Lessons learned

Research organisations focus on maximising one output, particularly by conventional harvest techniques. Implementing organisations have a tendency to favour multipurpose management for the poor on marginal sites. Both have their drawbacks.

Freedom of cashability of hedges and hedgetrees by resource-poor land users (restricted only by local consensus and not law enforcement) and support in marketing any surpluses deserve as much attention as developing technical packages for multi-purpose management.

There is a need to carry out specific research towards developing improved technologies and systems which, through multi-purpose and sustainable hedgerows, address the multiple problems of resource-poor land users.

APPENDICES

APPENDIX ONE: CASE STUDIES OF HEDGEROW SYSTEMS

Case study one: Hedges in hillfarming in the Andes

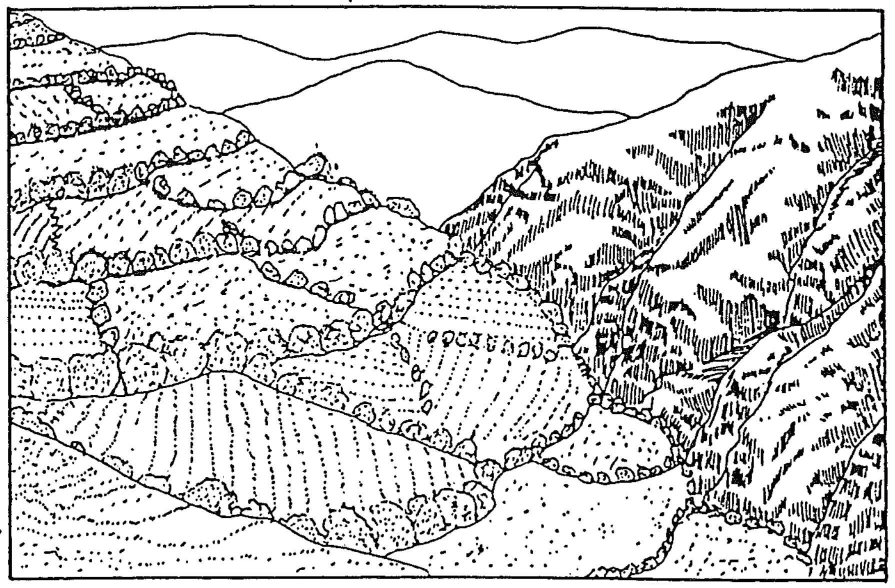

Figure 81: Hedges in the land use of a community in the Central Sierra of Peru (34)

The village of Huancal is situated over 3,600 meters up in the Andean Mountains. The climate is temperate cold; the annual precipitation varies between 500 and 700 mm. The topography is very hilly. The small community depends on fuelwood as a source of energy. When the natural vegetation disappeared the villagers protected and planted pacte (*Cassia spp.*) around their fields.

The villagers have developed an agroforestry land use system. The principal components are: agricultural crops (potatos, ollucos, beans, and barley) and *Cassia*. During the fallow period the animals (mainly sheep and cattle) graze in the fields (chacras). The cycle of *Cassia* fits in well with the cropping patterns. The first crop after the fallow period is potato which is usually sown in October. Just before sowing the farmer coppices *Cassia*. The leaves serve as mulch and the wood for fuel, which will be stored for drying before using it. The *Cassia* has been growing for 4 years and the cycle starts again.

A study in the village revealed that *Cassia* (intrarow spacing 1.5 m) planted around one hectare of farmland makes an average family self-sufficient in their annual fuel requirement (see table 45). This clearly demonstrates the great potential of hedges in the Andes for conserving the resource base and providing sufficient fuel and other outputs.

Table 38: Fuelwood production from a *Cassia* hedge surrounding one ha in the Central Sierra of Peru

Cassia	Yield after four years	Mean annual increment	Fuel consumption per family**
Tree	100 kg	25 kg	-
one ha*	28000 kg	7000 kg	< 7000 kg

*)400 m or 266 trees; **)7.3 members in village concerned

Source: (34)

Case study two: Hedges in the Bamileke land use planning

Hedges play a prominent role in Bamileke land use planning. They are an integral part of the spatial organisation of livestock units. This is the result of the specific socio-cultural tradition of the Bamileke, because other ethnic groups living in the same biophysical environment pursue other land management strategies.

Land use: The Bamileke live dispersed on sloping land. Maize, taro, groundnuts, and macaboe are grown generally in mixed cropping patterns. Perennial crops include avocados, macaboe, bananas and recently coffee. *Raphia* palms are the most important subsistence perennial crops. They are grown as hedges or in plantations. Animal husbandry consists of small livestock like sheep, goats, and poultry.

Women are engaged in subsistence crops while men focus on cash tree crops and livestock. Coffee growing has become an attractive alternative to animal husbandry. The communal pasture is restricted to the upper part of the slopes which are not suitable for agriculture. During the agricultural cycle (18 monts) the stock is enclosed and restricted to the areas above the fields. The source of animal feed includes pasture, fodder trees planted in hedges, and agricultural residues. After the harvest of the crops livestock is allowed to browse freely in the fields. To avoid conflicts between animal husbandry and agriculture and the necessity to guard or fence individual agricultural fields, the Bamileke decided in favour of a clear zoning of the livestock units.

Purpose of hedges: A network of hedges proved to be an effective instrument for zoning of land uses. The Bamileke isolate the concessions with a double living fence consisting mainly of *Raphia* palms. Through a network of paths bordered by hedges which are often many kilometers long the livestock reaches the communal pasture at the top of the slope.

The hedges are established primarily for fencing purposes. Claiming tenure rights is not their function, because the border of the individual parcels are well known and respected by the community. The anti-erosive role of the hedges is perceived as well, but this does not justify their existence. Hedges are also appreciated due to their supply of timber, fuel, and fodder in the dry season. Macaboe is frequently planted on the ridge of the hedges, because it demands much humidity. Men are responsible for the construction and maintenance of the communal enclosure and hedgerow network. Utilization of the land and the user rights follow a rigid procedure. The system of the Batie and Baham represents all successive phases of the organisation and the disappearance of the livestock units.

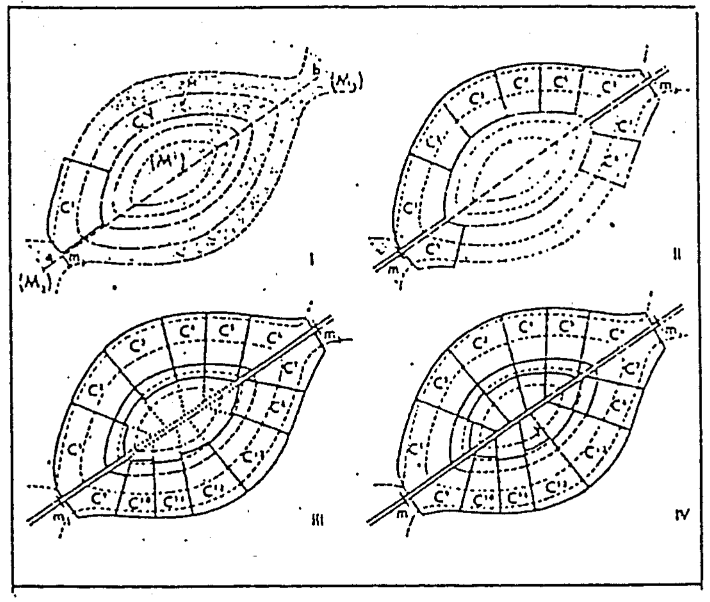

Figure 82: The successive phases of the organisation and the disappearance of the livestock units (179)

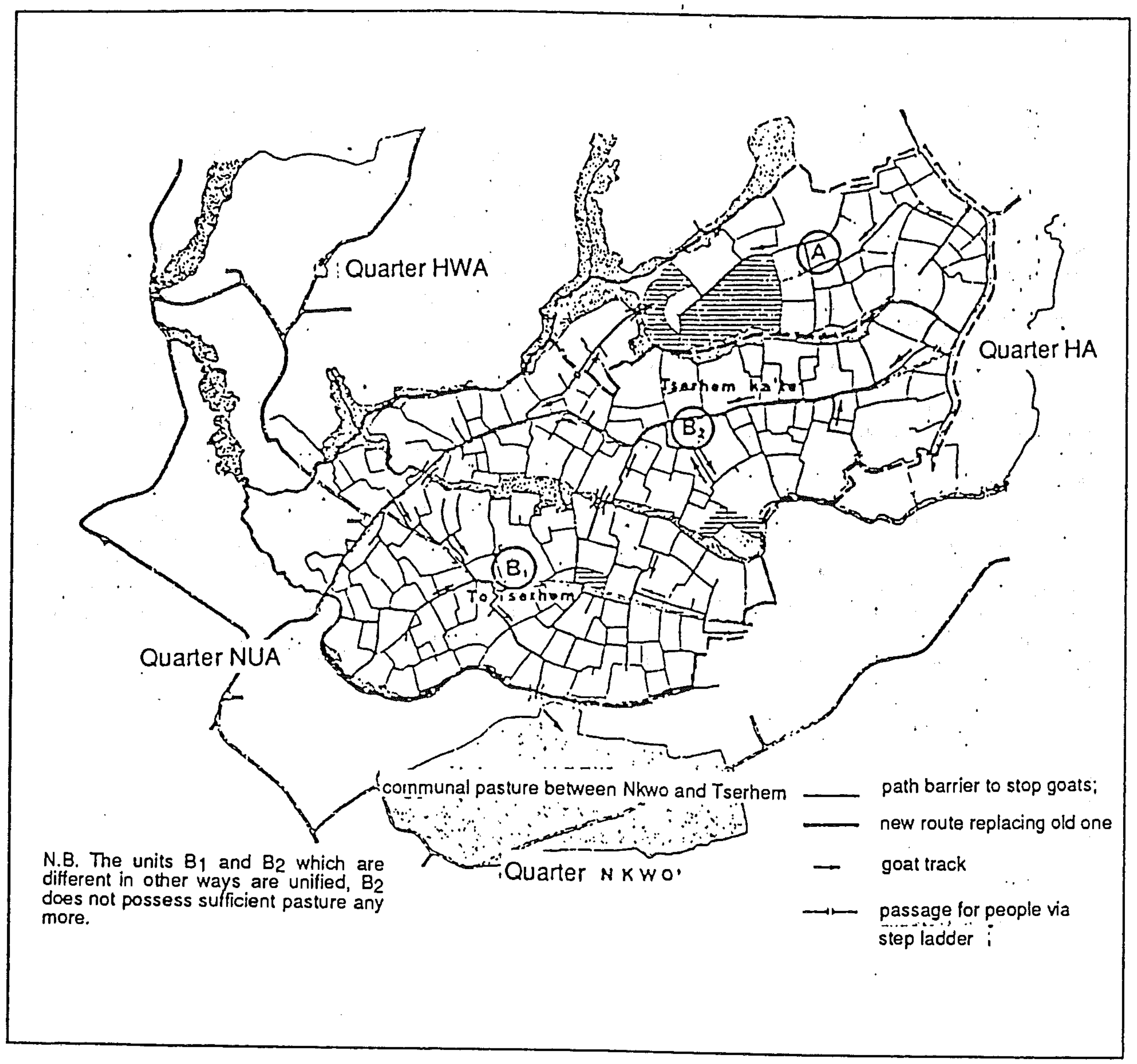

Figure 83: Hedgerow network - a dominant land use component of the Bamileke in Cameroon (179)

Phase one: The spatial organisation (see Figure 82) begins with the establishment of the closure of the concessions (C1) by a notable in charge of a mountain. He is supported by his sons. The clousure follows topograhical lines (CV). The remaining area, which can be reached via the ridge path (ab), is available for the stock of the inhabitants of the locality. The slopes are cultivated for several years (1-5) depending on soil quality. The parcels are given to women. The cropping cycle is 18 months. During this period the notable sends his stock to a slope (M1) which is isolated from another one (M1) by the barrier of hedges. After the harvest time this slope (M1) again serves as a communal pasture.

