

# Annex One

## Quantitative Analysis of Grassland Vegetation in Bhutan

Tsuchida (1987, 1991) described grassland communities over a wide range of environments. He used Numata's Summed Dominance Ratio (SDR) to estimate the relative importance of a particular species (Numata, 1991). The observations made by Tsuchida were summarised by combining observations from similar elevations and are presented in the tables below.

**Table A1: Plant communities at locations below 1000m, including those species unique to each site, along with SDR cover classes (adapted from Tsuchida 1987, 1991)**

Species	Phunsholling 350m (3 sites)		Gaylephu 350m (3 sites)		Lingmethang 700-720m (5 sites)	
	SDR (%) <sup>1</sup>	Sites <sup>2</sup>	SDR (%)	Sites	SDR (%)	Sites
<i>Chrysopogon aciculatus</i>	47.3	2	18.3	1	20	1
<i>Paspalum scrobiculatum</i>			88.3	3	25	3
<i>Desmodium heterocarpon</i>	42.7	2	26.7	2	3.6	1
<i>Eragrostis tenella</i>	24.0	2	26.0	2	3.4	1
<i>Cynodon dactylon</i>			47.0	3	26	5
<i>Ageratum conyzoides</i>	14.0	2	23.7	3	4	1
<i>Sida</i> sp	43.3	3	23.3	2		
<i>Tridax procumbens</i>			21.7	2	32	3
<i>Cassia occidentalis</i>	5.7	1	10.0	1	14	2
<i>Euphorbia hirta</i>			2.0	1	40	4
<i>Imperata cylindrica</i>	19.3	1			20	1
<i>Eleusine indica</i>	23.3	2	11.7	1	0	
<i>Fimbristylis</i> sp	27.3	3	6.7	2	0	
<i>Digitaria</i> sp	25.0	1			2.6	1
<i>Eragrostis unioloides</i>	14.0	2	11.0	2		
<i>Kyllinga</i> sp	14.7	2			1.6	1
<i>Phyllanthus virgatus</i>	5.7	1	2.3	1	6.4	2
<i>Arthraxon</i> sp			2.7	1	3	1
<i>Species unique to</i>	<b>Phunsholling</b>		<b>Gaylephu</b>		<b>Lingmethang</b>	
> 20 SDR (%)	<i>Paspalum orbiculare</i>		<i>Verbena</i> sp		<i>Heteropogon contortus</i> <i>Eupatorium adenophorum</i>	
11-20	<i>Mimosa</i> sp <i>Labiata</i> sp <i>Justicia adhatoda</i>				<i>Oxalis corniculata</i> <i>Artemisia indica</i> <i>Urena lobata</i> <i>Triumfetta rhomboidea</i>	
3-10	<i>Drymaria diandra</i> <i>Potentilla kleiniana</i> <i>Fimbristylis</i> sp2 <i>Carex</i> sp <i>Borreria alata</i>		<i>Dactyloctenium aegyptium</i>		<i>Leguminosae</i> sp <i>Cymbopogon flexuosus</i> <i>Setaria pallidifusca</i> <i>Erigeron canadensis</i> <i>Cucurbita</i> sp	
	<i>Crotalaria</i> sp <i>Rungia parviflora</i>				<i>Isachne albens</i> <i>Scrophulariaceae</i> sp	

<sup>1</sup>Numata's summed dominant ratio (SDR) averaged across sites; <sup>2</sup>number of sites where species was present

**Table A2: Plant communities at locations from 1000-2000m, including those species unique to each site, along with SDR cover classes (adapted from Tsuchida 1987, 1991)**

