Forage Species for Coconut Plantations in North Sulawesi

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Abstract

An experiment was conducted at Kayuwatu near Manado in North Sulawesi during 1988 and 1989 to evaluate the performance, in terms of dry matter yield and persistence under regular cutting, of 37 grass and 40 legume species. Most species were selected for their likely shade tolerance from the Australian Tropical Forages Genetic Resource Centre, CSIRO, Brisbane, Australia.

Species which showed good regrowth and persistence, but slightly lower total yields over 10 harvests, were the legumes *Arachis pintoi, A. repens, Arachis* sp. CPI 29986, *Desmodium ovalifolium* and *D. heterophyllum;* and the grasses *Paspalum notatum* cv. Competidor, *P. notatum* CPI 11864, *P. wettsteinii, Axonopus compressus* (local), and *Digitaria milanjiana* CPI 59721.

IN North Sulawesi farmers raise cattle in conjunction with other farming activities and regard livestock as draft animals and as savings. As in Bali, feed resources consist of local grasses which are generally of low quality. Most local species such as *Paspalum conjugatum*, *Centrosema pubescens* and *Calopogonium mucunoides* are not resistant to heavy grazing. An exception is *Axonopus compressus* which is often found in heavily grazed areas. However, almost all grazing areas are dominated by broadleaf weeds and shrubs. This shows that the growth of the naturally occurring palatable grasses and legumes is not sufficiently vigorous to suppress weeds. Grazing management is generally poor and overgrazing frequently occurs.

This species evaluation program attempted to identify forages which are adapted to the environmental conditions of North Sulawesi, grow well under the shaded conditions in coconut plantations, and are persistent under heavy grazing and low management inputs.

Materials and Methods

The experiment was conducted at Kayuwatu (close to sea level) near Manado Airport and which receives an average rainfall of 2700 mm. Rainfall distribution is fairly even, except for a period of lower rainfall (100-150 mm per month) from July to September. Once in approximately every five years a more severe dry season occurs. During the experiment, rainfall was slightly higher than the long-term average, particularly during the drier period (Fig. 1). The pH of the fertile, sandy loam soil is around 6. Light transmission (PAR) at the site under mature tall coconuts averaged 73% at 10.00 a.m. on a sunny day.

There were 37 grass and 40 legume species (Table 1). These consisted of the same introduced species as in Bali plus some promising local species. The design and management of the experiment was identical to those in Bali and seedlings were transplanted into the field in June 1988.

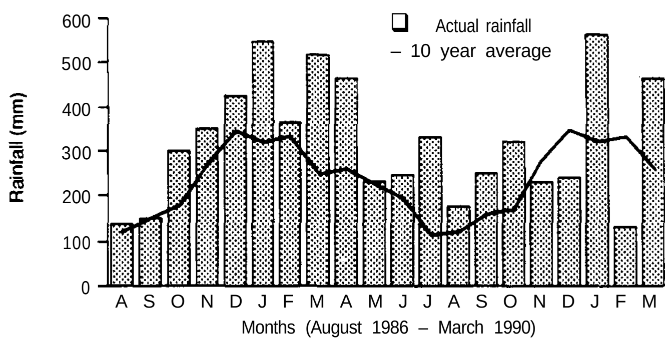

Fig. 1. Long-term and actual rainfall during the experimental period at Kayuwatu, Manado, Indonesia.

Results and Discussion

Dry matter yields and mean leaf percentage of the legumes and grasses are presented in Table 1.

Legumes

Species could be grouped according to their growth habit. Species with an upright growth habit such as *D. intortum* Grp.J. CPI 46552, *D. intortum* cv. Greenleaf and *Desmodium* sp. Grp. A. CPI 49668, gave the

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Table 1. Dry matter yield and mean leaf percentage of species evaluated under coconuts at Manado (each value = mean of three or four consecutive harvests).