Phase two: Several concessions have been established (C1-C5). The duration of the cropping period and whether to include the summit of the slope in land use planning is based on a local decision.

Phase three: The slope is totally occupied by the concessions of the inhabitants. They cultivate their land and secure their tenure rights. They share the part along the highest gradient which limits their concession. The farmers install poles but do not enclose their fields. The top of the hill remains a communal pasture.

Phase four: The local land users reconfirm their rights. The summit remains a collective pasture. During this phase the inhabitants obtain their land title and enclose their concessions up to the line of the ridge. The collective right disappears. There is not a corresponding social unit (compare following figure), e.g. the Tserhem of Badjou know three units of livestock but only two sublocalities. The livestock unit constitutes the division of the localities. The sheep barriers are always established along the border of the community to avoid the intrusion of outsiders. The Bamileke think that land use arrangements can be made more easily within the community.

Lessons learned:

- The Bamileke have evolved an approach that avoids conflicts between agriculture and animal production by temporary zoning of pasture without the individual need to protect fields from straying cattle (179).
- The precondition for this zoning of the livestock unit is the communal consensus on the procedure of land use planning.
- The notables play a leading role in the preparation of the communal pasture.
- The zoning and maintenance of the tree hedges is the task of all men.

Case study three: Living woven fencerows for sound watershed management in arid zones of Mexico

Floodplain farming: In Southwestern North America farming is limited by both arable land and availabe water supplies. In arid watersheds many floodplain farming communities have shrunk or disappeared, because the land bases have been destroyed by flood. In contrast agriculturists in the upper Rio San Miguel and other valleys in Eastern Sonora have remained in the same location maintaining a fairly stable agroecosystem. This remarkable demograhic and ecological equilibrium is closely related to the presence of "living" fencerows.

Geography: San Miguel, situated in the eastern upland edge of the Sonoran Desert, is surrounded by mountains. The valley itself is narrow. Xerophytic legumes and cacti dominate the vegetation. Mean annual precipitation ranges from 350-550 mm, with two thirds of the rain falling in July to September.

Land uses: Most agricultural activities take place in the floodplain of the river supplemented by rainfed farming. Most agriculturists follow traditional subsistence patterns, raising maize, legumes, squashes, and vegetables for their families, and barley, wheat or alfalfa for their livestock. They till their fields with horse- or mule-drawn metal hand plows. Their fields are irrigated by gravity-fed canals (0.5-2.0 meters wide) leading from earth-and-stick diversion weirs. The surrounding rangeland is overgrazed leading to erosion.

Living fencerows: A watershed management technology: Living fencerows are the only measure the farmers have taken to protect their flood-plain fields from erosion caused by water. They are locally known as "cercos de trejido" (woven fences) or "cercos de rama" (branch fences).San Miguel farmers plant these living fencerows along the riverbank margins of their fields to prevent erosion, fertilise and extend their land base and obtain various products (overview see fig. 85). Canals and diversion weirs are built and maintained cooperatively by the community of water users. The construction of living fencerows depends on individual or family initatives.

Establishment and maintenance of fences: Material for the fencerows is derived primarily from the riparian vegetation and/or from other fencerows. Cuttings are made from *Populus fremontii* (a cotton wood) and from *Salix gooddingii* (a willow). Brush for the fill woven between these vertical posts consists of *Baccharis glutinosa, Hymenoclea monogyra, Prosopis juliflora* and *Senecio salignus.*

Cuttings (3-4 m long) are trimmed off all branches and leaves. Between November and February they are planted in trenches (1.5 x 0.5 x 0.5 m) at a planting distance between 0.5 and 0.75 m. Sand and gravel are then shovelled around the cuttings to make them secure. Generally one cottonwood is planted between a dozen willows. Farmers follow this pattern because cottonwood grows faster and becomes larger than the willow. The living fencerows constitue a renewable, multipurpose resource that will serve the farmers for many years. The mature tree of the older fencerows needs some pruning so that the trunk seldom reaches more than two meters above the ground. This prevents the trunks from forking and splitting and encourages the proliferation of new branches within their reach. The brush fill needs to be replaced periodically, because it often sinks too low to keep cattle out of the fields.

Preservation and extension of land: The fencerows not only retard channel cutting and limit erosion, they trap floodwater sediments as well. Thus farmers increase and maintain the land base. As the floodwater surges and begins to overflow into the space between the fencerows and the edge of the field (usually protected by another older fencerow) the force of the water is broken by the brush fill of the fencerow. The sediment load then settles out and is deposited behind the trees. Flood by flood, enough fine alluvium is accumulated behind the fencerows for cultivation eventually to be extended out to the fencerow itself.

Fertilising: Farmers rely on rich floodwater sediments as manure from the river "abono del rio" to repenish soil nutrients. After the force of the floodwater is dissipated by the living fencerows, the water spreads out over the floodplain field and their nutrient-rich particles become part of top soil of these fields.

Additional benefits: Wood obtained from fencerows is used for the construction of gates, weirs, pens, corrals, and stores. Cottonwood is utilised as kindling, thereby conserving sources of preferred hardwood, such as *Prosopis juliflora*. Larger trees also often provide shade for workers, especially important on hotter days. These trees shelter numerous species of birds, inlcuding some that are insectivorous; they utilize the trees for shelter and feed over the water and croplands. Since few farmers can afford to use insecticides they consider blackbirds very beneficial. These birds follow them when they plow their fields, and eat the larvae exposed in the furrows. The brush of the woven fencerows may shelter a number of species of rodents and low-nesting birds, which have been a significant food resource in the past.

Conclusions: Floodplain farming is dependent on living fencerows for its environmental stability. Propagated fencerows of willow and cottonwood maintain, extend and enhance floodplain fields. These ecological filters also protect fields from cattle, harbor agents for biological control of pests, and provide a renewable supply of wood. Traditional Sonoran farmers do not perceive these trees as phreatophytic pests, as their Anglo-american neighbors do (251).

Lessons learned:

- Sound watershed management is possible by utilising local tools and vegetation to establish living woven fences;
- Communal (ejidal) work is restricted to activities which are beyond the means of individuals (irrigation systems).

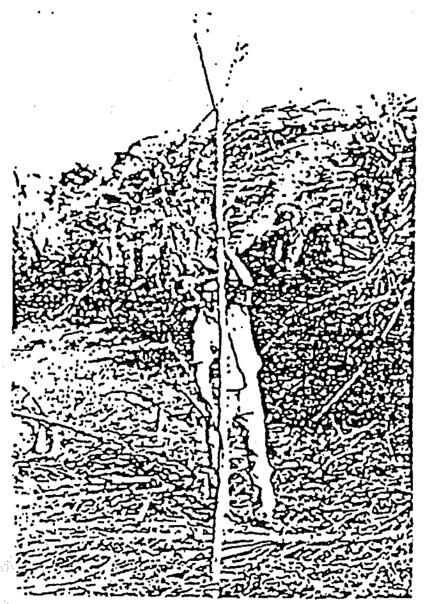

Figure 84: Pruning cuttings for preparation of a woven fencerow in San Miguel Watershed in Sonora/Mexico (251)

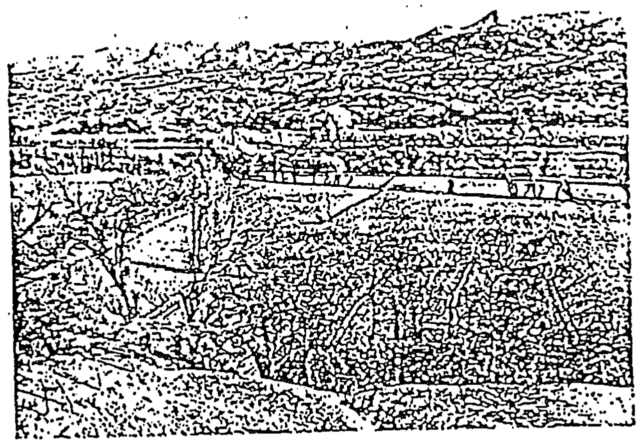

Figure 85: Overview of the floodplain in an arid Watershed in Sonora/Mexico (251)

Both remnant fencerows and more recent, continuous fencerows are apparent

Figure 86: Woven Fencerows (251)

Branches have begun to be woven between the cuttings of a newly propagated fencerow. Note the thickness of the woven brush in the older fencerows in the background.

Case study four: The Combretum Rice system: a vernacular pattern of tree border planting in South East Asia

Border tree planting (on-farm): On good level land, where farmers are not beset by extensive problems of site degradation through erosion and run-off and therefore do not require the protective role of trees, the motivation to intercrop with trees may be low: the desire to use every piece of fertile land is great. Thus, it is common to find vast areas of level croplands almost treeless.

However, border tree planting as a form of lowland use gains adherents when the free common vegetation does not provide field fodder, green manure, etc. or when the market value of trees increases (371). Individual trees along border lines do not occupy too much space, nor do they shade large areas of the field, because the treerows are not actually in the field, they do not interfere with regular farming operations (381). One vernacular system is often found in Asia.