Species	Wangdue 1350m (5 sites)		Kurthung 1300m (4 sites)		Zhemgang 1870m (4 sites)		Mongar 1680m (5 sites)	
	SDR (%) <sup>1</sup>	Sites <sup>2</sup>	SDR (%)	Sites	SDR (%)	Sites	SDR (%)	Sites
<i>Chrysopogon aciculatus</i>	58.6	4	55	3	25	1	80.2	5
<i>Cynodon dactylon</i>	70	5	41.75	3	50	3	29.4	4
<i>Artemisia indica</i>	7	1	25	3	30	2	5.6	1
<i>Spilanthes iabadicensis</i>	13.6	1	7.5	1	22	2	7	1
<i>Ageratum conyzoides</i>	27	3			20	2	6	2
<i>Eragrostis tenella</i>	19	3	16.25	2			6.2	1
<i>Sporobolus fertilis</i>	4	1			17	1	15	2
<i>Plantago erosa</i>	11.6	1			5	2	15	4
<i>Euphorbia hirta</i>	6.4	1	12	3			2	1
<i>Fimbristylis</i> sp	13	1			6.8	1	7.6	4
<i>Potentilla kleiniana</i>	8.4	1			1.3	1	7.6	2
<i>Eragrostis nigra</i>					56	4	16.4	3
<i>Heteropogon contortus</i>	39.8	4	14.5	1				
<i>Paspalum scrobiculatum</i>	14.4	1			37	2		
<i>Cassia tora</i>	20.8	2	13.75	2				
<i>Pteridium aquilinum</i>	8.6	1			20	1		
<i>Rubus ellipticus</i>	5	1			19	2		
<i>Centella asiatica</i>					18	2	5.4	3
<i>Rumex nepalensis</i>	16.4	1			3.5	1		
<i>Dactyloctenium aegyptium</i>	5.4	1	12.5	2				
<i>Setaria pallidifusca</i>					13.3	3	3.5	1
<i>Lespedeza cuneata</i>	7	1	9.25	1				
<i>Anaphalis margaritacea</i>					13	1	3.6	1
<i>Arthraxon</i> sp					5.2	1	10.8	3
<i>Stellaria media</i>	12.4	1			3	1		
<i>Leguminosae</i> sp					13	2	1.4	1
<i>Oxalis corniculata</i>					8.8	2	4.8	3
<i>Eleusine indica</i>			3	1	3	1		
<i>Geranium nepalense</i>					2.3	1	4	1
Species unique to	Wangdue		Kurthung		Zhemgang		Mongar	
SDR > 20%	<i>Digitaria cruciata</i>						<i>Paspalum</i> sp	
11-20%	<i>Desmodium heterocarpon</i> <i>Siegesbeckia orientalis</i> <i>Imperata cylindrica</i> <i>Xanthium stumarium</i> <i>Cynoglossum zeylanicum</i> <i>Potentilla</i> sp		<i>Digitaria setigera</i> <i>Ischaemum rugosum</i> <i>Saccharum spontanium</i> <i>Eragrostis</i> sp		<i>Arundinella hookeri</i> <i>Digitaria violascens</i> <i>Verbena</i> sp <i>Osbeckia</i> sp <i>Crotalaria cytisoides</i>		<i>Digitaria</i> sp	

Table A2 Cont.....

3-10 %	<i>Euphorbia humifusa</i> <i>Emilia sonchifolia</i> ** <i>Cymbopogon flexuosus</i> <i>Eupatorium adenophorum</i>  <i>Jasminum</i> sp <i>Adenostemma lavenia</i> <i>Tridax procumbens</i>	<i>Sida</i> sp <i>Zornia gibbosa</i> <i>Eragrostis uniolooides</i> <i>Bidens</i> sp <i>Amaranthus</i> sp	<i>Potentilla fragarioides</i> <i>Geranium procurrens</i> <i>Cosmos</i> sp <i>Lamium amplexicaule</i> <i>Elsholtzia strobilifera</i> <i>Anaphalis busua</i>  <i>Desmodium</i> sp	<i>Verbena officinalis</i>  <i>Sporobolus diander</i> <i>Desmodium multiflorum</i> <i>Bidens pilosa</i> <i>Potentilla fulgens</i> <i>Taraxacum</i> sp <i>Agrostis inaequiglumis</i>
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<sup>1</sup>Numata's summed dominant ratio (SDR) averaged across sites ; <sup>2</sup> number of sites where species was present

**Table A3: Plant communities at locations from 2000-3000 m, including those species unique to each site, along with SDR cover classes (adapted from Tsuchida 1987, 1991)**

