Environmental adaptation of forages in Vietnam

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The land area of Vietnam is relatively small (33.6 million ha) with a large population (75 million people). Steep hills and mountains cover two-thirds of the country. The average agricultural landholding per capita is only 0.1 ha. Population growth rate is more than 2% per year. As a result, land under cultivation for food and industrial crops is expanding at a fast rate while grassland and forests, which are the traditional resources for grazing, are shrinking.

The Vietnamese Government aims to change the structure of agricultural production and actively promote livestock production. To address the problem of diminishing feed resources for livestock, studies to identify new, adapted forage species are being conducted in collaboration with the Forages for Smallholders Project (FSP). Farmers normally prefer forage species which are productive, are easy to propagate, and are adapted to a wide range of environments and farming systems. This paper presents the results of forage evaluations conducted at three sites in Vietnam.

Site descriptions

Forages were evaluated at Ba Vi (Ha Tay province), FRC (Phu To), Xuan Loc (Hue) and M'Drak, (Daklak). A brief site description is provided in Table 1. Actual rainfall and air temperature data are attached in the Appendix 1.

Results

A total of 101 forage species were included in the nursery evaluations. This consisted of 63 legumes, 31 grasses and 7 tree legumes. The number of species evaluated at each site is presented in Table 2. The complete list of species tested at each site is attached in the Appendix 2.

Table 1. Physical characteristics of sites for nursery evaluation.

Site	Latitude	Altitude (m)	Annual rainfall (mm)	Wet season	Number of wet months (>50mm)	Soil characteristics	Farming systems
Ba Vi (Ha Tay)	21°N	50	1840	Apr – Nov	8	pH (KCl) 5.5-5.7, light loam, moderately fertile, well drained	Forestry in highland, industrial and other crops, home gardens, irrigated rice and livestock.
FRC (Phu Tho)	21° N	40	1850	Apr – Nov	8	pH (KC): 3.8-4.0, light loam, moderate drainage, poor soil	Forestry and upland crops, lowland rice and livestock.
Xuan Loc (Hue)	16°N	150	2300	Jul - Feb	8	pH (1:5 water) 5.0-5.5, Sandy loam soil, light to medium texture and well drained	Slash-and-burn cultivation on steep hills, irrigated rice, home gardens, livestock.
M'Drak (Daklak)	12°N	550	1895	Apr - Nov	8	pH(1:5 water):5, sandy loam, well drained, moderately fertile but P deficient	Shifting cultivation on steep hills, home gardens and lowland rice in the valleys.

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Table 2. Number of forage varieties evaluated at each site.

	Ba Vi	M'Drak	Xuan Loc	FRC
Grasses	20	22	21	24
Herbaceous legumes	49	49	28	18
Tree legumes	0	4	4	0
Total	69	75	53	42

A list of the best-adapted species at each site is presented in Table 3. Of the species evaluated in the study, some proved to be broadly adapted. These were *Brachiaria brizantha*, *Panicum maximum*, *Stylosanthes guianensis* CIAT 184, and *Flemingia macrophylla*. These species produced not only a lot of green leaf but also had good seed production potential.

Some species performed well only at some sites – *Paspalum atratum* at Hue, *Brachiaria ruziziensis* at Hue and Phu Tho, *Brachiaria humidicola* at M'Drak, and *Andropogon gayanus* at M'Drak and Ba Vi.

The performance of all forage accessions evaluated at Ba Vi, Hue and Xuan Loc is detailed in Appendices 4 to 6.

Table 3. List of best species at the four nursery sites.

Species	Ba Vi (Hatay)	M'Drak (Dak Lak)	Xuan Loc (Hue)	FRC (Phu Tho)
Grasses				
Brachiaria decumbens cv. Basilisk	✔	✔	-	-
B. brizantha CIAT 6780	✔	✔	✔	✔
Andropogon gayanus cv. Kent	✔	✔	-	-
Panicum maximum TD58	✔	✔	✔	✔
Brachiaria humidicola (several varieties)	-	✔	-	-
Brachiaria ruziziensis ex. Thailand	-	-	✔	✔
Paspalum atratum BRA 9610	-	-	✔	-
Legumes				
Stylosanthes guianensis CIAT 184	✔	✔	✔	✔
Stylosanthes guianensis FM 05-2	-	✔	-	✔
Stylosanthes hamata cv. Verano	-	-	✔	✔
Aeschynomene histrix CIAT 9690	✔	-	-	✔
Centrosema pubescens CIAT 15160	-	-	-	✔
Tree legumes				
Gliricidia sepium	-	✔	✔	-
Flemingia macrophylla	-	✔	✔	✔

Conclusions and recommendations

There is a range broadly adapted species which can be used for on-farm evaluations. These include Brachiaria species, Panicum maximum, and Stylosanthes guianensis. The lack of broadly adapted legumes suggests that we need to do more work on tree legumes for living fences, erosion control, soil improvement, and weed suppression.