The Combretum rice system: In Southeast Asia, in areas with an annual rainfall varying from 1500-2000 mm over five or six months the Combretum rice system is common. Farming activities mainly consist of rice cropping, which is done in the rainy season, but trees have always been planted in conjunction with rice. The rice fields in the form of squares of one hectare each are bounded by small dikes which are planted with two rows of *Combretum quadrangulare* at 1.5 x 1.5 m between and within the rows. Sometimes *Calophyllum insophyllum* is planted on large dikes to produce seeds from which oil is extracted for lighting.

Combretum is managed under a coppice system with a rotation of five to six years. This means that each year farmers cut between one fifth and one sixth of the total length of their dikes. Fuelwood production from the first cutting is estimated at between 0.6 and 1.0 m^3 per 400 meters per year. In the second and third rotation this production may double (30). This system clearly indicates the high potential of integrating hedge-like planting in lowland humid regions dominated by treeless cropping, e.g. rice.

APPENDIX TWO: RESOURCE PERSONS AND CONTACT ADDRESSES OF PEOPLE CONCERNED WITH HEDGEROW - A TENTATIVE LIST

Agriculture, Man and Ecology, Groenekanseweg 90, 3737 AH Groenekan, Netherlands

Agroecolog. Dev. Inform., c/o Ökozentrum, 4338 Langenbruck, Switzerland

Agruro-Agrobiologia Universidad, Casilla 1836, Cochabamba, Bolivia, c/o Franz AUGSTBURGER

Botanisches Institut der Universität, Im Neuenheimer Feld 360, 6900 Heidelberg, Fed.Rep.of Germany, c/o Prof. Dr. K. EGGER

CARE, c/o John M. KRAMER, Program Coordinator, Renewable Natural Res., 660 First Avenue, New York, N.N. 10016, USA

CEMAD (Centro de Estudios Mesoamericanos sobre Tecnologia appropriada), Apartado Postal 1160, Guatemala

Canadian Forestry Service, 351, St. Joseph, Hull, Quebec, Canada KIA IG 5, c/o L.W. CARLSON, Director

CATIE (Centro Agronomico Tropical de Investigacion y Ensenanza), Turrialba, Costa Rica *

Centre for Sciences and Environment, 807 Vishal Bhawan, 95 Nehru Place, New Delhi, 110019, India, c/o Anil Agrawal,

Departmento de Ciencia Agraria, Nucleo Universitario "Rafael Rangel", Universidad de los Andes, Trujilo Estado Trujilo, Venezuela, c/o Eduardo E. ESCALANTE

EWC (East-West-Center), East-West-Road, Honolulu, Hawaii

ETC (Foundation Educational Training Consultants), Information Centre for low External Input Agriculture (ILEIA), P.O.Box 64, 3830 AB Leusden, Netherlands

FAO (Food and Agriculture Organisation), Forestry Department, Via delle Terme di Caracalla, Rome, Italy

Foundation for Ecological Development Alternatives, P.O.Box 168, 2040 Zandvoort, Netherlands

Foundation Ghana Organic Agricultural (AGOMEDA Project), General Foulkesweg 50, 6703 BT Wageningen, Netherlands

GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit), Dag-Hammarskjöld-Weg 1, 6230 Eschborn, Fed.Rep.of Germany, c/o Dr. D. BURGER

ICRAF (International Council for Research in Agroforestry), P.O.Box 30677, Nairobi, Kenya *

IDF (L'Institut por le Developpement Forestier), Avenue Bosquet 75007 Paris, France c/o C GUINAUDEAU

IITA (International Institute of Tropical Agriculture), Oyo Rd, PMB, 5320 Ibadan, Nigeria *

IITA, Sri Lanka Program, 133 Dharmapala Mawatha, Colombo, Sri Lanka, c/o Ray WIJEWARDENA

ILCA (International Livestock Center for Africa), P.O.Box 5689, Addis Ababa, Ethiopia *

Internationaal Agrarisch Centrum, Postbus 88, 6700 AB Wageningen, Netherlands

International Resources Dev. Conserv. Services, 5797 Bogart, Boise, Idaho 83703, USA, c/o Fred R. WEBER

IUCN (International Union for Conservation of Nature and natural Resources), Avenue de Mont Blanc, Gland, Switzerland

Mindanao Baptist Rural Life Center, P.O.Box 95, Davao City, Philippines. c/o Rev. Harold R. WATSON

NFTA (Nitrogen Fixing Tree Association), P.O.Box 610, Wimanalao, Hawaii, USA

Peace Corps, Internat. Collection and Exchange, 806 Connecticut Av., N.W. Washington, D.C. 30526, USA

Permaculture Institute, P.O.Box 96, Tasmania, 7331, Australia, c/o Mr. MOLLISON

Cornell University, Ithaca, New York, 14853, USAD. c/o PIMENTAL, Dept. of Ecology and Systematic

Pakistan Forest Institute, Director General, Peshawar, Pakistan

Royal Botanic Gardens, Kew West, London, U.K. c/o Sepasat Project or Dr. G.E. WICKENS

Social Forestry Network, Overseas Develop. Institute, Regent's College, Inner Circle, London NW1 4NS, U.K.

Universität Hohenheim, P.O.Box 700562, 7000 Stuttgart, Fed.Rep.of Germany, c/o G. ESPIG

Universite de Ouagadougou, Institut Superieur Polytechnique, Ouagadougou, Burkino Faso

Wau Ecology Institute, P.O.Box 77, Wau, Papua-New Guinea

* prime contact addresses are some research institutions

APPENDIX THREE: BIOMASS DATA FROM HEDGEROW SYSTEMS

Table 39: Annual biomass production (dry weight in kg) from *Erythrina poeppigiana* pollarded once, twice, and three times a year in Turrialba (Costa Rica)

Pollarding frequency (monthly interval)	harvested biomass per tree per yeara)				fallen leaves	product	total biomass
	leaf	branch	total	ha	ha	ha	ha
1 (12)	11.7	54.3	66.0	18,470	15.3	81.3	22,750
2 (6)	13.9	28.2	42.1	11,800	6.8	48.9	1,314
3 (4)	15.5	12.5	28.0	7,850	-	28.0	?

a) original data from 311 rounded up

Table 40: Fodder and fuel production (kg/100 m) from pollarded *Erythrina poeppigina**

Frequenc. o.Pollard.	1	2	3	1	2	3
Spacing		5 x 5 m			3 m	
Fodder	234	278	310	390	463	517
Fuelwood	1,086	564	250	1,810	940	417

* biomass data taken from (311)

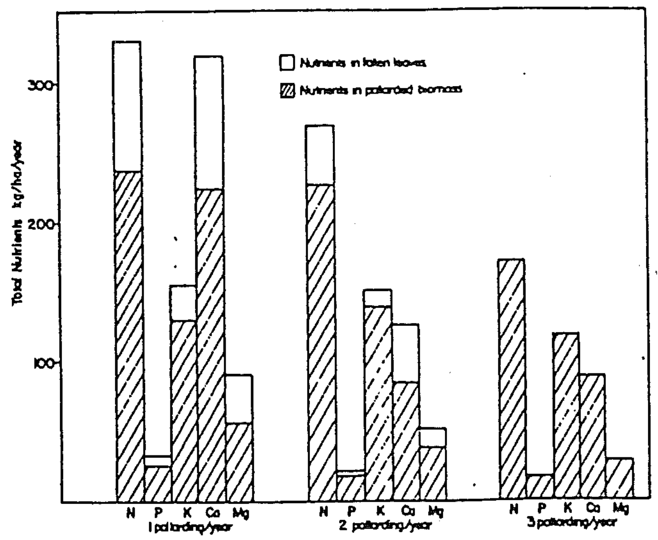

Figure 87: Total nutrients recycled by pollarding and fallen leaves from *Erythrina poeppigiana* trees in Costa Rica (311)

Table 41: Biomass production from a 5 year old *Gliricidia* hedge in Sri Lanka (in kg green weight) (59)

frequency of pruning monthly	% interval leaves	harvestable/yr[a)] plants[b)] leaves	branch.[c)]	total	harvestable/yr/100m[e)] ha[d)] (total)	leaves	branches	total
6 (2)	61	4.6	3.0	7.6	56,296	1,022.2	666.7	1,688.9
4 (3)	58	5.8	4.2	10.0	74,074	1,288.9	933.3	2,222.2
3 (4)	46	3.5	4.2	7.7	57,037	777.8	933.3	1,711.1
2 (5)	36	2.6	4.5	7.1	52,593	577.8	1,000.0	1,577.8
2 (6)	33	2.9	6.0	8.9	65,926	644.4	1,333.3	1,977.7

a) fallen leaves are not included
b) spacing 0.45 cm
c) calculated
d) 0.45 x 3 m spacing
e) spacing 0.45 cm

Table 42: Biomass from *Calliandra callothyrsus* in Costa Rica (21)

Vegetative parts	Age of the harvest (months)	Spacing treatments (cm) 25 kg	%	50 kg	%	100 kg
Leaves	5	89	68	92	61	73
	10	2765	63	2129	58	1722
Green stems	5	11	8	13	9	14
	10	527	12	514	14	373
Woody stems	5	31	24	46	30	37
	10	1098	25	1027	28	775
Total*	5	131(a)	100	151(a)	100	124(a)
	10	4390(a)	100	3670(a)	100	2870(b)

* Values within a line having the same letter do not differ statistically (p = 0.01)

Table 43: Biomass production of *Leucaena* and *Calliandra* hedges under different cutting height regimes in Rwanda (263)

Species	Cutting height	annual biomass production t/ha leaves	wood	total	kg/100 m total
Leucaena	80	3.88	177	5.65	102
	45	2.55	1.11	3.66	66
Calliandra	165	10.59	5.83	16.42	196
	50	7.00	3.33	10.33	124

Table 44: Biomass production of various multi-row hedges in Rwanda (298)

Plants	plant rows	cutting height	biomass (ha)	biomass (100m)	remarks
Leucaena	1				
Tithonia	1	120	8.14	147	Tithonia = 84 %
Lantana	1				of total yield;
Euphorbia*	1				
Leucaena	2				Tithonia = 68 %
Tithonia	1	110	23.10	462	of total yield
					(without trees);
Leucaena	2				Leucaena = 73 %;
Morus	1	100	3.96	59	of total yield
Euphorbia*	1				(with trees);
Leucaena	1				Morus = 60 %
Mourus	2	100	5.09	59	of total yield
Euphorbia*					(with trees);
Leucaena	1				
Euphorbia*	1	75	4.11**	31	with trees
Calliandra	1				
Euphorbia*	1	75	10.04**	75	with trees