Species	Thimphu 2370m (6 sites)		Trongsa 2200-2400m (4 sites)		Sengor 3000m (3 sites)	
	SDR (%) <sup>1</sup>	Sites <sup>2</sup>	SDR (%)	Sites	SDR (%)	Sites
<i>Eragrostis nigra</i>	30.8	5	22	3	20	1
<i>Arundinella hookeri</i>	0.8	1	36.5	3	16	1
<i>Fimbristylis</i> sp	5.8	4	6.8	1	31	2
<i>Helictotrichon parviflorum</i>	8.8	1	18.3	2	16	1
<i>Prunella vulgaris</i>	1.2	1	7.8	2	32	3
<i>Chrysopogon aciculatus</i>	54.5	5	25.3	2		
<i>Sporobolus fertilis</i>	7.5	3	26	2		
<i>Anaphalis margaritacea</i>			30.3	4	8	2
<i>Primula capitata</i>			2	1	35	2
<i>Potentilla fulgens</i>			10.5	3	19	1
<i>Artemisia indica</i>	7.8	2	20	3		
<i>Miscanthus nudipes</i>	10.7	2	13	1		
<i>Hypericum</i> sp	1	1			20	2
<i>Setaria</i> sp	3	2	17.8	1		
<i>Carex nubigena</i>	15.7	3			1.7	1
<i>Cynodon dactylon</i>	10	3	6.3	1		
<i>Pycurus</i> sp	2.3	2	12.5	1		
<i>Myriactis nepalensis</i>			6.2	1	4.7	1
<i>Rumex nepalensis</i>	7.2	1			3.3	1
<i>Smithia ciliata</i>	4.7	1	5.3	2		
<i>Cotoneaster microphyllus</i>			5	1	4.7	1
<i>Stellaria vestita</i>	1.7	1	6.3	2		
<i>Poa annua</i>	1.7	1			1.7	1
<i>Plantago erosa</i>	0.8	1	1	1		
<b>Species unique to</b>	<b>Thimphu</b>	<b>Trongsa</b>		<b>Sengor</b>		
SDR > 20 %		<i>Eularia</i> sp		Moss <i>Carex albata</i> <i>Agrostis nervosa</i> <i>Senecio chrysanthemoides</i>		
11-20 %	<i>Digitaria stricta</i>	<i>Centella asiatica</i> <i>Spilanthus iabadicensis</i> <i>Viburnum coriaceum</i> <i>Salix</i> sp		<i>Eriocaulon</i> sp <i>Coelachne simpliciuscula</i> <i>Elymus sikkimensis</i> <i>Luzula</i> sp		
3-10 %	<i>Erigeron canadensis</i> <i>Cosmos</i> sp <i>Galinsoga parviflora</i> <i>Cassia mimosoides</i> <i>Cyperus</i> sp <i>Paspalum scrobiculatum</i>	<i>Juncus</i> sp <i>Agrimonia pilosa</i> <i>Cirsium</i> sp <i>Gnaphalium</i> sp <i>Quercus</i> sp <i>Imperata cylindrica</i> <i>Desmodium multiflorum</i> <i>Euphrasia</i> sp <i>Pimpinella</i> sp		<i>Aster</i> sp <i>Iris</i> sp <i>Cyanotis vaga</i> <i>Persicaria nepalensis</i> <i>Halenia elliptica</i> <i>Solanum</i> sp <i>Fimbristylis</i> sp <i>Hemiphragma</i> sp <i>Heterophyllum</i> sp		

<sup>1</sup>Numata's summed dominant ratio (SDR) averaged across sites, <sup>2</sup> number of sites where species was present

**Table A4: Plant communities at locations from 3000-4000 m, including those species unique to each site, along with SDR cover classes (adapted from Tsuchida 1987, 1991)**

Species	Kurbang 3300-3500m (3 sites)		Morathang 3580m (3 sites)		Gorseum 3120m (3 sites)	
	SDR (%) <sup>1</sup>	Sites <sup>2</sup>	SDR (%)	Sites	SDR (%)	Sites
<i>Juncus sp</i>	22.7	1	25.0	1	28.3	1
<i>Agrostis nervosa</i>	17.0	1	12.7	1	28.0	2
<i>Prunella vulgaris</i>	28.7	3	21.3	3	3.7	1
<i>Carex nubigena</i>	9.0	1	29.0	2	11.7	3
<i>Senecio chrysanthemoides</i>	6.0	1	6.0	1	26.0	2
<i>Poa sp</i>	6.0	1	17.0	1	5.7	1
<i>Potentilla fulgens</i>	6.0	1			62.3	3
<i>Anaphalis margaritacea</i>	2.0	1			46.7	3
<i>Arundinaria sp</i>	33.3	1			13.3	1
<i>Agrostis pilosula</i>	22.7	1	12.7	1		
<i>Carex sp</i>	33.3	1	4.3	1		
<i>Aconogonon molle</i>	17.0	1	17.3	1		
<i>Agrostis inaequiglumis</i>	21.0	1	11.3	1		
<i>Elsholtzia strobilifera</i>	4.7	1			26.7	2
<i>Berberis umbellata</i>	14.0	1			14.0	1
<i>Umbelliferae sp</i>	3.0	1			23.0	2
<i>Plantago erosa</i>	7.0	2	19.3	1		
<i>Epilobium wallichianum</i>	8.7	1	12.3	2		
<i>Potentilla fragarioides</i>	12.3	2	2.3	1		
<i>Geranium donianum</i>	4.7	1	5.7	1		
Species unique to	Kurbang		Morathang		Gorseum	
SDR > 20 %	<i>Primula capitata</i> <i>Rumex nepalensis</i>		<i>Myricaria rosea</i> <i>Primula sp</i>		<i>Festuca undata</i> <i>Bromus staintonii</i>	
11-20 %	<i>Juniperus recurva</i> <i>Persicaria runcinata</i> Fern <i>Kobresia duthiei</i> <i>Glyceria sp</i> <i>Agrostis myriantha</i>		<i>Anaphalis triplinervis</i> <i>Festuca sp</i> <i>Trisetum spicatum</i>		<i>Euphrasia sp</i> <i>Cupressus torulosa</i> <i>Fimbristylis sp</i> <i>Artemisia indica</i> <i>Eragrostis nigra</i> <i>Myriactis nepalensis</i>	
3-10 %	<i>Deyeuxia scabrescens</i> <i>Strobilanthes sp</i> <i>Festuca ovina</i> <i>Gallium asperifolium</i>		<i>Persicaria nepalensis</i> <i>Euphrasia sp</i> <i>Glyceria tonglensis</i> Orchidaceae sp <i>Parochetus communis</i> <i>Saxifraga sphaeradena</i> <i>Stelaria vestita</i>		<i>Agrostis sp</i> <i>Arundinella hookeri</i> <i>Brachypodium sp</i> <i>Elymus sikkimensis</i> <i>Halenia elliptica</i> <i>Helictotrichon parviflorum</i>	

