-based preparations include the following (Photos 14.1 and 14.2):

- *Khao mao* is a soft, aromatic, and tasty form of flaked rice that is usually eaten with small quantities of boiled coconut milk and sugar. A popular preparation of the lowland Lao population group, *Khao mao* is made from "almost ripe rice" that is harvested at the early dough stage; it is prepared by following a process of steam cooking, drying, dehusking, and then being steamed again.
- *Khao haang* (parboiled rice): This is a form of parboiled rice that is made from paddy harvested at the late dough stage, followed by steaming the grain with hulls, dried in sun, dehulled by pounding, and consumed after steam cooking. Some ethnic groups steam the grain while it is still in the panicle. Following steaming, the grain or panicles are sun-dried, then pounded and winnowed to give the parboiled rice. This is either consumed as glutinous rice prepared in the usual way or used to prepare special delicacies or snacks. It is generally believed that parboiling improves taste and quality. However, parboiling is recognized to be time-consuming and requires more fuel than regular rice preparation.
- *Khao waan* (sweet rice): This is a popular snack food that is usually made from parboiled rice. It is prepared using whole dehulled grain, which is cooked in combination with coconut milk, sugar, taro, and/or pumpkin.
- *Kanom piak-poon* (rice cake): This is a flat square or rectangular cake made from a mixture of glutinous and nonglutinous rice. Rice flour is made from grinding the grain of both types of rice. The flour is cooked in a mixture of coconut milk, water, sugar, and salt. After cooking, it is poured into a flat container, cooled, and cut. It is a popular product in local markets.
- *Kanom khok:* Glutinous and nonglutinous rice in proportions of 2:1 are presoaked in water for 4 to 6 hours, and then ground to obtain a free-flowing batter of the desired consistency. Using a metal pan with 9 to 12 cup-like depressions, the batter is poured into the depressions, which are first smeared with pig fat. Grated coconut is usually added to the top of the batter and the pan is then held over a low fire to allow the mixture to cook.
- *Khao tom-phat:* Polished glutinous rice is soaked in water for 4 to 6 hours. The water is decanted and sugar, salt, and coconut milk are added to the rice; the mixture is then boiled. Split mungbean seed, which has been soaked in water for about 12 hours, steamed for 30 to 40 minutes, and subsequently

crushed in a mortar, is added to the cooked rice mixture. This is then wrapped in banana leaves and steam-cooked or boiled for 20 to 30 minutes.

- *Khao tom-kheuang:* Glutinous rice is soaked in water for about 6 hours and the excess water subsequently decanted. The rice is then spread on a banana leaf, to which is added a mixture of small pieces of pork, onion, garlic, pepper, and salt. The resulting mixture is then wrapped in the banana leaf and steamed for 2 to 3 hours.
- *Khao sangkhaya:* Glutinous rice is presoaked in water for 4 to 6 hours, then steamed for 30 to 40 minutes after decanting the water. A mixture of coconut milk, salt, and sugar is added, followed by a further period of steaming for 30 to 40 minutes. This is then consumed in combination with a specially prepared sweet dressing made by steam cooking for about 30 minutes, marinated with a combination of fresh eggs, coconut milk, and flour.
- *Khao niaw deng:* Glutinous rice is presoaked in water for 4 to 6 hours and, following decanting of the water, steamed for 30 to 40 minutes. It is then boiled in a combination of coconut milk, salt, palm sugar, or refined sugar. The viscous mixture is then spread in a flat container to which roasted sesame seed or groundnut grits are added. If refined palm sugar is used in the preparation, the final product is red in color and is called *Khao niaw deng* (glutinous rice, red); if refined sugar is used, the final product is whitish and is called *Khao niaw keo* (glutinous rice, white).
- *Khao kriab:* Glutinous rice is soaked in water for 4 to 6 hours and then steamed for 30 to 40 minutes. Upon cooling, it is made into thin round cakes that are sun-dried. These rice cakes are then deep-fried in oil and immersed in syrup made from palm sugar.
- *Khao lam:* Coconut milk, sugar, and salt are added to presoaked glutinous rice, and the resulting mixture is packed into a piece of hollow bamboo. Sometimes the soaked grain of legumes, yam, or sweet potato pieces is added to the mixture. The bamboo is then roasted over an open fire. On cooling, the inner membrane of the bamboo forms a layer around the cooked rice that separates with the rice when the outer bamboo layer is stripped away. Both white and dark-colored grains are used for this preparation that is popular throughout the country.
- *Kanom-nep:* Glutinous and nonglutinous rice grain are mixed in a proportion of 5:1 and presoaked in water for 4 to 6 hours. After decanting the water, the mixture is ground into a paste and made into egg-size portions. Inserted into each portion is a special mixture of grated coconut and sugar, or each portion is steamed with mungbean flour and sugar. Each portion is then wrapped in a banana leaf and steam-cooked for at least 30 to 40 minutes.
- *Khao kaed (Pok-peuak):* Developing grain that has reached the dough stage is sometimes harvested as individual panicles; the glumes are removed from the spikelets using a nail and the soft grain consumed. Varieties with large grains are preferred for this kind of consumption. Some traditional varieties, such as *Khao lep chang* (elephant nail rice) and *Khao lep mue* (fingernail

rice), have been so named on account of their suitability for consumption in this way.