*Euphorbia only at outer row of hedge, without regular contribution to biomass production;
**Means of two hedges;

Table 45: Biomass yield of alley-cropped tree species in dry weight (t/ha/yr) during second year of their establishment at ICRAF Field Station, Kenya (255)

Hedgerow cut. height (cm)	Leucaena 3	4	5	6	mean	Cassia 3	4	5	6	mean	Gliricidia 3	4	5	6	mean
	row spacing (m)														
30	1.8	2.0	1.6	1.9	1.8	1.4	1.8	1.4	1.4	1.5	0.6	0.8	0.6	0.4	0.6
60	1.6	2.1	1.4	1.6	1.7	1.7	1.9	1.7	1.6	1.7	0.5	0.5	0.4	0.5	0.5
90	1.6	1.5	1.3	2.0	1.6	1.3	1.6	1.3	1.2	1.4	0.4	0.5	0.4	0.4	0.4
mean	1:7	1.9	1.4	1.8	1.7	1.5	1.8	1.5	1.4	1.6	0.5	0.6	0.5	0.4	0.5

Notes
- *Leucaena leucocephala* and *Cassia siamea* hedgerows were established from transplanted seedlings, *Gliricidia sepium* from cuttings.
- The trial is laid out on gently sloping land. The narrower spacings fall on the more sloping area with shallower soils and therefore those hedgerows are generally less vigorous than the widely spaced ones.
- Pruning regime: *Leucaena leucocephala* 1985: March and October, 1986: four times; *Cassia siamea* 1985: October (30 cm only), 1986: three times; *Gliridcidia sepium* 1985: none, 1986 twice (March and October)

APPENDIX FOUR: BACKGROUND INFORMATION ON HEDGE PLANTS

Table 46: List of some species and examples of geographical occurrence

SPECIES, COUNTRIES AND REGIONS

Species	Country/Region	Source
Acacia albida	Haiti, Nigeria, Chad	62,177,406
A.ataxacantha	South America	118
A.decurrens	Central America	118
A.farnesiana	Sudan	215a
A.longifolia	Botswana, Mosambique, Zimbabwe	166
A.mellifera	India, Sri Lanka, Sudan	166,215a
A.nilotica	Sudan	215a
A.saligna	Botswana, Mosambique, Zimbabwe	166
A.senegal	Sudan	215a
A.tortilis	Botswana, Mosambique, Zimbabwe	166
A.villosa	Indonesia	265
Agave americana	India, Mexico, Peru, West Indies, America	34,118,316,337
A.sisalana	Costa Rica, Mexico, Central America	118,315,388
Albizzia gummifera	Rwanda	25
Aloe arborescens	Botswana, Mosambique, Zimbabwe	166
Anacardium occidentale	Costa Rica, Sri Lanka, Thailand, Venezuela, America	12,118,337
Annona cherimola	Rwanda	25
A:reticula	Rwanda	25
Atriplex halimus	Algeria	337
A.nummularia	Algeria	337
Azadirachta indica	Haiti, Nigeria, Thailand	177,353,406
Baccharis sarothroides	Peru	34
Balanites aegyptiaca	Nigeria, Sahel	177,314
Bauhinia rufescens	Sahel	314
Bixa orellana	Costa Rica, Malaysia, West Indies	53,86,332
Bougainvillea glabra	Mexico, New Hebrides, America	54,118,316
Brosium alicastrum	Mexico	216,316
Bursera simarouba	Mexico	316
Caesalpinia bonducella	Mosambique, Zimbabwe	166
C.pulcherrima	Rwanda, America	118,298,337
C.sappan	Indonesia	177,243
Cajanus cajan	Cuba, India, Nigeria, Sudan, Togo, Thailand	152,153a,315a
Calliandra calothyrsus	Costa Rica, Indonesia, Papua New Guinea, Thailand, Rwanda	298,353,359
Carica papaya	Papua New Guinea, Rwanda	25,359
Carissa grandiflora	India, Sudan, West Indies	92,177,332
Cassia siamea	Nigeria, Kenya, Sahel	25,70,254
C.spectablis	Rwanda	25
C.fistula	Rwanda	25
Cassinopsis ilicifolia	Zimbabwe	166
Casuarina equisetifolia	Algeria, Haiti, Malaysia, Papua New Guinea	148,406
Cedrela serrata	Rwanda	25
Citrus aurantifolia	India, Nigeria, West Indies	39,177

Species	Country/Region	Source
Cnidiscolus chayamansa	Cuba, Mexico	90,151,216
Combretum quatrifolia	South Esat Asia	30
Commiphora africana	Botswana, Mozambique, Nigeria, Sahel, Zimbabwe	167,328
Cotoneaster pannosa	Southern Africa	166
Croton megalocarpus	Rwanda	25
C.macrostachyus	Rwanda	25
Crotolaria capensis	Mozambique, Zimbabwe	166
Cupressus lusitania	Algeria, Mexico, Venezuela, Central America	118,316,337
Cyphomandra betacea	Rwanda	25
Dichrostachys cinerea	Botswana, Mosambique, Zimbabwe	166
Diospyros lycioides	Botswana, Mozambique, Zimbabwe	166
D.whyteana	Zimbabwe	166
Dodonaea angustifolia	Mozambique, Zimbabwe	166
D.viscosa	Sudan	215a
Duranta repens	India, Zimbabwe	166
Entada abessinica	Rwanda	25
Erythrina abissinica	Cuba, Rwanda	25,77
E.poeppigiana	Costa Rica	311
Eucalyptus camaldulensis	Haiti	406
E.eremophila	Southern Africa	166
E.lehmannii	Southern Africa	166
E.balsamifera	Nigeria, Sudan, Sahel	215a, 381
E.tirucalli	Sri Lanka, Mozambique, Zimbabwe, East Africa	12,166,177,215a
Flacourtia indica	Botswana, Mozambique, West Indies, Zimbabwe	166,177
Flemingia macrophylla	Nigeria, Indonesia, Philippines, Ivory Coast	202,353
Fouquieria splendens	Mexico	316
Gleditsia triacanthos	Mexico	316
Gliricidia sepium	Colombia, Costa Rica, Cuba, Haiti, Mexico, Sri Lanka, Nigeria, Venezuela	3,17,107,131, 177,188,318,319
Gmelina arborea	Mexico	316
Grevillea robusta	Nigeria,Rwanda	2517
Grevillea banksii	Rwanda	25
Grewia flavescens	Botswana, Mozambique, Zimbabwe	166
G.occidentalis	Mozambique, Zimbabwe	166
Halleria lucida	Zimbabwe	166
Harpephyllum caffra	Mozambique	166
Hibiscus tiliaceum	Mozambique, West Indies, South Africa	166
Jatropha curcas	Angola, Cuba, India, Nigeria, Philippines	13,70,78,152,164 208,254a
Kiggelaria africana	Mozambique, Zimbawe	166
Lannea discolor	Botswana, Mozambique, Zimbawe	166
Lantana camara	Indonesia, Sudan	215a
lawsinia inermis	Nigeria, Sudan	39,166,215a
Leucaena diversivolia	Philippines	353
L.leucocephala	Indonesia, Mexico, Nigeria, Rwanda, Sri Lanka, Thailand	202,242,298, 395,316
		177
Lycium afrum	America	25
Macadamia ternifolia	Rwanda	25
Maesopis eminii	Rwanda	25
Milletia dura	Rwanda	25
M.laurentii	Rwanda	

Species	Country/Region	Source
Mimosa pigra	Thailand	305a
M.scabrella	America	118
Moringa oleifera	Haiti, Thailand, Sri Lanka	215a,406
Morus alba	Rwanda	25,298
M.nigra	Rwanda	25
Opuntia ficus-indica	Egypt, Mexico, Peru, Sudan, Tunisia	79,34,39,104,177
Parkinsonia aculeata	Egypt, Nigeria, Sahel, Sudan, Sri Lanka	12,215a,238
Passiflora edulis	Rwanda	25
Persea americana	Rwanda	25
Phoenix reclinata	Botswana, Mozambique, Zimbawe	166
Pinus patula	Rwanda	25
P.caribaea	Rwanda	25
P.radiada	Rwanda	25
Pithecellobium dulce	India, Malaysa, West Indies, South East Asia, Sudan, Thailand	12,53,166,177 215a,332
Pittosporum viridifl.	Mozambique, Zimbawe	166
Podocarpus milanjianus	Rwanda	25
P.usambarensis	Rwanda	25
Polylepis spp.	Peru	34
Prosopis chilensis	India, Sudan	215a
P.juliflora	Haiti, India, Pakistan, Venezuela, Central America	101,155,181, 215a,406
Psidium guajava	Rwanda	25
Rhus pyroides	Botswana, Mozambique, Zimbawe	166
Schinus molle	Peru	34
Sesbania bispinosa	India	12
S.grandiflora	Sri Lanka	3,
S.roxburgy	Philippines	353
S.sesban	Botswana, Mozambique, Rwanda, Sudan, Zimbabwe	25,166,215a
Simarouba glauca	Haiti, America	166,244,316
Simondsia chinensis	Mexico	316
Syzygium cuminii	Venezuela	107
Vernonia amygdalina	Rwanda, Nigeria	177,298
Ximenia americana	Botswana, Central America, Mozambique, Zimbawe	116
Yucca elephantipes	Costa Rica, Honduras, Guatemala, Mexico	118,316,318
Z.spina-christi	Sudan	215a

REGIONS AND COUNTRIES

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Philippines[274, 379]
Sri Lanka[3,12,67,395]
Thailand[115, 215]
South East Asia[30].