Species	Dry matter yield Harvest 1-3	Dry matter yield Harvest 4-6 (g/m^2/2 months)	Dry matter yield Harvest 7-10	Mean % leaf
Legumes				
Desmodium intortum Grp.J CPI 46552	222	172	131	60
Desmodium aparine CPI 33814	139	142	117	55
Centrosema pubescens CPI 58575	86	128	103	68
Teramnus labialis cv. Semilla Clara	103	86	103	64
Centrosema pubescens cv. Belalto	61	111	100	63
Desmodium intortum cv. Greenleaf	319	128	94	57
Arachis repens CPI 28273 (vegetative)	42	78	94	84
Desmodium ovalifolium Q 8194	89	92	78	76
Centrosema pubescens (common)	75	83	78	69
Cassia rotundifolia cv. Wynn	6	44	78	52
Desmodium adsendens Grp.A CPI 93125	61	83	75	66
Arachis pintoi CPI 58113	81	83	72	81
Desmodium heterophyllum cv. Johnstone	81	81	69	65
Mimosa sp. (local) Manado	1144	108	61	52
Desmodium sp. Grp. A CPI 49668	217	92	61	60
Pueraria phaseoloides (commercial)	81	81	58	78
Vigna hosei CQ 729	47	56	47	80
Arachis sp. CPI 19898 (vegetative)	28	42	47	72
Calopogonium mucunoides (commercial)	64	19	44	68
Arachis sp. CPI 29986 (vegetative)	47	47	42	68
Centrosema pubescens (local) Manado	31	39	39	77
Desmodium intortum Grp.C CPI 43201	44	28	39	75
Desmodium scorpiurus CPI 87514	78	78	36	65
Neonotonia wightii cv. Tinaroo	106	72	22	62
Neonotonia wightii cv. Malawi	28	33	19	62
Aeschynomene americana cv. Glenn	336	33	17	38
Cassia pilosa CPI 57503	78	33	14	60
Vigna luteola cv. Dalrymple	42	17	6	65
Centrosema macrocarpum CPI 95531	192	33	0	56
Desmodium heterocarpon cv. Florida	28	14	0	47
Vigna lasiocarpa Grp.A CPI 34436	19	6	0	69
Calopogonium mucunoides (local) Manado	36	0	0	64
Centrosema sagittatum CPI 82277	14	0	0	63
Macrotyloma axillare cv. Archer Grp.A	14	0	0	48
Desmodium triflorum (local) Manado	6	0	0	80
Lotus pedunculatus cv. Maku	3	0	0	
Vigna parkeri cv. Shaw	0	0	0	–
Vigna oblongifolia.aff CPI 60433	0	0	0	–
Arachis sp. CPI 12121 (vegetative)	0	0	0	
Trifolium semipilosum cv. Safari	0	0	0	–
Mean harvest dry matter yield	75	58	53	

highest dry matter production in the early harvests l-3, but their yield decreased sharply in later harvests. It was suspected that species with a sharply declining yield were either not resistant to regular defoliation or required a higher fertility. No fertilizer was applied to the experiment and some nutrients may have been limiting after several harvests. Other species of medium height such as C. *pubescens* CPI 58575, C. *puhescens* (common) and *Teramnus lahialis cv.* Semilla Clara had a more even dry matter production throughout the experiment. Lastly, low growing species such as *Arachis repens, A. pintoi, D. ovalifolium* and *D. heterophyllum* cv. Johnstone gave low initial yields but higher yields in later harvests. The overall yield of this group was lower than that of the higher-growing species, but they showed fast regrowth, better ground