<sup>1</sup> Numata's summed dominant ratio (SDR) averaged across sites; <sup>2</sup> number of sites where species was present

**Table A5: Plant communities at locations above 4,000m, including those species unique to each site, along with SDR cover classes (adapted from Tsuchida 1987, 1991)**

Species	Umatatsho 4,340-4,500m (3 sites)		Yango 4,800-4,900m (5 sites)		Geschowoma 4,600-4,800m (4 sites)	
	SDR (%) <sup>1</sup>	Sites <sup>2</sup>	SDR (%)	Sites	SDR (%)	Sites
<i>Potentilla microphylla</i>	50.3	3	23.2	5	21	4
<i>Kobreasia duthiei</i>	22.3	1	46	5	34	4
<i>Kobreasia royleana</i>	25.3	2	20.8	3	35	4
<i>Poa</i> sp	34.3	2	10	1	23	2
<i>Moss</i>	18.0	2	26.8	4	36	5
<i>Agrostis inaequiglumis</i>	46.7	3	26.6	2		
<i>Taraxacum</i> sp	11.7	1	7	1		
<i>Juncus</i> sp	26.3	2	35.6	4		
<i>Gentiana depressa</i>			12	3	16	2
<i>Umbelliferae</i> sp	6.0	1			5.2	2
<i>Bistorta macrophylla</i>			23.2	5	9.8	3
<i>Carex</i> sp	5.0	1	12	2	15	2
<i>Berberis</i> sp			6	1	15	1
<i>Swertia</i> sp			2.8	2	9.4	1
<i>Potentilla saundersiana</i>			10	1	20	1
<i>Gentiana</i> sp			3.8	2	14	1
<i>Deyeuxia pulchella</i>	7.0	1	10.6	2		
<i>Lomatogonium</i> sp			4.6	1	11	1
<i>Festuca ovina</i>			10.6	1	33	4
<i>Potentilla cuneata</i>	3.7	2	9.6	2		
<i>Primula</i> sp			10.8	2	11	3
<i>Anaphalis triplinervis</i>			8.8	2	17	4
<i>Agrostis</i> sp			8	1	7.8	1
<i>Rhododendron anthopogon</i>			11.2	2	25	2
<i>Festuca</i> sp	29.0	3	24.6	3		
<i>Gentiana algida</i>	15.3	3	5	1		
Species unique to	Umatatsho		Yango		Geschowoma	
SDR > 20 % ( )			<i>Rhododendron nivale</i>		<i>Rhodiola</i> sp <i>Arenaria polytrichoides</i>	
11-20 %	<i>Persicaria runcinata</i>		<i>Leontopodium</i> sp <i>Trisetum spicatum</i> <i>Arenaria</i> sp		<i>Rheum nobile</i>	
3-10 %	<i>Chrysosplenium</i> sp <i>Poa annua</i> <i>Bistorta vivipara</i> <i>Pedicularis siphonantha</i>		<i>Ephedra gerardiana</i> <i>Ranunculus brotherusii</i> <i>Cassiope fastigiata</i> <i>Aconitum</i> sp <i>Lonicera myrtillus</i> <i>Deyeuxia</i> sp		<i>Geranium donianum</i> <i>Cortiella hookeri</i> <i>Saussurea hookeri</i>	

<sup>1</sup> Numata's summed dominant ratio (SDR) averaged across sites; <sup>2</sup> number of sites where species was present

## Species Tested for Use as Fodder

Tables A6 to A8 show the grass, legume and other species tested for use as fodder and the stage of testing. The stages of testing reflected are: initial testing in observation nurseries in research station plots; on-farm testing of material that performs well; and promotion of suitable material in the extension programme.