Table 47: Families and genera of hedge plants in alphabetical order

Families	Genera
ACANTHACEAE:	Adhatoda, Barleria
AGAVACEAE:	Agave, Yucca
AIZOACEAE:	Lampranthus
ANACARDIACEAE:	Anacardium, Lannea, Mangifera, Rhus, Schinus, Sclerocarya, Spondias
ANNONACEAE:	Annona
APOCYNACEAE:	Adenium, Carissa, Nerium, Thevetia
AQUIFOLIACEAE:	Ilex
ARALIACEAE:	Brassaiopsis
ASCLEPIADACEAE:	Calotropis, Leptadenia
ASTERACEAE:	Baccharis, Centratherum, Chrysanthemoides, Loricaria, Osteospermum, Vernonia
BALANITACEAE:	Balanites
BERBERIDACEAE:	Berberis, Mahonia
BETULACEAE:	Alnus
BIGNONIACEAE:	Campsis, Jacaranda, Tabebuia, Tecoma
BIXACEAE:	Bixa
BOMBACACEAE:	Adansonia, Bombax, Bombacopsis, Ceiba
BORAGINACEAE:	Cordia, Ehretia
BROMELIACEAE:	Bromelia
BUDDLEIACEAE:	Buddleia
BURSERACEAE:	Balsamodendron, Bursera, Commiphora, Elaphrium
BUXACEAE:	Buxus, Simmondsia
CACTACEAE:	Acanthocereus, Cactus, Cereus, Eulychnia, Hylocereus, Lophocereus, Marginatocereus, Marshallocereus, Nopalea, Opuntia, Pachycereus, Pereskia, Pereskiopsis, Ritterocereus, Stenocereus, Trichocereus
CAESALPINIACEAE:	Acrocarpus, Bauhinia, Bactyrilobium, Caesalpinia, Cassia, Cathartocarpus, Colophospermum, Gleditsia, Parkinsonia, Parkinsonia, Piliostigma, Senna, Tamarindus
CAPPARIDACEAE:	Capparis
CAPRIFOLIACEAE:	Viburnum
CARICACEAE:	Carica
CASUARINACEAE:	Casuarina
CELASTRACEAE:	Celastrus, Maytenus
CHENOPODIACEAE:	Atriplex, Enchylaena, Rhagodia
COCHLOSPERMACEAE:	Bombax, Cochlospermum
COMBRETACEAE:	Combretum, Conocarpus lancifolius, Terminalia
CONVOLVULACEAE:	Batatas, Ipomea
CUCURBITACEAE:	Acanthosicyos
CUPRESSACEAE:	Biota, Cupressus, Juniperus, Platycladus
DICTOYLEDONS:	Cytisus
EBENACEAE:	Diospyros
ELEAGNACEAE:	Eleagnus
EUPHORBIACEAE:	Bridelia, Cnidiscolus, Codiaeum, Croton, Euphorbia, Jatropha, Manihot, Pedilanthus, Securinega, Synadenium

Families	Genera
FAGACEAE:	Quercus
FLACOURTIACEAE:	Aberia, Dovyalis, Flacourtia, Xylosma
FOUQUIERIACEAE:	Fouquieria
GRAMINEAE:	Arundo, Bambusa, Miscanthus, Pennisetum, Phyllostachys, Vetiveria
KOEBERLINIACEAE:	Koeberlinia
LABITAE:	Westringia
LAURACEAE:	Laurocerasus, Persea
LILIACEAE:	Aloe, Dracaena
LOGANIACEAE:	Strychnos
LYTHRACEAE:	Laurus, Lawsonia
MAGNOLIACEAE:	Drimys
MALPIGHIACEAE:	Byrsonima
MALVACEAE:	Hibiscus
MELIACEAE:	Azadirachta, Cedrela, Khaya, Trichilia
MENISPERMACEAE:	Cocculus
MIMOSACEAE:	Acacia, Acuan, Adenium, Albizia, Calliandra, Ceratonia, Cordeauxia, Crotolaria, Desmanthus, Desmodium, Dichrostachys, Dolichos, Entada, Leucaena, Mimosa, Parkia, Pithecellobium, Prosopis
MORACEAE:	Artocarpus, Brosium, Ficus, Morus
MORINGACEAE:	Moringa
MYOPORACEAE:	Eremophila
MYRTACEAE:	Callistemon, Eucalyptus, Feijoa, Leptospermum, Myrtus, Psidium, Syzygium
Nyctaginaceae	Bougainvillea,
OLACACEAE:	Ximenia
OLEACEAE:	Jasminum, Ligustrum, Olea
PALMAE:	Borassus, Butia, Hyphaene, Phoenix, Washingtonia
PANDANACEAE:	Pandanus
PAPILIONACEAE:	Chamaecyparis, Chamaecytisus, Cajanus, Corallodendron, Dalbergia, Erythr ina, Gliricidia, Leucaena, Pterocarpus, Schotia, Sesbania, Spartium
PETULACEAE:	Alnus
PINACEAE:	Cedrus, Pinus
PITTOSPORACEAE:	Pittosporum
PLATANACEAE:	Platanus
POLYGONACEAE:	Coccoloba
PROTEACEAE:	Grevillea
PROTULACEAE:	Portulacaria
PUNICACEAE:	Punica
RHAMNACEAE:	Paliurus, Rhamnus, Ziziphus
ROSACEAE:	Cotoneaster, Crataegus, Photinia, Polylepis, Prunus, Pyracantha, Pyrus, Raphiolepis
RUBIACEAE:	Craterispermum, Gardenia, Hamelia, Randia
RUTACEAE:	Adhatoda, Aegle, Citrus, Eremocitrus, Fagara, Poncirus
SALICACEAE:	Populus, Salix
SALVADORACEAE:	Azima, Salvadora
SAPINDACEAE:	Dodonaea
SAPOTACEAE:	Butyrospermum, Manilkara

Families	Genera
SIMAROUBACEAE:	Kirkia
SOLANACEAE:	Acnistus, Datura, Lycium
STERCULIACEAE:	Sterculia
STYRACEAE:	Styrax
TAMARICACEAE:	Tamarindus, Tamarix
TILIACEAE:	Grewia
ULMACEAE:	Celtis, Ulmus
URTICACEAE:	Urera
VERBENACEA:	Cornutia, Gmelina, Lantana, Stachytarpheta, Tectonia, Vitex
VITACEAE:	Vitis

Source:94, 166,177,238,328,

Table 48: Koeppen climate class codes *

Koeppen Class	Mean Annual Rainfall in mm	Dry Period(s) Tot. No. of dry months (<50 mm) per yr.	No. of dry Periods per yr.	Temperature in degree C Annual Mean	Mean Coldest Month	Mean Hottest Month	Remarks
Af	>1500	-	none		>18		permanently humid
Am	>1500	<4	1(short)		>18		monsoonal,short dry season
Aw	600-1500	4-8	1		>18		subhumid; drier than Am
Aw"	600-1500	4-8	2		>18		as Aw, but humid bimodal rainfall
BSh	250-600	8-10	1 or 2	>18			semi-arid, hot; "steppe", "sahel"
BSk	250-600	8-10	1 or 2	<18			semi-arid, warm to cold
BWh	<250	11-12	1	>18			arid, hot desert
BWk	<250	11-12	1	<18			arid, warm to cold
Cfa	>1200	-	none		<18 >-3	>22	humid subtropics incl. montane humid
Cfb	>1200	-	none		<18 >-3	10-22	temperate maritime
Cw	500-1200	2-6	1		<18 >-3	>10	highland subhumid; summer rainfall
Cw"	500-1200	2-6	2		<18 >-3	>10	highland subhumid; bimodal rainfall
Cs	300-800	6	1		<18 >-3	>10	mediterranean; winter rainfall
D					<-3	>10	temperate continental; also trop. and subtrop. montane zone
E					<-3	<10	cold tundra; also high montane zone

Values of "Mean Annual Rainfall" and "No of Dry Months" are guidelines and not Koeppen Class definitions

* slightly modified from 64

Table 49: List of some species, their site adaptability and example of geographical occurence of hedge plants

SPECIES		CLIMATE						SOILS				
	Botanical name	climatic class	altitude (m)	mean annual rainfall (mm)	drought hardy	frost hardy	texture	reaction	drain.	Other characteristics	remarks	source
No	1	2	3	4	5	6	7	8	9	10	11	12 13
Tropical highlands:												
1.	A.decurrens	Af,Aw,Cs,Cw,Cfa,Cfb	25-1000	900-1600	-	F	L,M	NE	W		IN	64,254a
2.	E.americana	-	-	-	-	-	-	-	-	-	-	328
3.	E.poeppigiana	Aw,Cfa	500-1500	>2000?	-	-	L	AL	W	-	-	42,64,
4.	Gleditsia triacanthos	Bsh,Bsk,Cfa,Cfb,Cs,Cw,D	>1500	400-1500	V	-	L	AL	S,W	SA	IN	64,254a
5.	Grevillea robusta	Cfa,Cfb,Cw,(Bsh,Bsk)	1000-1800	750-1500(400-2500)	H	M	L	NE	W		IN,LD	64,318
6.	Melia azadirach	Am,Aw,Bsh,Bsk,Cfa,Cfb,Cs,Cw	-2000	600-1000		M	H,L,M	AC,NE	W(S)	SA,SH	IN	64,254a
7.	Opuntia ficus-indica	Aw,Bwh,Bsk,Cs,Cw	-3300	>150	-	-	L,M	-	-	-	-	64,94,106,328
8.	Robinia pseudoacacia	Cs,Cw,D	-2500	1000	V	-	-	-	-	-	-	64,94
9.	Schinus molle	Bsh,Bsk,Bwk,Cw	-3300	300-650	-	-	L,M	AL,NE	S,W	SA	IS,LD	34,64,328
Humid tropics:												
1.	Bixa orellana	Aw	-	50-1750	-	-	H,M	AC,NE	S,W	-	-	64,89
2.	Bougainvillea glabra	Aw,Cs	-	-	-	-	-	-	-	-	-	64,166,177,304
3.	Brosium alicastrum	Aw	-800	-	-	-	H,L,M	AL,NE	-	-	-	64
4.	Bursera simarouba	Aw	-1000	500-1400	-	-	H,L,M	-	-	-	-	51,64,107,254a
5.	Calliandra calothyrsus	Af,Aw,D	-	150-1500	-	-	L	AC,NE	S,W	-	-	21,64,177,254a
6.	Carica papaya	Aw	-2000	-	-	-	-	-	-	-	-	258,304
7.	Casuarina equisetifolia	Aw,Bsh,Bsk,Cfa,Cfb,Cw,Cs	-1500	700-5000	V	-	L,M	AL	S,W	SA	-	64,166,238,332
8.	Ceiba pendantra	Af,Aw	-	-	-	-	L,M	AL,NE	W	-	LD	64
9.	Citrus aurantifolia	Aw	-	-	-	-	-	-	-	-	-	39,153,177
10.	Cnidiscolus chayamansa	Aw	-1300	-	-	-	M	-	-	-	-	90,275
11	Dichrostachys cinerea	Aw,Cfa,Cfb,Cs,Cw	-	300-600	-	-	L,M	AC,NE	W	SA,SH	-	64,177,238
12.	Erythrina abissinica	Aw	200-2400	1000-1200	V	-	H,L,M	-	-	-	-	64,328
13.	Flemingia macrophylla	Aw	-	-	-	-	-	AC	-	-	-	365
14.	Gliricidia sepium	Af,Am,Aw	500(1600)	1500-2300	-	-	H,L,M	AC,NE	S,W	(SH)	-	27,64,254a
15.	Gmelina arborea	Am,Aw,Cfa,Cfb	-1000m	750-4550	-	-	L	NE	W	-	-	64,166,254a,328
16.	Hibiscus tiliaceum	Aw	<500	-	-	-	L,M	-	S	-	-	58,64,166,254a
17.	Leucaena leucocephala	Af,Am,Aw,Cfa,Cfb,(Bs)	-500	600-1700	-	-	L,M(H)	AL,NE	S,W	(SH)	-	64,254a,328
18.	M.scabrella	Af,Aw	-2400	1100-3500	-	-	L	AL,NE	S,W	-	-	64,226
19.	Moringa oleifera	Aw,Cs,Cw	-1000	300-1100	V	-	L,M	AC,NE	W	(SH)	-	64,304,328
20.	Sesbania bispinosa	Af,Am,(Bs)	-1200	550-1100	-	-	L	AL	S	SA	-	64,254a
21.	S.grandiflora	Af,Am,Aw,Bs	-800	1000	-	-	L,M	AC,AL,NE	S	-	-	64,254a
22.	Simarouba glauca	Aw	-1000	-	M	-	L,M	AC,NE	W	SH	-	
23.	Vernonia amygdalina	Aw	-	-	-		L,M	-	-	-	-	275,298