Fermented beverages

Rice wine: A large range of alcoholic beverages are produced, consumed, and sold throughout Laos, the production of most of which is based on the use of glutinous rice. The consumption of these rice-based alcoholic beverages is a usual part of any traditional Lao social occasion. These beverages are also readily available in most local markets. Rice wine is a requisite part of many ceremonies, especially among the Mon-Khmer.

The most widespread method of alcohol production is to ferment steamed sticky rice with balls of yeast in sealed earthenware pots, which are then kept in the shade. The mixture is allowed to ferment for 3 days to 1 week (the longer the fermentation period, the higher the alcohol content and quality). Different ethnic groups have different recipes for rice-based alcohol production. Members of the Khmu ethnic group usually follow precise traditional recipes that are maintained by families, with different flavors of wine being produced, from bitter to sweet-tasting (Simana and Preisig, Chapter 6).

Rice brandy: Rice brandy is made from rice wine and is produced by distilling the rice wine, using a simple home distillation technique. Although the Khmu drink some rice brandy, it is not as popular as rice wine. Many Khmu communities make rice brandy strictly for ritual purposes. It is generally not consumed in the same way or frequency as rice wine. However, in some northern provinces, this type of alcohol is also served to guests to welcome them and announce them to the house-spirit.

Sweet fermented rice: For the preparation of sweet fermented rice, black glutinous rice is preferred, together with a sweet strain of the fermenting agent. Black rice, when fermented, is more highly regarded than fermented white rice. In producing sweet fermented rice, the rice is first cooked like ordinary glutinous rice. After cooling, the appropriate amount of fermenting agent is added, after which the rice is then put in a jar or bamboo tube, which is then covered. It is allowed to ferment for about 2 days, after which it is ready to eat. Fermented rice is sometimes preferred as a source of energy when upland farmers are engaged in heavy clearing work associated with upland rice cultivation (Simana and Preisig, Chapter 6). It is also sometimes used for animistic rituals by some ethnic groups.

Early introduction and distribution of glutinous varieties

The earliest recorded introductions of improved varieties to Laos took place in the late 1960s and early 1970s (Schiller et al 2001). Some of these introductions were through USAID-sponsored agricultural development projects, and others through a program of collaboration among the governments of Laos, Thailand, and the Philippines. Recent collecting missions (Appa Rao et al 2002a,b) have revealed that some of these introductions are still being used on a limited scale, with the varieties being called by names identified with the programs with which they were introduced, for

example, American rice, Philippines rice. These varieties were largely nonglutinous. On account of the preference for the consumption of glutinous varieties throughout the country, these early introductions were grown only on a very limited scale in some areas of rainfed lowland rice cultivation.

Seed multiplication of selected glutinous varieties began in 1964. Three traditional varieties, *Khao do-nang-nuan*, *Khao do-lay*, and *Khao kew-lay*, were the first varieties distributed in the lowlands through the seed multiplication program. Among them, *Khao do-nang nuan* (early maturity, soft lady), an aromatic photoperiod-sensitive variety, was the most popular. In 1971, the varieties *Sanpatong* (a photoperiod-sensitive traditional variety from Sanpatong District in northern Thailand), IR253-100 (an improved variety from the International Rice Research Institute), and *Khao do-hom* (early maturity, aromatic rice), a Lao traditional variety, were also included in the seed multiplication and distribution program. Other glutinous varieties introduced in the late 1970s and 1980s and that were adopted on a relatively large scale included three from the Philippines (IR848-120, IR848-44, and IR789-98) and three from Thailand (RD6, RD8, and RD10). The varieties IR253-100, RD8, and RD10 are still being grown in some provinces. From 1979 to 1989, a number of Vietnamese improved glutinous varieties were introduced and evaluated; the most notable of these was the aromatic japonica-type VN72, and OM80.

Apart from those introductions made through and between government agencies, and selections from among collections of traditional varieties, some varieties from Thailand have been introduced to Laos as a result of farmer-to-farmer exchange between Lao and Thai farmers in the central and southern regions of the country. This seed exchange has almost exclusively been of glutinous genotypes. In the northern agricultural region, there has been similar farmer-to-farmer exchange of lowland varieties, involving Vietnam and China. Most of the varieties obtained from China have been nonglutinous, while those from Vietnam have included both glutinous and nonglutinous varieties. The overall level of adoption of varieties introduced in this manner in the north of the country has been much less than in the central and southern regions.