The references referred to are 1 - Roder 1983c ; 2 - AHD 1990; 3 - Rumball 1990; 4 - RNR-RC Jakar 1997c; 5 - Roder 1982c; 6 - Gibson 1989b; 7 - RNR RC-Jakar 1998; 8 - RNR RC-Jakar 1997d

**Table A6: Grass species tested for use as livestock fodder**

Species	Year	Cultivars	Stage of testing	Ref.
<i>Agropyron desertorum</i>	1980	1	Observation nursery	1
<i>Agropyron elongatum</i>	1980	1	Observation nursery	1
<i>Agropyron inerme</i>	1980	1	Observation nursery	1
<i>Agropyron intermedium</i>	1980	1	Observation nursery	1
<i>Agropyron smithii</i>	1980	1	Observation nursery	1
<i>Agropyron trachycaulum</i>	1980	1	Observation nursery	1
<i>Agrostis alba</i>	1987	1	Observation nursery	2
<i>Agrostis tenuis</i>	1980	3	On-farm	1
<i>Alopecurus pratensis</i>	1990	1	On-farm	2
<i>Alopecurus arundinaceus</i>	1988	1	On-farm	3
<i>Andropogon gayanus</i>	1996	1	On-farm	4
<i>Andropogon gerardi</i>	1996	2	Observation nursery	4
<i>Arrhenatherum elatius</i>	1975	1	Observation nursery	1
<i>Brachiaria brizantha</i>	1996	2	On-farm	4
<i>Brachiaria decumbens</i>	< 1982	2	Extension	5
<i>Brachiaria inculpta</i>	1996	1	Observation nursery	4
<i>Brachiaria humidicola</i>	1996	1	Observation nursery	4
<i>Brachiaria pertusa</i>	1996	1	Observation nursery	4
<i>Brachiaria ruziziensis</i>	1988	2	Extension	6
<i>Bothriochloa caucasica</i>	1988	1	Observation nursery	3
<i>Bothriochloa ischaemum</i>	1988	3	Observation nursery	3
<i>Bromus catharticus</i>	1980	2	On-farm	1
<i>Bromus erectus</i>	1988	1	Observation nursery	2
<i>Bromus inermis</i>	1980	3	On-farm	1
<i>Cenchrus ciliaris</i>	< 1982	5	Observation nursery	5
<i>Chloris gayana</i>	< 1982	4	Observation nursery	5
<i>Cynosurus cristatus</i>	1980	1	Observation nursery	1
<i>Dactylis glomerata</i>	1974	30	Extension	1
<i>Digitaria milanjiana</i>	1988	1	Observation nursery	6
<i>Digitaria natalensis</i>	1996	1	Observation nursery	4
<i>Digitaria setivalva</i>	1996	1	Observation nursery	4
<i>Digitaria smutsii</i>	1988	1	Observation nursery	6
<i>Echinochloa utilis</i>	1988	1	Observation nursery	6
<i>Elymus junceus</i>	1980	1	Observation nursery	1

Table A6 Cont.....

Species	Year	Cultivars	Stage of testing	Ref.
<i>Elymus dauricus</i>	1988	1	Observation nursery	3
<i>Elymus sibiricus</i>	1988	1	Observation nursery	3
<i>Festuca arundinacea</i>	1978	20	Extension	1
<i>Festuca ovina</i>	1989	1	Observation nursery	2
<i>Festuca pratensis</i>	1974	8	On-farm	1
<i>Festuca rubra</i>	1975	8	On-farm	1
<i>Holcus lanatus</i>	1981	3	Observation nursery	1
<i>Lolium multiflorum</i>	1974	20	Extension	1
<i>Lolium perenne</i>	1974	25	On-farm	1
<i>L. multiflorum x perenne</i>	1979	8	Observation nursery	1
<i>Melinis minutiflora</i>	< 1982	1	Extension	5
<i>Panicum antidotale</i>	< 1982	1	Observation nursery	5
<i>Panicum coloratum</i>	1996	2	Observation nursery	4
<i>Panicum maximum</i>	< 1982	8	On-farm	5
<i>Panicum virgatum</i>	1988	8	Observation nursery	3
<i>Paspalum atratum</i>	1996	2	On-farm	4
<i>Paspalum dilatatum</i>	< 1982	3	Observation nursery	5
<i>Paspalum guenoarum</i>	1996	2	Observation nursery	4
<i>Paspalum notatum</i>	1981	1	Observation nursery	1
<i>Pennisetum clandestinum</i>	< 1975	3	Extension	
<i>Phalaris arundinacea</i>	1989	1	Observation nursery	2
<i>Phalaris tuberosa</i>	1979	1	Observation nursery	1
<i>Phleum pratense</i>	1974	10	Observation nursery	1
<i>Poa compressa</i>	1989	1	Observation nursery	2
<i>Poa pratensis</i>	1975	10	On-farm	1
<i>Secale cereale</i>	1974	4	On-farm	1
<i>Secale montanum</i>	1980	2	Observation nursery	1
<i>Setaria incrassata</i>	1988		Observation nursery	6
<i>Setaria sphacelata</i>	< 1982	3	On-farm	5
<i>Sorghastrum nutans</i>	1988	5	Observation nursery	6
<i>Sorghum bicolor</i>	1988	1	Observation nursery	6
<i>Sorghum sudanense</i>	1988	2	Observation nursery	6
<i>Trisetum flavescens</i>	1979	1	Observation nursery	1
<i>Urochloa mosambicensis</i>	1996	1	Observation nursery	4
<i>Urochloa ologotricha</i>	1996	1	Observation nursery	4