Table 1 *(Cont'd)*

Species	Dry matter yield Harvest 1-3	4-6 (g/m²/2 months)	7-10	Mean % leaf
Grasses				
Brachiaria decumbens cv. Basilisk	564	311	278	47
Brachiaria decumbens (local) Manado	328	292	278	50
Panicum maximum cv. Riversdale	1294	281	275	54
Digitaria milanjiana CPI 59721	356	264	269	51
Setaria sphacelata cv. Splenda	744	167	222	42
Brachiaria humidicola cv. Tully	469	275	197	55
Paspalum plicatulum cv. Bryan CPI 21379	644	256	197	68
Paspalum notatum cv. Competidor	286	192	194	99
Digitaria milanjiana CPI 41192	194	189	189	63
Panicum maximum cv. Embu	478	192	186	37
Paspalum notatum CPI 11864	317	156	169	99
Paspalum scrobiculatum cv. Paltridge	356	161	139	47
Paspalum conjugatum CPI 60059	225	158	136	42
Paspalum dilatatum (commercial)	464	256	128	65
Axonopus compressus (local) Manado	194	150	125	87
Digitaria milanjiana CPI 59775	194	153	122	47
Bothriochloa insculpta CPI 59584	356	197	119	39
Paspalum wettsteinii (commercial)	258	219	114	63
Panicum maximum cv. Petrie	386	203	103	41
Digitaria pentzii CPI 41190	67	169	97	82
Paspalum malacophyllum CPI 27690	356	186	86	55
Panicum maximum cv. Rumuruti	375	214	83	47
Bothriochloa pertusa	172	158	83	53
Panicum maximum cv. Gatton	464	181	75	51
Paspalum commersonii CPI 15705	336	122	69	51
Paspalum conjugatum (local) Manado	267	83	67	58
Digitaria smutsii cv. Premier CPI 38869	94	94	64	81
Acroceras macrum CPI 62122	108	50	50	45
Paspalum simplex CPI 27709	108	89	47	50
Panicum laxum CPI 113582	117	89	44	65
Brachiaria mutica (local) Manado	236	78	25	36
Local grass (local) Manado	39	19	17	51
Panicum laxum CPI 53932	39	14	0	42
Stenotaphrum secundatum (local) Brisbane	0	0	0	
Panicum laxum CPI 113580	0	0	0	
Axonopus affinis (commercial)	0	0	0	
Mean harvest dry matter yield	408	178	147	

cover and higher persistence, and they dominated the weeds surrounding the plots. All of these species possessed a high proportion of leaf.

It was suspected that the medium and low-growing species were more resistant to regular defoliation than the more upright species. Persistence under heavy grazing is probably the most important factor determining the success of species in North Sulawesi pastures.

The low initial yield of *Cassia rotundifolia* was caused by a fungal disease which killed some plants. It recovered, however, and yielded well in later harvest.

Grasses

The yield of grasses was generally higher than that of legumes (Table 1). Nearly all species showed a decline in yield regardless of their growth habit. It was suspected that nitrogen may have limited the yield of grasses. As for legumes, productivity of grasses was associated with growth habit. Dry matter production of many of the erect grasses was high initially but dropped sharply after the first few harvests. Some of the species which fell into this group were *Panicum maximum* cv. Riversdale, *Setaria sphacelata* cv. Splenda and *Paspalum plicatulum.* However, there were some species which increased or decreased yield only slightly between harvests 4-6 and 7-10. Examples were *Brachiaria decumbens* (local), *Digitaria milanjiana* CPI 59721, *P. maximum cv.* Riversdale, *Setaria sphacelata* cv. Splenda and *P. notatum* CPI 11864. Although the dry matter productions of *P. notatum* cv. Competidor and *P. notatum* CPI 11864 were not the highest, it is likely that these grasses, because of their low sward-forming growth habit, will persist and provide stable pastures. They also had a high proportion of leaf. *Panicum maximum* cv. Riversdale, with its high yield potential, may be suited for a fertilised cut-and-carry situation.

Conclusions

The evaluation showed clearly that there are a number of legumes and grasses which appear promising. However, there are still questions which need to be answered regarding their ability to grow in mixtures and to suppress weed growth, before they can be recommended for pastures under coconut plantations.

The objective of this experiment was to identify species suited for use by small farmers who tether cattle and for larger coconut plantation enterprises which practice herd grazing. Accordingly, legumes and grasses are required which are persistent under heavy grazing and under poor management. Some of the species which may possess the necessary characteristics are presented in Table 2.

Although these species gave lower yields than other species, they showed generally good seedling vigour and resistance to diseases and insects. Further, most showed a very good ground cover and indicated an ability to compete with weeds. Because of these characteristics, it is predicted that these species will be adapted to the grazing systems practised in North Sulawesi.

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Table 2. Species considered persistent to heavy grazing.

Species	Disease/ insect attack	Ground cover %	Seedling/ plant replacement	Growth habit
a. Legumes				
A. repens CPI 28273	none	100	high	low
A. pintoi CPI 58113	none	100	high	low
D. ovalifolium Q 8194	none	100	high	low
Arachis sp. CPI 29986	none	80	high	low
D. heterophyllum cv. Johnstone	none	100	high	low
b. Grasses				
P. notatum cv. Competidor	none	100	high	low
P. notatum CPI 11864	none	100	high	low
A. compressus (local)	none	100	high	low
P. wettsteinii	none	80	high	low
P. milanjiana CPI 59721	none	80	high	low