SPECIES		CLIMATE						SOILS				
	Botanical name	climatic class	altitude (m)	mean annual rainfall (mm)	drought hardy	frost hardy	texture	reaction	drain.	Other characteristics	remarks	sources
No	1	2	3	4	5	6	7	8	9	10	11	12
Arid and semi arid regions:												
1.	Acacia albida	Aw,Bsh,Bwh,Bwk,Cfa,Cf	-	100-1450	-	-	M,L	NE	W	SA	-	23a,64,84,238,328
2.	A.ataxacantha	Bw, sm	-	300-1200	H	-	L	-	-	-	-	64,188
3.	A.campagei	a	75-100	125-500	H	-	-	-	-	-	-	338
4.	A.catechu	a,s	-	-	-	H,L	-	-	-	-	--	304
5.	A.constricta	a,s	-	300-1200	-	-	L	-	-	-	-	328
6.	A.farnesiana	Bs,Bw	-	200-4050	-	-	L	AL	W	SA	-	64,177,328
7.	A.greggii	Bs	<1500	<300	-	-	-	-	-	-	-	328
8.	A.longifolia	s,sm	500-1500	-	M	L	-	-	-	-	IN	64,166,177,328
9.	A.macrostachya	Bs	-	400-1200	-	-	L	-	-	-	-	328
10.	A.mellifera	Bsh,Bsk,Bwh,Cfa,Cfb,Cs	-	50-1300	-	M	L,M	AL,NE	W	SH(SA)	-	23a,238,328
11.	A.nilotica	Aw,Bsh,Bwh,Cfa,Cfb,Cw	-500	300-600	H	-	M	AL,NE	S,W	SA	IN	23a,64,238,254a,328
12.	A.saligna	Bsh,Bsk,Cfa,Cfb,Cs,Cw	-	350-600(1000)-	-	-	L,M	AL,NE	W(S)	SA,SH	IN	64,328
13.	A.senegal	Bs	-1700	200-800	V	-	L,M	-	-	-	-	64,238,328
14.	A.tortilis	Bsh,Bsk,Bwh,Cfa,Cfb,Cs,Cw	-	100-1000	V	M	-	AL,NE	W	SA,SH	(IN)	64,166,238,328.
15.	Agave americana	Aw,Bs,Cw	-3600	-	-	-	H,L,M	AL,NE	-	-	-	34,64,166,166,172
16.	A.sisalana	Aw,Bs	-	-	-	-	-	-	-	-	-	166,177
17.	Aloe arborescens	-	-	650-1500	-	-	-	-	-	-	-	32,166,177
18.	Anacardium occidentale	Bs	-1500	500-3750	-	-	-	-	-	-	-IN	64,166,177,238,328,
19.	Atriplex halimus		-	>150	-	-	L,M	-	-	SA	-	64
20.	A.nummularia	Bsh,Bsk,Bwh,Cfa,Cfb,Cs,Cw	-	120-150	-	-	M	AL	S,W	SA	IN	
21.	Azadirachta indica	Aw,Bsh,Bsk,Bwh	50-1500	450-1150	V	-	L	AL,NE	W	-	IN,IS	64,166,328
22.	Baccharis sarothroides	a,s	-3700	>500	-	M	H,L,M	AC,AL,NE	-	-	-	34,94
23.	Balanites aegyptiaca	Aw,Bs,Bwh,Cw	400-1500	450-1150	-	-	H,L,M	AL,NE	S,W	SA	BS	64,238,328
24.	Bauhinia rufescens	Bs	-	300-600	-	-	L	-	-	-	-	23a,64,328
25.	Caesalpinia bonducella	s	350	-	-	-	L	AL	-	SA	-	328
26.	C.pulcherrima	Aw,Bs,Cs	-2000	-	-	-	-	-	-	-	-	94,151,328
27.	Cajanus cajan	Aw,Bw	-3000	400-1000	-	-	H,L,M	-	-	-	-	151,254a
28.	Capparis decidua	BSh,Bw	-	100-1000	-	-	L	AL	-	SA	-	23a,328

SPECIES Botanical name		CLIMATE climatic class	altitude (m)	mean annual rainfall (mm)	Ddought hardy	frost hardy	SOILS texture	reaction	drain.	other characteristics	remarks	source
No	1	2	3	4	5	6	7	8	9	10	11	
Arid and semi arid regions												
29.	Cassia artemisoides	Bs	-	200-500	M	-	L	-	-	-	-	64
30.	C.siamea	Aw,Bsh,Cfa,Cfb,Cs,Cw	lowland	>1000 (500)	-	-	L,M	AC,NE	W	-	-	39,64
31.	Chamaecytisus palmensis	Bwh,Cf,D	-1800	300-1270	M	F	-	-	-	-	-	64,328
32.	Colophospermum mopane	Bs, Bw	-900	200-450	-	-	H,L,M	AL,NE	-	SA	-	23a,64
33.	Combretum aculeatum	Bs	-	300-600	-	-	-	-	-	-	-	23a,328
34.	C.micranthum	Bs	-1000	300-1500	M	-	-	-	-	-	-	23a,101,328
35.	C.paniculatum	Bs	>600	-	-	-	H,M	-	-	-	-	328
36.	Commiphora africana	Bs	100-1800	350-750	H	-	L,H	-	-	-	-	59,64,177
37.	Cordeauxia edulis	Bs,Dwh	-	-	-	-	L	AL	W	-	-	23a,238
38.	Cotoneaster pannosa	Bs,	-	-	-	-	M	-	-	-	-	
39.	Cupressus lusitania	-	-1500	800	M	-	-	-	-	-	-	166
40.	C.sempervirens	Bwh	400-600	-	-	-	L	-	-	-	-	166
41.	Dodonea viscosa	Bs	-200?	>300	-	-	L,H	AL	-	-	-	64,328
42.	Duranta repens	-	-	>300	-	-	H	-	-	-	-	166
43.	Eleagnus angustif0lia.	Bs	-	>300	-	-	H,L,M	-	-	-	-	94
44.	Erythrina flabelliformis	-	-	900-2000	-	-	L	-	-	-	-	328
45.	Eucalyptus camaldulensis	Aw,Bsh,Bsk,Bwh,Bwk,Cfa,Cs,	1200	400-1250	-	-	L,M	AL,AC,NE	S,W	SA(SH)	IN,LD	64,238,254a
46.	E.lehmannii	BSh	-	100-600	-	-	H,L,M	-	-	-	-	166
47.	Euphorbia balsamifera	Bs,Bw	-	700	-	-	L	-	-	-	BS	39,64,177,381,272
48.	E.tirucalli	-	-	>600	-	-	-	-	-	-	-	64,177,230
49.	Ficus capensis	-	-2400	500-1300	-	-	L	-	-	-	-	64
50.	Flacourtia indica	Bs, Bw-	-2150	40-450	-	-	-	-	-	-	-	177
51.	Fouquieria splendens	Bs,Bw	-	300-600	H	-	L,H	-	S	-	ST	177,328
52.	Grewia flavescens	-	-	-	M	M	L	-	S	-	ST	328
53.	G.occidentalis	-	-	-	-	-	-	-	S	-	-	328
54.	Halleria lucida	-	-	-	-	H	-	-	-	-	ST	64,89
55.	Harpephyllum caffra	Bwh	-	800-1200	-	-	-	-	-	-	-	64
56.	Ilex aquifolia	Aw,Am,Bsh,Bwh,	-1700	-750	V	M?	H,L,M	-	-	-	-	166,177,227