**Table A7: Legume species tested for use as livestock fodder**

Species	Year	Cultivars	Highest test level	Ref.
<i>Acacia angustissima</i>	1988	1	Observation nursery	6
<i>Acacia villosa</i>	1998	1	Observation nursery	7
<i>Acacia mearnsii</i>	1988	1	Observation nursery	6
<i>Aeschynomene americana</i>	1988	3	Observation nursery	6
<i>Aeschynomene brasiliana</i>	1996	3	Observation nursery	4
<i>Aeschynomene elegans</i>	1988	1	Observation nursery	6
<i>Aeschynomene histrix</i>	1996	3	Observation nursery	4
<i>Aeschynomene villosa</i>	1988	3	Observation nursery	6
<i>Albizia chinensis</i>	1989	1	Observation nursery	6
<i>Alysicarpus glumaceus</i>	1988	1	Observation nursery	6
<i>Alysicarpus monilifer</i>	1988	2	Observation nursery	6
<i>Alysicarpus ovalifolius</i>	1988	1	Observation nursery	6
<i>Alysicarpus rugosus</i>	1988	2	Observation nursery	6
<i>Arachis pintoi</i>	1989	4	On-farm and management studies	6
<i>Astragalus cicer</i>	1979	3	Observation nursery	1
<i>Astragalus falcatus</i>	1979	1	Observation nursery	1
<i>Astragalus sinicus</i>	1989	1	On-farm	8
<i>Cajanus cajan</i>	1989	15	On-farm (as tree fodder)	2
<i>Calliandra calothyrsus</i>	1989	1	Observation nursery	6
<i>Canavalia brasiliensis</i>	1998	1	Observation nursery	7
<i>Canavalia ensiformis</i>	1998	1	Observation nursery	7
<i>Caragana arborescens</i>	1981	1	Observation nursery	1
<i>Centrosema acutifolium</i>	1996	1	Observation nursery	4
<i>Centrosema arenarium</i>	1998	1	Observation nursery	7
<i>Centrosema brasilianum</i>	1998	1	Observation nursery	7
<i>Centrosema macrocarpum</i>	1996	1	Observation nursery	4
<i>Centrosema pascuorum</i>	1998	1	Observation nursery	7
<i>Centrosema pubescens</i>	1982	1	Observation nursery	5
<i>Chamaecrista rotundifolia</i>	1988	4	On-farm and establishment studies	6
<i>Chamaecytisus palmensis</i>	1981	1	Observation nursery	1
<i>Chamaecytisus proliferus</i>	1989	1	Observation nursery	6
<i>Clitoria ternatea</i>	1996	2	Observation nursery	4
<i>Coronilla varia</i>	1980	4	On-farm	1
<i>Crotalaria anagyroides</i>	1998	1	Observation nursery	7
<i>Desmanthus virgatus</i>	1996	4	Observation nursery	4
<i>Desmodium discolor</i>	1988	1	Observation nursery	3
<i>Desmodium heterocarpon</i>	1988	1	Observation nursery	6
<i>Desmodium intortum</i>	1982	3	Extension	5
<i>Desmodium nicaraguense</i>	1996	1	On-farm	4
<i>Desmodium ovalifolium</i>	1996	1	Observation nursery	4
<i>Desmodium prostratum</i>	1988	1	O. nursery	6
<i>Desmodium rensonii</i>	1996	1	On-farm	4
<i>Desmodium salicifolium</i>	1996	1	Observation nursery	4
<i>Desmodium subserceum</i>	1988	1	Observation nursery	2
<i>Desmodium uncinatum</i>	1982	1	Extension	5
<i>Dorycnium hirsutum</i>	1981	1	Observation nursery	6

Table A7 Cont.....