We need to continue to evaluate new species for particular niches (such as Setaria sphacelata cv. Solander for the cooler northern regions). We need to organize training courses on forage agronomy and management for farmers.

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Appendices

Appendix 1. Climatic data for the period of nursery evaluation at each site.

			Month												
		Year	J	F	M	A	M	J	J	A	S	O	N	D	Total
Ba Vi (Ha Tay)	Rainfall (mm)	1996	10	14	130	49	169	309	620	451	133	157	287	5	2332
		1997	30	15	157	188	89	258	602	438	99	256	10	17	2156
	Number of rain days	1996	14	5	20	22	16	22	19	16	13	6	13	3	169
		1997	08	13	19	14	11	12	21	17	15	12	03	08	153
	Mean max. temp (^{o}C)	1996	26	29	39	32	40	37	38	36	34	34	30	27	
		1997	28	26	28	31	37	40	36	38	35	33	35	29	
	Mean min. temp (^{o}C)	1996	5	6	12	13	20	23	23	22	21	16	14	10	
		1997	10	11	16	17	22	24	24	22	18	17	14	11	
FRC (Phu Tho)	Rainfall (mm)	1996	27	13	126	89	280	389	335	474	79	98	161	13	1781
		1997	24	34	167	170	104	142	380	289	121	178	61	-[1]	1670[2]
	Number of rain days	1996	12	10	17	22	17	18	20	16	13	7	11	8	171
		1997	12	16	21	16	8	15	24	14	14	13	3	-	156[2]
	Mean max. temp (^{o}C)	1996	26	29	32	32	38	36	37	36	34	33	29	27	
		1997	27	26	28	32	36	40	34	37	34	33	33	-	
	Mean min. temp (^{o}C)	1996	7	6	12	13	20	22	24	23	22	18	16	11	
		1997	10	12	16	18	22	23	24	23	17	18	15	-	
Xuan Loc (Hue)	Rainfall (mm)	1996	29	137	9	73	120	9	51	66	66	760	824	363	2507
		1997	51	80	38	90	118	17.1	63	151	559	726	-	-	1892[2]
	Number of rain days	1996	11	20	6	8	12	17	8	10	23	24	25	23	177
		1997	11	18	7	18	13	4	11	8	18	16	-	-	124[2]
	Mean max. temp (^{o}C)	1996	29	33	37	39	36	38	38	38	34	34	31	28	
		1997	30	28	35	36	38	38	39	38	37	34	-	-	
	Mean min. temp (^{o}C)	1996	11	12	15	17	23	23	23	23	22	21	18	14	
		1997	12	15	15	20	22	23	24	24	20	21	-	-	
M'Drak (Daklak)	Rainfall (mm)	1996	24	53	4	93	160	122	95	109	357	605	1057	656	3334
		1997	56	6	10	14	235	28	150	102	87	350	201	150	1389
	Number of rain days	1996	12	12	3	9	18	15	20	16	26	25	25	24	205
		1997	7	7	3	9	15	9	15	16	19	19	15	13	147
	Mean max. temp (^{o}C)	1996	27	35	36	36	35	34	33	34	31	32	30	25	
		1997	29	34	35	36	36	35	32	32	32	30	28	28	
	Mean min. temp (^{o}C)	1996	14	16	15	19	21	20	21	21	20	19	18	15	
		1997	11	14	15	21	22	20	21	22	20	20	16	15	

[1] Data not yet available.
[2] Most recent data not yet included.

Appendix 2. Forage varieties evaluated at each site.