SPECIES Botanical name		CLIMATE climatic class	altitude (m)	mean annual rainfall (mm)	drought hardy	frost hardy	SOILS texture	reaction	drain.	other characteristics	remarks	source
No	1	2	3	4	5	6	7	8	9	10	11	12
Arid and semi arid regions												
57.	Jatropha curcas	s,sm,Cw	-	-	-	-	H	-	-	-	-	64,166,328
58.	Kiggelaria africana	s,sm	-	-	-	-	L	-	-	-	-	166
59.	Lannea discolor	Bs,Bw,Cs	-	-	-	-	H,L,M	-	-	-	-	64,328
60.	Lantana camara	Bwh	-	-800	-	-	-	-	-	-	-	54,94,166
61.	Laurus nobilis	Bw	-1500	500-1000	-	-	L	-	-	-	-	64
61.	Mimosa pigra	Bw,Bs,Cw	-	-	-	M	L,M	AC	W	-	LD	328
62.	Morus alba	Bwh	-	>800	-	-	H,L,M	-	-	-	-	25,124,166,298
63.	Myrtus communis	Bsh,Bsk,Bwh,Cs,Cw	-1300	200-1000	V	M	L,M	AL	W	SA	IS,IN,LD	227,328
64.	Parkinsonia aculeata	Bsh,Bsk,Cs,Cw,Cfa,Cfb	-1000+	250-800	M	F	L,M	AC,AL	W	SH(SA)	IS(IN),LD	39,64,89,166,254a
65.	Pinus halepensis	Am,Aw,(Bs)	-1800	450-600	-	-	L,M	AC,NE	S,W	SA	-	64
66.	Pithecellobium dulce	Bs,Bw,Bwk	-	-	-	-	-	-	-	-	-	64,177,254a,328
67.	Pittosporum viridifl.	Bsh,Bsk,Bwh,Bwk,Cs,Cw	350-1250	200-400	V	M	L	AL,NE	W	SA	IN,LD	64,81
68.	Prosopis chilensis	Aw,Bsh,Bwh,Bwk,C	-1500	100-850	-	-	L	AL,NE	S,W	SH(SA)	IN,LD	64,94
69.	P.juliflora	Bs,Bwh,Bwk	1000-1500	0-10	V	-	L,M	AL	S,W	SA	IN,LD	23a,64,226,238
70.	P.tamarugo	Af,Aw	850-1500	1000	V	-	L,M	AC	W		IN	155
71.	Psidium guajava	-Aw	-1650	600-1250	-	-	L	AC,AL,NE	-	-	-	254a,318
72.	Pterocarpus erinaceus.	Bw	-	-	-	-	H	AL	-	-	-	23a,188,328
73.	P.lucens	Aw,Bw	-1500	-	M	-	-	AL	-	-	-	272
74.	Punica granatum	-a	-30	-	H	F	L,H	-	S	-	ST	155,304
75.	Rhus pyroides	Af,Bs,Cw	300-1600	350-1000	-	-	M	AC,NE	S,W	SA		328
76.	Sesbania sesban	Bsh,Bwh	1000-1500	250+	-	-	L,M	AL	W	SA	IN,LD	64,254a
77.	Simondsia chinensis	Bsh,Bwh	-	100-500	-	-	L,M	AL	W	SA	IN,LD	94
78.	Tamarix aphylla	Bsh	-	>600	-	-	L,M	-	W,S	-	-	166
79.	Ximenia americana	Am,Aw,Bsh,Bsk,Bwk,Cw	-600	350-500(-2000)	-	-	L,M	AL,NE	W(S)	SA	IS	64,177,238
80.	Ziziphus mauritiania	Bs	-	-	-	-	-	-	S	-	-	64,101
81.	Z.mucronata	Bsh,Bsk,Bwk	-	-	-	-	-	-	S	-	-	64,177
82.	Z.spina-christi	Bsh,Bsk,Bwk	-1500	100	V	-	L,M	AC,NE	W	SA	IN,LD	23a,43,64,188

Table 50: List of species, some of their biological features, reproduction and management

SPECIES		BIOPHYSICAL FEATURES								MANAGEMENT			
Nr	botanical name	live form	height (m)	foli.	arma.	irri-tant	growth rate	seed pretreat.	No of seeds per kg(000)	Applied reproduction	applied managem.	intra-row spacing (cm)	source
Nr	1	2	3	4	5	6	7	8	9	10	11	12	13
Tropical highlands:													
1.	Acacia decurrens	T	6-12(30)	E	x	-	x (xx)	-	70-110	DS,SE,SU	CO,TR	-	64,166
2.	Erythrina americana	T	-	E	-	-	xxx	-	-	CU	-	-	328
3.	E.poeppigiana	T	3-7(20)	-	x	-	xxx	-	3	CU	CO,PO	-	64
4.	Gleditsia triacanthos	T	24	D,S	x	-	xx	x	5.4-9	CO,CU,DS,SE,SU	CO,GR	-	64,254a
5.	Grevillea robusta	T	15-20	E	-	-	xxx	-	51-100	CO,SE	CO,PO,PR	-	64,318
6.	Melia azadirach	T	6-30	D,S	-	-	xxx	x	0.5-2.8	CU,DS,SE,SU	CO,LO	-	64,254a
7.	Opuntia ficus-indica	S,T	1-3(4)	E	-	-	x	-	-	CU,DS	-	>25	64,328
8.	Robinia pseudoacacia	T	13-17(20)	D,S	x	-	xxx	x	35-70	CO,CU,DS,SE,SU	CO,LO,PO	-	64,254a
9.	Schinus molle	S,T	7-10	-	-	-	x	-	14-44	SE	CO	-	34,64,328
Humid tropics:													
1.	Bixa orellana	S,T	40	-	-	-	-	-	-	DS	CO	-	64,89,177
2.	Bougainvillea glabra	C,S,T	24	E	-	-	xx	-	-	CU	-	50-200	166,177
3.	Brosium alicastrum	T	15	E	-	-	xx	-	-	DS,SE	LO	50-300	64,216
4.	Bursera simaruba	T	20-30	D	-	-	xxx	-	-	CU,DS	LO,PO	-	51,64,107,254a
5.	Calliandra calothyrsus	S	4-6(12	E(D	-	-	-	-	19	CO,CU,DS,	-	25-100	64,254a
6.	Carica papaya		2-10	-	-	-	xxx	-	76.3	DS,SE	-	-	258
7.	Casuarina equisetifolia	T	25(50)	-	-	-	xxx	-	600-1400	CO,CU,DS,SE,SU	CO	100-200	64,254a
8.	Ceiba pendantra	T	10-15(30)	D,E	-	-	xx	x	10-45	CO,CU,SE	CO,LO,PO	-	
9.	Citrus aurantifolia	T	5-7(10)	S, E	-	-	-	-	100-200	DS,SE	-	-	39,177
10.	Cnidiscolus chayamansa	S	5-7	E	-	-	xxx	-	-	CU,DS	CO	100-500	216,275
11.	Dichrostachys cinerea	S,T	2-4(8)	D,S	x	-	-	-	39	CO,CU,DS,SE,SU	CO,LO,PO	-	64,177
12.	Erythrina abissinica	S,T	-	-	-	-	-	-	0.3-4	CU,DS	CO	-	64
13.	Flemingia macrophylla	S	<2	-	-	-	xx	-	-	DS,SE	CO	-	298,365
14.	Gliricidia sepium	T	10	S	-	-	xxx	x	6.5-8	CO,CU,DS,SE	CO,LO,PO	25-300	64,254a
15.	Gmelina arborea	T	20(30)	S	-	-	xxx	x	0.4-3	CO,CU,DS,SE	CO	-	166,254a
16.	Hibiscus tiliaceus	S,T	3-6(12)	E	-	-	xxx	-	-	CU,DS,CO	CU,DS	-	58,64,166
17.	Leucaena leucocephala	S,T	<20	E	-	-	xxx	x	22	CO,CU,DS	CO,LO	25-200	64,254a
18.	Mimosa scabrella	S	<12	-	-	-	xxx	x	68	DS,SE	CO-	-	64,226
19.	Moringa oleifera	S,T	<7	S	-	-	xxx	-	4-5	CO,CU,DS,SE	CO,LO,PO	30-400	23a,5a.64
20.	Sesbania bispinosa	S,T	2-2.5(4)	-	-	-	xxx	-	-	DS	CO	-	64,254a
21.	S.grandiflora	T	<10	E	-	-	xxx	-	17-20	CU,DS,SE	CO,LO	-	64,254a
22.	Simarouba glauca	T	-	-	-	-	xx	-	0.5-1.5	DS	-	-	
23.	Vernonia amygdalina	S	-	S	-	-	-	-	-	CO,CU,DS,SE	CO	-	275,298

SPECIES		BIOPHYSICAL FEATURES						MANAGEMENT					
Nr	botanical name	live form	height (m)	foli.	arma.	irri-tant	growth rate	seed pretreat.	No of seeds per kg(000)	applied reproduction	applied managem.	intra-row spacing (cm)	source
Nr	1	2	3	4	5	6	7	8	9	10	11	12	13
Arid and semi-arid regions:													
1.	Acacia albida	T	15-25	W	x	-	xx	x	20-40	CO,DS,SE	CO,PO	-	23a,64,153a328
2.	A.ataxacantha	C,S,T	3-5(15)	E,D	x	-	-	-	11	SE	CO	-	64,328
3.	A.cambagei	T	<10	-	-	-	-	-	-	-	SE	-	338
4.	A.catechu	T	10-38	SE	-	-	-	x	-	-	DS,SE	-	
5.	A.constricta	T,S	-	-	-	-	-	-	-	DS,SE	-	-	328
6.	A.farnesiana	S,T	<4	-	-	-	x	-	10-16	SE	CO	-	328
7.	A.greggii	S,T	-	-	-	-	-	-	-	-	CU,DS,SE	-	166,177
8.	A.longifolia	S	-	-	-	-	-	-	47-77	SE	-	-	64,166,177
9.	A.macrostachya	S,T	-	-	-	x	-	-	13-17	-	-	-	23a,153a
10.	A.mellifera	S	3-4(9)	D	x	-	-	x	20	CO,DS,SE	CO	-	23a,153a,238,332
11.	A.nilotica	T	6-12(20)	D(E)	x	-	xxx	x	5-7	DS,SE	LO(CO)	-	23a,64,153a328
12.	A.saligna	S	2-5(8)	E	x	-	xxx	x	14-80	CO,CU,DS,SE,SU	CO,LO,PO	-	64,328
13.	A.senegal	S,T	2-8(17)	D	x	-	x	x	10-33	CO,SE	CO	10	23a,64,153a
14.	A.tortilis	S,T	5-8(20)	E	x	x	xxx	x	12-20	CO,DS,SE	CO,LO,PO	-	64,238,328
15.	Agave americana	S	1-2	-	-	-	xxx	-	-	CU	-	-	166,177
16.	A.sisalana	S	1-2	-	-	-	xxx	-	-	CU	-	-	166,177
17.	Aloe arborescens	S,T	2.3(4)	E	-	-	-	-	-	CU	-	50-100	
18.	Anacardium occident.	S,	6-10(15	E	-	-	-	-	0.15	-	-	100-300	65,153a,238,328
19.	Atriplex halimus	S	-	-	-	-	-	x	0.35-0.8	-	-	-	23a,64
20.	A.nummularia	S	-	E	-	-	-	x	0.05-0.2	CO,CU,SE	CO,LO	-	23a,64,166,328
21.	Azadirachta indica	T	5-20	(D)E	-	-	xxx	x	2-6	CO,DS,SE	CO,LO,PO	100-300	64,153a,166,328
22.	Baccharis sarothrpides.	S	2-3	-	-	-	xx	-	-	DS,CO	CO	60-100	34,94
23.	Balanites aegyptiaca	S,T	6(10)	D,S,E	x	-	xx	x	0.5-1.5	DS,SE(CU,SU)	CO,LO,PO	-	23a,64,153a,328
24.	Bauhinia rufescens	S,T	<8	E	-	-	-	-	9-10	CO,CU,SE	-	100	23a,64,101,153a
25.	Caesalpinia bonduc.	C,S	2-6	D	x	-	-	-	-	-	-	-	328
26.	C.pulcherrima	S,T	2-4	-	-	-	xx	-	-	CU	-	50-200	94,151,328
27.	Cajanus cajan	S	1-3(4)	E	-	-	xxx	-	-	DS	CO	30-100	151,254a