Species	Year	Cultivars	Stage of testing	Ref.
<i>Flemingia macrophylla</i>	1989	2	Observation nursery	6
<i>Galactia striata</i>	1996	1	Observation nursery	4
<i>Galactia</i> sp	1996	2	Observation nursery	4
<i>Gleditsia triacanthos</i>	1981	2	Observation nursery	1
<i>Gliricidia sepium</i>	1989	7	Observation nursery	6
<i>Hedysarum coronarium</i>	1980	2	Observation nursery	1
<i>Hedysarum boreale</i>	1980	2	Observation nursery	1
<i>Lablab purpureus</i>	1980	3	On-farm	5
<i>Lathyrus cicera</i>	1992	15	On-farm	8
<i>Lathyrus latifolius</i>	1980	2	Observation nursery	1
<i>Lathyrus sylvestris</i>	1980	1	Observation nursery	1
<i>Lespedeza cuneata</i>	1980	5	Observation nursery	1
<i>Lespedeza cyrtobotrya</i>	1989	1	Observation nursery	2
<i>Lespedeza maximowiczii</i>	1989	1	Observation nursery	2
<i>Lespedeza sericea</i>	1980	2	Observation nursery	1
<i>Leucaena leucocephala</i>	1978	3	Observation nursery	9
<i>Leucaena pallida</i>	1989	1	On-farm, extension	6
<i>Leucaena diversifolia</i>	1989	3	Observation nursery	6
<i>Lotononis bainesii</i>	1989	2	Observation nursery	1
<i>Lotus angustissimus</i>	1988	1	Observation nursery	4
<i>Lotus corniculatus</i>	1975	15	On-farm	1
<i>Lotus pedunculatus</i>	1979	8	On-farm	1
<i>Lupinus angustifolius</i>	1980	8	Observation nursery	10
<i>Lupinus albus</i>	1980	5	Observation nursery	10
<i>Lupinus arboreus</i>	1989	1	Observation nursery	2
<i>Lupinus cosentinii</i>	1996	1	Observation nursery	10
<i>Lupinus hartwegii</i>	1989	1	Observation nursery	2
<i>Lupinus luteus</i>	1980	4	Observation nursery	10
<i>Lupinus nootkatensis</i>	1989	1	Observation nursery	2
<i>Lupinus mutabilis</i>	1977	50	Management studies	10
<i>Lupinus polyphyllus</i>	1989	1	Observation nursery	2
<i>Lupinus sativus</i>	1996	7	Observation nursery	4
<i>Macroptilium atropurpureum</i>	< 1982	1	Observation nursery	5
<i>Macroptilium gibbosifolium</i>	1996	1	Observation nursery	4
<i>Macroptilium gracile</i>	1996	1	Observation nursery	4
<i>Macrotyloma axillare</i>	< 1982	3	Observation nursery	5
<i>Macrotyloma daltonii</i>	1996	1	Observation nursery	4
<i>Medicago arborea</i>	1981	6	Observation nursery	1
<i>Medicago coerulea</i>	1981	1	Observation nursery	1
<i>Medicago falcata</i>	1980	4	Observation nursery	1
<i>Medicago glutinosa</i>	1979	1	Observation nursery	1
<i>Medicago marina</i>	1996	4	Observation nursery	1
<i>Medicago media</i>	1981	8	Observation nursery	1
<i>Medicago polychroa</i>	1981	1	Observation nursery	1
<i>Medicago polymorpha</i>	1989	2	Observation nursery	1

Table A7 Cont.....