Species	M'Drak (Daklak)	Xuan Loc (Hue)	FRC (Phu Tho)	Ba Vi (Ha Tay)
Legumes				
Aeschynomene americana CPI 93667	✔	-	-	✔
Aeschynomene americana cv. Glenn	✔	✔	-	✔
Aeschynomene americana cv. Lee	✔	✔	-	✔
Aeschynomene brasiliana CIAT 8628	✔	-	-	✔
Aeschynomene histrix CIAT 9690	✔	✔	✔	✔
Aeschynomene histrix CPI 93595	✔	✔	✔	✔
Aeschynomene villosa CPI 91209	✔	-	-	✔
Aeschynomene villosa CPI 93621	✔	-	-	✔
Alysicarpus rugosus CPI 30034	✔	-	-	✔
Alysicarpus rugosus CPI 52348	✔	-	-	✔
Alysicarpus vaginalis CPI 100856	✔	-	-	✔
Arachis pintoi CIAT 17434	✔	✔	✔	✔
Arachis pintoi CIAT 18744	✔	-	-	✔
Arachis pintoi CIAT 18748	✔	-	-	✔
Arachis pintoi CIAT 18750	✔	-	-	✔
Arachis pintoi CIAT 22160	-	✔	✔	-
Calopogonium mucunoides CIAT 7722	✔	-	-	-
Centrosema acutifolium CIAT 5277	✔	✔	✔	✔
Centrosema brasilianum CPI 55698	✔	✔	✔	✔
Centrosema macrocarpum CIAT 15014	✔	-	-	✔
Centrosema macrocarpum CIAT 25522	-	✔	✔	-
Centrosema pascuorum cv. Cavalcade	-	✔	✔	✔
Centrosema plumieri CPI 58657	✔	-	-	✔
Centrosema pubescens CIAT 15160	✔	✔	✔	✔
Centrosema pubescens CIAT 438	✔	-	-	✔
Centrosema pubescens cv. Cardillo	-	✔	✔	-
Chamaecrista rotundifolia CPI 86172	✔	-	-	✔
Chamaecrista rotundifolia cv. Wynn	✔	-	-	✔
Chamaecrista rotundifolia Q 10067	✔	-	-	✔
Clitoria ternatea CIAT 772	✔	-	-	✔
Clitoria ternatea cv. Milgarra	✔	✔	-	✔
Desmanthus virgatus cv. Bayamo	✔	✔	-	✔
Desmanthus virgatus cv. Marc	✔	✔	-	✔
Desmanthus virgatus ex. Thailand (CPI 52401)	-	✔	-	-
Desmodium distortum CPI 38568	✔	-	-	-
Desmodium heterocarpon CPI 86277	✔	-	-	✔
Desmodium heterophyllum CIAT 394	✔	-	✔	✔
Desmodium ovalifolium CIAT 13089	✔	-	-	✔
Desmodium ovalifolium CIAT 3666	✔	-	-	✔
Desmodium sericophyllum CPI 91147	✔			
Desmodium subsericeum CPI 78402	✔	-	-	✔
Macroptilium atropurpureum CPI 90844	✔	✔	✔	✔
Macroptilium atropurpureum cv. Aztec	✔	✔	✔	✔
Macroptilium bracteatum CPI 27404	-	✔	✔	✔
Macroptilium gracile cv. Maldonado	-	✔	-	✔
Macrotyloma daltonii CPI 6030	-	-	-	✔
Stylosanthes scabra cv. Seca	-	✔	✔	-
Stylosanthes scabra cv. Siran	-	✔	✔	-
Vigna oblongifolia CPI 121699	-	-	-	✔
Vigna parkeri cv. Shaw	-	✔	✔	-
Vigna trilobata CPI 13671	-	-	-	✔

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Appendix 2 (cont.). Forage varieties evaluated at each site.