Early improvement of glutinous varieties for the lowland environment

The first crosses aimed at improving glutinous varieties for Laos were made in 1976 at the Salakham Rice Research and Seed Multiplication Station in Vientiane Municipality. Established in 1955, Salakham Station was the first research station to be established in the country (Schiller et al 2001). The first rice crosses were between the Thai traditional glutinous variety *Sanpatong* and IRRI variety IR848-120; the aim of the cross was to produce varieties with the yield potential of IR848-120 while having the grain quality of *Sanpatong*. Several Salakham lines were subsequently established, but only one, Salakham 1-3-2, demonstrated a yield potential comparable with that of IR848-120. A second set of crosses was made, based on the parental lines *Khao mae-hang* (divorced woman rice), a traditional Lao variety with large panicles, and IR2823-103, a nonglutinous line introduced from IRRI. These crosses aimed at producing a series of

high-yielding glutinous lines with a combination of desired plant type and resistance to brown planthopper (BPH). Many promising glutinous fixed lines were established; however, most did not have the yield potential of IR2823-103. A third series of crosses was made based on the Lao traditional glutinous variety *Ea-khao* and IR2823-103; however, no fixed lines were established from the progeny of these crosses. No improved varieties were released as a result of these early breeding initiatives.

Recent developments in the improvement of glutinous varieties

A systematic varietal improvement program for the lowland environments of Lao PDR started in 1991 in collaboration with the International Rice Research Institute. Initial emphasis was on the development of improved glutinous varieties for both the rainfed lowland and irrigated environments. From 1993 to 2004, 14 improved glutinous varieties were released by this program. Many of these varieties have been readily accepted by smallholder rice farmers in the Mekong River Valley. In 1990, less than 5% of the rainfed lowland rice in the Mekong River Valley, the main rice-growing area of the country, was being planted with improved varieties. Along with variety improvement, requirements for the use of nutrients for sustainable rice production were established (Schiller et al 1998). However, by 2000, more than 70% of the area was being planted with improved glutinous varieties, the majority of which were those released by the Lao national rice research program (Schiller et al 2000, Shrestha 2002). Details on these varieties are reported by Inthapanya et al in Chapter 21.

Erosion of Lao traditional glutinous rice varieties

Lowland environment

Following the release of improved Lao glutinous rice varieties in 1993 for the lowland environment (both rainfed and irrigated), there has been a rapid replacement of many of the traditional lowland varieties by improved varieties in provinces in the central and southern regions of the Mekong River Valley, with the rate of replacement accelerating since about 1996 (Schiller et al 1999) and with the availability of technology for increasing yield even in drought-prone areas. The replacement of traditional varieties by improved varieties has been less marked in the northern agricultural region. However, this reflects a lack of improved varieties suited to the agroclimatic conditions in this region, rather than the reluctance of farmers to adopt new varieties. It can be anticipated that, as better-performing improved varieties are identified for the northern region, they will quickly replace most of the traditional varieties still being grown in the early 2000s. However, perhaps the rate of loss will be slower than in lowland areas of the Mekong River Valley because of the greater ecological and ethnic diversity in the northern agricultural region. In lowland areas of the Mekong River Valley, it is expected that there will be a trend toward increased production of nonglutinous rice and the adoption of improved nonglutinous varieties, reflecting increased consumption of this form of rice in the larger urban centers of Laos, together with greater export opportunities for specialized nonglutinous varieties of rice, rather than glutinous ones.

Combined, these factors will inevitably result in the further depletion of the traditional glutinous rice germplasm base in the lowland environment.

Upland environment

In the rainfed upland environment, the erosion of the diversity of both glutinous and nonglutinous rice varieties can be expected as a result of changes in agricultural production in this environment. Current government policy for the upland environment is to focus on the development and promotion of more ecologically sustainable forms of agriculture (Roder et al 1994, UNDP 2000). Theoretically, the implementation of this policy will result in the eventual cessation of rice cultivation under the slash-and-burn shifting cultivation systems (Chazée 1994) that have been the basis of most traditional upland rice cultivation. However, it is also acknowledged that alternative production systems capable of generating the cash income required to enable communities in the upland areas to purchase rather than produce their own rice needs have yet to be developed. In the medium term, it can be anticipated that most upland communities will continue to grow upland rice in order to meet most of their rice consumption requirements. However, this production can also be expected to be within the context of agricultural production systems that are more stable than the slash-and-burn shifting cultivation that has prevailed in the past. The screening of upland varieties collected during 1995-2000 (Appa Rao et al 2002a) has already started, with the aim of identifying varieties able to perform well in the changed cropping environment of short fallow periods, generally lower soil fertility, and potentially higher disease (particularly nematodes) and pest incidence. Testing of some of this material has already begun under upland farming conditions. It can therefore be expected that the current situation with a high level of biodiversity of upland varieties in areas of upland cultivation will change to one in which fewer higher-yielding varieties will be grown on smaller areas. Yamanaka (2001) has shown that, in upland areas of neighboring Thailand, the introduction and use of modern varieties has resulted in significant genetic contamination (by both improved upland and lowland varieties) of the traditional landraces that have continued to be grown. This genetic erosion of traditional varieties in the uplands of Laos can be expected to occur in a way similar to that reported in Thailand.

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Notes

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