Species	Year	Cultivars	Stage of testing	Ref.
<i>Medicago sativa</i>	1974	40	Extension	1
<i>Medicago trautvetteri</i>	1981	1	Observation nursery	1
<i>Melilotus alba</i>	1980	5	Observation nursery	1
<i>Melilotus elegans</i>	1996	2	Observation nursery	4
<i>Melilotus neapolitana</i>	1996	3	Observation nursery	4
<i>Melilotus officinalis</i>	1980	8	On-farm and establishment studies	1
<i>Melilotus wvulgica</i>	1981	1	Observation nursery	1
<i>Mucuna pruriens</i>	1996	1	On-farm	4
<i>Neonotonia wightii</i>	1980	4	Observation nursery	5
<i>Onobrychis arenaria</i>	1981	2	Observation nursery	1
<i>Onobrychis caput-galli</i>	1996	2	Observation nursery	4
<i>Onobrychis crista-gally</i>	1996	2	Observation nursery	4
<i>Onobrychis transcaucasica</i>	1981	1	Observation nursery	1
<i>Onobrychis viciifolia</i>	1974	5	Observation nursery	1
<i>Pueraria lobota</i>	1980	1	Observation nursery	1
<i>Pueraria phaseoloides</i>	1998	1	Observation nursery	7
<i>Robina pseudoacacia</i>	1975	2	Observation nursery	1
<i>Sesbania rostrata</i>	< 1990	1	Observation nursery	
<i>Sesbania aculeata</i>	< 1990	1	Observation nursery	
<i>Sesbania sesban</i>	< 1990	1	Observation nursery	
<i>Stylosanthes capitata</i>	1996	1	Observation nursery	4
<i>Stylosanthes guianensis</i>	< 1982	4	Extension	5
<i>Stylosanthes hamata</i>	< 1980	3	Observation nursery	5
<i>Stylosantes scabra</i>	< 1980	3	Observation nursery	5
<i>Teline stenopetala</i>	1989	1	Observation nursery	2
<i>Teramnus uncinatus</i>	1996	2	Observation nursery	4
<i>Trifolium alexandrinum</i>	1974	1	On-farm	1
<i>Trifolium ambiguum</i>	1980	11	Observation nursery	1
<i>Trifolium arvense</i>	1981	1	Observation nursery	1
<i>Trifolium baccarinii</i>	1988	1	Observation nursery	6
<i>Trifolium badium</i>	1988	1	Observation nursery	6
<i>Trifolium burchellianum</i>	1988	1	Observation nursery	6
<i>Trifolium decorum</i>	1988	1	Observation nursery	6
<i>Trifolium dubium</i>	1981	1	Observation nursery	1
<i>Trifolium fragiferum</i>	1980	2	Observation nursery	1
<i>Trifolium hirtum</i>	1996	1	Observation nursery	4
<i>Trifolium hybridum</i>	1974	4	Establishment studies	1
<i>Trifolium incarnatum</i>	1974	1	Management and establishment	1
<i>Trifolium lugardii</i>	1988	1	Observation nursery	6
<i>Trifolium mattirolianum</i>	1988	1	Observation nursery	6
<i>Trifolium medium</i>	1980	5	Observation nursery	1
<i>Trifolium pichi-sermolli</i>	1988	1	Observation nursery	6
<i>Trifolium pratense</i>	1968	20	On-farm	11
<i>Trifolium polymorphum</i>	1988	1	Observation nursery	6
<i>Trifolium polystachyun</i>	1988	1	Observation nursery	1

Table A7 Cont.....

Species	Year	Cultivars	Stage of testing	Ref.
<i>Trifolium quatinium</i>	1998	1	Observation nursery	7
<i>Trifolium repens</i>	1968	12	Extension	11
<i>Trifolium resupinatum</i>	1974	1	Observation nursery	1
<i>Trifolium ruelianum</i>	1988	11	Seed production studies	6
<i>Trifolium semipilosum</i>	1979	3	Observation nursery	1
<i>Trifolium steudneri</i>	1988	1	Observation nursery	6
<i>Trifolium tembense</i>	1988	8	Observation nursery	6
<i>Trifolium usambarense</i>	1988	1	Observation nursery	6
<i>Vicia dasycarpa</i>	1981	1	Observation nursery	1
<i>Vicia sativa</i>	1974	18	Observation nursery	1
<i>Vicia villosa</i>	1974	20	On-farm, management studies	1
<i>Vicia tenuifolia</i>	1980	1	Observation nursery	1
<i>Vigna luteola</i>	1996	1	Observation nursery	4
<i>Vigna oblongifolia</i>	1996	1	Observation nursery	4
<i>Vigna parkeri</i>	1988	3	Observation nursery	6
<i>Vigna racemosa</i>	1996	1	Observation nursery	4
<i>Vigna schimperi</i>	1996	1	Observation nursery	4
<i>Vigna trilobata</i>	1988	1	Observation nursery	6
<i>Vigna vexillata</i>	1988	4	Observation nursery	6
<i>Zornia latifolia</i>	1996	1	Observation nursery	4
<i>Zornia glabra</i>	1996	1	Observation nursery	4

Table A8: Other species tested for use as livestock fodder

Species	Year	Cultivars	Highest test level	Ref.
<i>Cichorium intybus</i>	1987	1	Observation nursery	2
<i>Helianthus tuberosus</i>	1978	8	Extension, management studies	1
<i>Brassica oleracea</i> (Kale)	1979	3	Observation nursery	1
<i>Brassica napus</i> (Swede)	1979	3	On-farm	1
<i>Brassica napus</i>	1979	8	Observation nursery	1
<i>Brassica rapa</i>	1979	4	Observation nursery	1
<i>Brassica pekinensis</i>	1979	1	Observation nursery	1
<i>Raphanus sativus</i>	1979	1	Observation nursery	1
<i>Phacelia tanacetifolia</i>	1979	1	Observation nursery	1
<i>Beta vulgaris</i>	1975	4	On-farm	1