Species	M'Drak (Daklak)	Xuan Loc (Hue)	FRC (Phu Tho)	Ba Vi (Ha Tay)
Macroptilium gracile CPI 33498	✔	✔	-	✔
Macroptilium gracile CPI 91094	✔	-	-	✔
Macroptilium gracile CPI 91340	✔	-	-	✔
Stylosanthes guianensis CIAT 184	✔	✔	✔	✔
Stylosanthes guianensis FM05-2	✔	✔	✔	✔
Stylosanthes hamata cv. Amiga	✔	-	-	✔
Stylosanthes hamata cv. Verano	✔	✔	✔	✔
Stylosanthes mexicana CPI 87484	✔	-	-	-
Teramnus uncinatum CIAT 7315	✔	-	-	✔
Vigna decipiens CPI 73602	✔	-	-	✔
Zornia latifolia CIAT 728	✔	✔	✔	✔
Grasses				
Andropogon gayanus cv. Kent	✔	✔	✔	✔
Bothriochloa insculpta cv. Bisset	✔	-	-	✔
Bothriochloa pertusa cv. Dawson	✔	-	-	✔
Brachiaria brizantha CIAT 16318	✔	✔	✔	✔
Brachiaria brizantha CIAT 16827	-	✔	✔	-
Brachiaria brizantha CIAT 16835	-	✔	✔	-
Brachiaria brizantha CIAT 26110	-	✔	✔	-
Brachiaria brizantha CIAT 6387	-	✔	✔	-
Brachiaria brizantha CIAT 6780	✔	✔	✔	✔
Brachiaria decumbens cv. Basilisk	✔	✔	✔	✔
Brachiaria humidicola CIAT 16886	✔	-	-	✔
Brachiaria humidicola CIAT 26144	-	✔	✔	-
Brachiaria humidicola CIAT 6133	✔	✔	-	✔
Brachiaria humidicola cv. Tully	✔	✔	✔	✔
Brachiaria ruziziensis ex. Thailand	✔	✔	✔	✔
Cenchrus ciliaris cv. Biloela	✔	-	-	✔
Dichanthium aristatum cv. Floren	✔	-	-	✔
Digitaria milanjiana CPI 40700	✔	-	-	✔
Digitaria milanjiana CPI 41192	✔	-	-	✔
Digitaria milanjiana cv. Jarra	✔	-	-	✔
Panicum maximum CIAT 6299	✔	✔	✔	✔
Panicum maximum TD 58	-	✔	✔	-
Paspalum atratum BRA 9610	✔	✔	✔	✔
Paspalum guenoarum BRA 3824	✔	✔	✔	✔
Paspalum nicorea CPI 37526	✔	-	-	-
Paspalum notatum cv. Competidor	✔	-	-	✔
Urochloa mosambicensis CP 46876	-	✔	-	-
Urochloa mosambicensis CPI 60128	-	✔	✔	-
Urochloa mosambicensis CPI 60147	-	✔	-	-
Urochloa mosambicensis Nixon	✔	✔	✔	✔
Urochloa stolonifera CPI 60128	✔	-	-	✔
Tree and shrub legumes				
Calliandra calothyrsus CPI 115690	-	✔	-	-
Flemingia macrophylla CIAT 17403	✔	✔	✔	✔
Gliricidia sepium ex. Costa Rica	✔	-	-	-
Gliricidia sepium OFI 124/91	-	✔	-	-
Gliricidia sepium OFI 82/94	-	✔	-	-
Leucaena leucocephala K636	✔	✔	-	-
Zapoteca tetragona ex. Indonesia	✔	-	-	-

Appendix 3. Results of nursery evaluation at Ba Vi, Ha Tay Province.

Species	Establish-ment	Yield	Persist-ence	Seed production	Pest/ disease damage
Grasses					
Andropogon gayanus cv. Kent	1	4	4	2	0
Bothriochloa insculpta Bisset	1	1	2	1	0
Bothriochloa pertusa cv. Dawson	1	1	-	2	0
Brachiaria brizantha CIAT 16318	1	3	4	3	0
Brachiaria brizantha CIAT 6780	2	4	4	3	0
Brachiaria decumbens CIAT 606	1	3	3	3	0
Brachiaria humidicola CIAT 16886	1	2	3	3	0
Brachiaria humidicola CIAT 6133	1	2	4	3	0
Brachiaria humidicola CIAT 679 (Tully)	1	2	4	3	0
Cenchrus ciliaris cv. Biloela	1	1	-	3	0
Dichanthium aristatum cv. Floren	1	1	-	1	0
Digitaria milanjiana CPI 40700	1	2	-	3	0
Digitaria milanjiana CPI 41192	1	2	1	2	0
Digitaria milanjiana cv. Jarra	2	2	1	3	0
Panicum maximum CIAT 6299	1	4	4	3	0
Paspalum atratum BRA 9610	4	4	1	2	0
Paspalum guenoarum BRA 3824	2	3	1	3	0
Paspalum notatum cv. Competidor	2	1	1	-	0
Urochloa mosambicensis cv. Nixon	1	1	2	3	0
Urochloa stolonifera CPI 60128	-	-	-	-	-
Legumes					
Aeschynomene americana cv. Glenn	1	2	1	3	1
Aeschynomene americana cv. Lee	2	2	1	3	1
Aeschynomene americana 93667	2	2	1	3	1
Aeschynomene brasiliana CIAT 8628	3	3	2	3	0
Aeschynomene histrix CIAT 9690	2	4	3	3	0
Aeschynomene histrix CPI 93595	1	2	2	3	0
Aeschynomene villosa CPI 91209	1	1	-	3	0
Aeschynomene Villosa CPI 93621	2	1	-	2	0
Alysicarpus rugosus CPI 52348	1	1	-	2	2
Alysicarpus monilepher CPI 52343	1	1	-	2	2
Alysicarpus vaginalis CPI 100856	2	1	-	1	0
Arachis pintoi CIAT 17434	1	1	4	1	0
Arachis pintoi CIAT 18744	1	1	1	2	0
Arachis pintoi CIAT 18748	-	-	-	-	-
Arachis pintoi CIAT 18750	1	1	1	1	0
Centrosema acutifolium CIAT 5277	1	1	-	2	1
Centrosema brasilianum CPI 55698	2	2	1	3	0
Centrosema macrocarpum CIAT 15014	1	1	2	1	0
Centrosema pascuorum cv. Cavalcade	2	2	-	3	1
Centrosema plumieri CPI 58567	1	1	-	2	1
Centrosema pubescens CIAT 438	3	1	3	2	1
Centrosema pubescens CIAT 15160	1	1	4	3	1
Chamaecrista rotundifolia CPI 86172	1	2	4	3	0
Chamaecrista rotundifolia cv. Wynn	1	2	4	3	0
Chamaecrista rotundifolia Q10057	1	1	-	-	0
Clitoria ternatea CIAT 772	1	1	-	3	1
Clitoria ternatea cv. Milgarra	1	1	-	2	1
Desmodium heterocarpon CPI 86277	2	1	-	2	1
Desmodium heterophyllum CIAT 349	2	1	-	-	1

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Appendix 3 (cont.). Results of nursery evaluation at Ba Vi, Ha Tay Province.

Species	Establish-ment	Yield	Persist-ence	Seed production	Pest/ disease damage
Desmodium ovalifolium CIAT 13089	3	1	2	1	1
Desmodium ovalifolium CIAT 3666	3	1	-	1	1
Desmodium subsericeum CPI 78402	-	-	-	-	-
Macroptilium atropurpureum cv. Aztec	2	2	1	3	1
Macroptilium atropurpureum CPI 90844	1	1	1	1	2
Macroptilium bracteatum CPI 27404	-	-	-	-	-
Macroptilium gracile CPI 33498	1	2	-	2	1
Macroptilium gracile CPI 91094	1	1	-	-	2
Macroptilium gracile CPI 91340	2	1	-	-	2
Macroptilium gracile cv. Maldonado	2	2	-	2	1
Macrotyloma daltonii CPI 60303	1	1	-	-	2
Stylosanthes guianensis CIAT 184	4	4	2	2	0
Stylosanthes guianensis FM 05-2	4	3	2	2	1
Stylosanthes hamata cv. Amiga	2	3	-	3	0
Stylosanthes hamata cv. Verano	1	2	-	3	0
Teramnus uncinatum CIAT 7315	1	1	-	-	1
Vigna decipiens CPI 73602	2	1	-	3	0
Vigna oblongifolia CPI 121699	1	1	-	-	2
Vigna trilobata CPI 13671	-	-	-	-	-
Zornia latifolia CIAT 728	1	1	3	2	0

Establishment success: 0=did not emerge, 1=poor, 2=moderate, 3=good, 4=excellent.
Yield potential, persistence, and seed production: 1=poor, 2=moderate, 3=good, 4=excellent.
Pests/diseases: 0= none, 1=little impact, 2=moderate impact, 3=severe impact, 4=plants killed.

Appendix 4. Results of nursery evaluation at Xuan Loc, Hue Province.

Species	Establish-ment	Yield	Persist-ence	Pest / disease damage
Grasses				
Andropogon gayanus CIAT 621	0	-	-	-
Brachiaria brizantha CIAT 16318	0	-	-	-
Brachiaria brizantha CIAT 6387	3	3	3	4
Brachiaria brizantha CIAT 678044	4	4	4	4
Brachiaria brizantha CIAT 26110	4	4	4	4
Brachiaria brizantha CIAT 16835	3	3	3	4
Brachiaria brizantha CIAT 16827	4	4	4	4
Brachiaria decumbens cv. Basilisk	4	3	3	4
Brachiaria humidicola cv. Tully	0	-	-	-
Brachiaria humidicola CIAT 6133	0	-	-	-
Brachiaria humidicola CIAT 26149	0	-	-	-
Brachiaria ruziziensis ex. Thailand	4	4	3	4
Desmanthus virgatus ex. Thailand (CPI 52401)	0	-	-	-
Panicum maximum TD58	4	4	4	4
Panicum maximum CIAT 6299	4	4	4	4
Paspalum atratum BRA 9610	4	4	4	4
Paspalum guenoarum BRA 3824	3	1	2	4
Urochloa mosambicensis CPI 46876	2	1	2	4
Urochloa mosambicensis CPI 60128	0	-	-	-
Urochloa mosambicensis CPI 60147	1	1	1	4
Urochloa mosambicensis cv. Nixon	1	1	1	4
Legumes				
Aeschynomene histrix CIAT 9690	2	2	4	4
Aeschynomene americana cv. Lee	1	1	3	4
Aeschynomene americana cv. Glenn	0	-	-	-
Aeschynomene histrix CPI 93595	3	3	3	4
Arachis pintoi CIAT 22160	3	2	4	4
Arachis pintoi cv. Amarillo	0	-	-	-
Centrosema acutifolium CIAT 5277	1	1	3	2
Centrosema brasilianum CPI 55698	2	2	3	2
Centrosema macrocarpum CIAT 25522	1	1	2	2
Centrosema pubescens CIAT 15160	2	2	3	2
Centrosema pascuorum cv. Cavalcade	1	1	2	2
Centrosema pubescens cv. Cardillo	1	2	2	2
Clitoria ternatea cv. Milgarra	1	1	2	4
Desmanthus virgatus cv. Marc	0	-	-	-
Desmanthus virgatus cv. Bayamo	0	-	-	4
Macroptilium atropurpureum CPI 90844	3	2	2	4
Macroptilium atropurpureum cv. Aztec	1	3	2	3
Macroptilium bracteatum CPI 27404	3	3	2	3
Macroptilium gracile CPI 33498	1	2	2	3
Macroptilium gracile cv. Maldonado	2	3	3	3
Stylosanthes guianensis CIAT 184	4	4	4	4
Stylosanthes guianensis FM05-1	3	3	4	4
Stylosanthes hamata cv. Verano	3	3	3	4
Stylosanthes scabra cv. Siran	3	2	3	4
Stylosanthes scabra cv. Seca	4	4	4	4
Vigna parkeri cv. Shaw	0	-	-	-
Zornia latifolia CIAT 728	0	-	-	-
Tree legumes				
Calliandra calothyrsus CPI 115690	3	2	3	4
Gliricidia sepium OFI 124/91	2	1	3	4
Gliricidia sepium OFI 82/94	3	4	4	4
Flemingia macrophylla CIAT 17403	4	4	4	4
Leucaena leucocephala K636	1	1	2	2

Establishment success: 0=did not emerge, 1=poor, 2=moderate, 3=good, 4=excellent.
Yield potential, and persistence: 1=poor, 2=moderate, 3=good, 4=excellent.
Pests/diseases: 0= none, 1=little impact, 2=moderate impact, 3=severe impact, 4=plants killed.

Appendix 5. Results of nursery evaluation at M'Drak, Daklak Province.

Species	Establish-ment	Yield potential	ersist-ence	Seed production	Pest-/-disease damage
Legume species					
Aeschynomene americana cv. Gienm	1	1	1	2	2
Aeschynomene histrix CIAT 9690	1	1	1	2	2
Aeschynomene histrix CPI 93696	2	1	1	2	2
Arachis pintoi CIAT 17434	3	2	3	2	0
Arachis pintoi CIAT 18744	3	2	3	2	0
Arachis pintoi CIAT 18748	3	2	3	2	0
Arachis pintoi CIAT 18750	3	2	3	2	0
Centrosema plumieri CPI 58567	3	2	1	2	2
Centrosema acutifolium CIAT 2577	3	1	1	2	2
Centrosema macrocarpum CIAT 15014	3	1	1	2	2
Centrosema pubescens CIAT 438	3	1	1	1	2
Centrosema pubescens CIAT 15160	3	1	1	1	2
Chamaecrista rotundifolia cv. Wynn	3	3	3	1	1
Chamaecrista rotundifolia CPI 86172	2	2	2	3	1
Chamaecrista rotundifolia Q10067	3	2	2	3	1
Desmanthus virgatus cv. Marc	3	2	2	2	2
Desmanthus virgatus cv. Bayamo	3	2	3	2	2
Desmodium distortum CPI 38568	3	2	3	3	1
Desmodium heterocarpon CPI 86277	3	2	3	3	1
Desmodium heterophyllum CIAT 349	3	2	3	3	1
Desmodium ovalifolium CIAT 3666	3	2	3	2	1
Desmodium ovalifolium CIAT 13089	3	2	3	2	1
Desmodium sericophyllum CPI 91147	3	2	3	2	2
Desmodium subsericeum CPI 78402	3	2	2	2	2
Macroptilium atropurpureum cv. Aztec	4	2	1	3	2
Macroptilium atropurpureum CPI 90844	4	2	1	3	2
Macroptilium gracile cv. Maldonado	2	1	1	2	3
Macroptilium gracile CPI 33498	3	1	1	2	3
Macroptilium gracile CPI 91094	3	1	1	2	3
Macroptilium gracile CPI 91340	3	1	1	2	3
Stylosanthes guianensis CIAT 184	4	4	4	4	1
Stylosanthes guianensis FM05-2	4	4	4	3	1
Stylosanthes hamata cv. Amiga	2	2	2	3	2
Stylosanthes hamata cv. Verano	2	2	2	3	2
Stylosanthes mexicana CPI 87484	1	1	1	1	3
Grasses					
Andropogon gayanus CIAT 621	4	3	4	4	0
Brachiaria brizantha CIAT 16318	3	4	4	3	0
Brachiaria brizantha CIAT 6780	3	4	4	3	0
Brachiaria decumbens CIAT 606	3	3	4	2	0
Brachiaria humidicola CIAT 16886	2	2	4	1	0
Brachiaria humidicola CIAT 679	2	3	4	1	0
Brachiaria humidicola CIAT 6133	2	2	4	1	0
Brachiaria ruziziensis ex. Thailand	3	2	2	4	1
Panicum maximum CIAT 6299	4	3	3	4	0
Paspalum atratum BRA 9610	3	2	3	1	1
Paspalum guenoarum BRA 3824	3	2	3	1	1
Paspalum nicorea CPI 37526	2	2	1	1	1
Tree legumes					
Flemingia macrophylla CIAT 17403	3	4	4	3	1
Gliricidia sepium ex. Costa Rica	4	3	4	2	1
Leucaena diversifolia ex. Davao	3	1	1	0	3
Leucaena leucocephala CIAT 17263	3	1	1	0	3
Zapoteca tetragona ex. Indonesia	3	1	2	2	0

(continued next page)

Appendix 5 (cont.). Results of nursery evaluation at M'Drak, Daklak Province.

Species	Establish-ment	Yield potential	ersist-ence	Seed production	Pest-/-disease damage
Leucaena diversifolia CPI 33820	2	1	1	0	3
Leucaena diversifolia CPI 35134	3	1	1	0	3
Leucaena hybrid ex. tropical America	2	1	1	0	3
Leucaena leucocephala CPI 61227	3	1	1	0	3
Leucaena leucocephala CPI 64189	3	1	1	0	3
Leucaena leucocephala cv. Cunningham	3	1	1	0	3
Leucaena leucocephala cv. Peru	3	1	1	0	3
Leucaena leucocephala K636	3	1	1	0	3
Leucaena pallida CQ 3439	3	1	1	0	3

Establishment success: 0=did not emerge, 1=poor, 2=moderate, 3=good, 4=excellent.
Yield potential, persistence, and seed production: 1=poor, 2=moderate, 3=good, 4=excellent.
Pests/diseases: 0= none, 1=little impact, 2=moderate impact, 3=severe impact, 4=plants killed.