SPECIES botanical name	BIOPHYSICAL FEATURES live form	height (m)	foll.	arma.	irri-tant	growth rate	MANAGEMENT seed pretreat.	No of seeds per kg(000)	applied reproduction	applied managem.	intra-row spacing (cm)	source
Nr 1	2	3	4	5	6	7	8	9	10	11	12	13
Semi-arid Regions:												
28. Capparis decidua	C,S										-	
29. Cassia artemisoides	S	<2	E	-	-	xxx	-	60	SE	-	-	64
30. C.siamea	T	5(15-20)	E	-	-	xxx	x	30-45	CO,DS,SE,SU	CO,LO	100-200	39,64,254a
31. Chamaecytisus palmensis	S	<6	-	-	-	-	-	-	-	-	-	64,328
32. Colophospermum mopane	S,T	<23	D,S	-	-	-	-	-	SE	-	-	
33. Combretum aculeatum	C,S	12-17	-	-	-	-	-	-	-	-	-	23a,64,153a,238,328
34. C.micranthum	S(T)	2-5(10)	-	-	-	-	-	12-30	DS,SU	-	-	23a,64,153a,328
35. C.paniculatum	C,S	-	-	x	-	-	-	13.5	-	-	-	328
36. Commiphora africana	S,T	1-5(10)	D	x	-	-	-	8	CU,DS	-	-	39,64,177
37. Cordeauxia edulis	-	-	E	-	-	-	-	-	DS,SE	-	-	23a,238
38. Cotoneaster pannosa	S	2-3	-	-	-	xx	-	-	-	-	-	64
39. Cupressus lusitania	T	20-40	E	-	-	xx	x	72-250	-	-	100	166
40. C.sempervirens	T	20-40	-	-	-	xx	-	-	-	-	100	84,166
41. Dodonaea viscosa	S,T	<5	E	-	-	xxx	-	70-130	DS, SE	-	100-120	64,166,328
42. Duranta repens	-	16	-	-	-	-	-	-	-	-	-	166
43. Eleagnus angustifolia	S,T	<7	D	-	-	xx	-	6.5-11	-	-	120-180	94
44. Erythrina flabelliformis	S,T	-	-	-	-	-	-	-	CU	-	-	328
45. Eucalyptus camaldulensis	T	<20	E	-	-	xxx	-	200-1000	CO,DS,SE	CO,PO	100-300	64,153a,254a
46. E.lehmannii	T?	-	-	-	-	xxx	-	-	-	-	80-100	166
47. Euphorbia balsamifera	S	<5	-	-	-	-	-	-	CU	-	-	39,64,177,272
48. E.tirucalli	T	2-5(12)	D,E	x	-	xx	-	-	CU,DS	TR	50-100	64,177
49. Ficus capensis	T	<6(25)	-	-	-	-	-	-	-	-	-	64
50. Flacourtia indica[1]	S,T	3-5(15)	D,E	x	-	-	-	-	DS	-	-	177,328
51. Fouquieria splendens	S	4-6	D	-	-	x	-	-	CU	-	>10	328
52. Grewia flavescens	C,S	1-3(5)	E	-	-	-	-	14	DS	-	328	
53. G.occidentalis	C,S	2-4(12)	D,E	-	-	-	-	-	CU,DS	-	-	
54. Halleria lucida	S,T	2-5(12)	D,E	-	-	-	-	-	CU,DS	-	-	64,89
55. Harpephyllum caffrum	T	8-12(26)	E	-	-	-	-	-	CU,DS	-	-	64
56. Ilex aquifolium	-	-	E	-	-	-	-	6.3	-	-	-	166,177,227

SPECIES botanical name	BIOPHYSICAL FEATURES live form	height (m)	foll.	arma.	irri-tant	MANAGEMENT growth rate	seed pretreat.	No of seeds per kg(000)	applied reproduction	applied managem.	intra-row spacing (cm)	source
Nr 1	2	3	4	5	6	7	8	9	10	11	12	13
Semi-arid Regions:												
57. Jatropha curcas	S,T	1.5-5	D	-	-	xxx	-	2.4	CU,DS	CO	30-300	64,166,228
58. Kiggelaria africana	S,T	3-9(25)	D,E	-	-	-	-	6	-	-	-	166
59. Lannea discolor	T	3-6(15)	-	-	-	-	-	-	CU,DS	-	-	64,
60. Lantana camara	S	2-3	E	-	-	xx	-	-	CU,DS	-	50-100	94,166
61. Laurus nobilis	T	5-7	E	-	-	xxx	-	1.4	-	-	-	
62. Mimosa pigra	C,S	1-4(7)	E,D	-	-	xxx	x	42.6	-	-	-	64,305
63. Morus alba	T	<13	E	-	-	xxx	x	324-400	CO,CU,DS,SE	CO,LO	-	25,124,166,298
64. Myrtus communis	S	4-5	E	-	-	xx	-	-	-	-	50-100	227,328
65. Parkinsonia aculeata	S,T	3-10	D,S	x	-	xxx	x	7.5-13	CU,DS,SE	PO	100	39,89,166
66. Pinus halepensis	T	10-17	E	-	-	xxx	-	13-80	DS,SE	-	-	64
67. Pithecellobium dulce	T	5-20	S,E	x	-	xxx	-	9-25.7	CO,CU,DS	-	-	64,177,328
68. Pittosporum viridifl.	S,T	3-6(20)	E	-	-	-	-	-	-	-	30-100	64,89
69. Prosopis chilensis	S,T	5-9	D,E,S	x	-	xxx	x	25-27	CO,DS,SE	CO	-	33,64
70. P.juliflora	T	8-15	D,E	x	-	xxx	x	8-15	CO,DS,SE,SU	CO,LO,PO	30-100	64,226
71. P.tamarugo	T	3-12(18)	S,E	x	-	xxx	x	65-90	CO,SE	CO,LO	-	155
72. Psidium guajava	S,T	3-10	E	-	-	xxx	-	-	CU,DS,SE	GR	-	254a
73. Pterocarpus erinac.	T	12-15(35)-	-	-	-	-	x	3.4-5	-	-	-	64,328
74. P.lucens	S(T)	3-4(12)	D	-	-	-	-	3.7	-	-	-	272
75. Punica granatum	S	2-7	D	-	-	xx	-	67.2	DS,CU,SU	-	100-120	64,166,304
76. Rhus pyroides	S,T	3-5(15)	D,E	x	-	x	x	-	-	-	-	328
77. S.sesban	S,T	2-3(7.5)	-	-	-	-	-	-	CO,DS,SE	CO,LO	-	64,254a
78. Simondsia chinensis	S	<2	E	-	-	xx?	-	0.6	-	-	60	94
79. Tamarix aphylla	S,T	<10	E	-	-	xxx	-	-	CO,CU	CU	100	166,238
80. Ximenia americana	S,T	4-5(8)	-	-	-	-	-	1.4	DS	-	-	64,177,238
81. Ziziphus mauritiania	T	3-4(12)	E,S	x	-	xx	x	0.7-3.5	CU,DS,SE,SU	CO,LO,PO	-	64,272
82. Z.mucronata	S,T	3-6(21)	D,E	x	-	-	-	-	CU,DS	-	-	64,177
83. Z.spina-christi	S,T	3-10	S	-	-	-	x	15	CO,CU,SE	-	-	43,64,153a,238

Table 51: Productive and service uses of selected hedge plants

SPECIES		PRODUCTIVE USES						SERVICE USE					
		food	fodder	fuel	other wood	other products	general service functions	orna-mental hedge	gard. hedge	wind break	secu-rity hedge	live fence post	source
no.	1	2	3	4	5	6	7	8	9	10	11	12	13
Tropical highlands:													
1.	Acacia decurrens	-	B	x	PO,V	T	N,S	x	-	x	-	-	64,254a
2.	Erythrina americana	S,V	B,L	x	V	M	N,S	x	x	x	x	-	328
3.	E.poeppigiana	-	B,L	x	PU,UT	-	N,S	x	x	x	-	x	64
4.	Gleditsia triacanthos	F	B,L,P,S	x	PO,V	-	D,S,Nx	x	-	x	-	-	64,254a
5.	Grevillea robusta	-	B	x	V	-	S	x	-	x	-	-	318
6.	Melia azadirach	O	B	x	FI,PO,UT,V	E,M-	S	x	-	-	-	-	64,254a
7.	Opuntia ficus-indica	F,V	L,P	x	-	F,M	S	x	-	-	p?	-	104,328
8.	Robinia pseudoacacia	F	B,L	x	PO,V	T	N,S	x	-	x	-	-	64
9.	Schinus molle	F	B	x	V	H	S	x	-	x	-	-	34,64,328
Humid tropics:													
1.	Bixa orellana	O	-	-	-	F,H,M,T	-	x	-	-	-	-	64,89
2.	Bougainvillea glabra	-	-	x	-	-	-	x	x	-	p	-	166,177
3.	Brosium alicastrum	F,N,S	L,S	x	UT,V	M		x	-	-	-	x	64
4.	Bursera simaruba	-	-	x	V	M,P	-	x	-	-	-	x	64,254a
5.	Calliandra calothyrsus	-	B	x	PU	-	N,S	x	-	x	-	-	64
6.	Carica papaya	B,F,V	x	-	-	M	-	-	-	-	-	-	258
7.	Casuarina equisetifolia	O	-	x	PO,V	D,N,S	-	-	x	x	-	-	64,238
8.	Ceiba pendantra	F,V	L,P,S	x	V	I,M,T	S	x	-	-	x	x	64
9.	Citrus aurantifolia	F	-	-	-	-	-	x	-	-	p	-	39,177
10.	Cnidiscolus chayamansa	B,V	L	-	-	M	-	-	x	-	-	-	216,275
11.	Dichrostachys cinerea	F,S	B,L,P,S	x	C,PO,UT	F,M	S	x	x	-	x	-	64,177
12.	Erythrina abissinica	V	B,L	x	V	M	N,S	x	x	x	-	-	64
13.	Flemingia macrophylla	-	-	x	-	-	N,S-	-	-	-	-	-	
14.	Gliricidia sepium	O,V	B,L,P,S	x	PO	M,P	N,S	x	-	x	-	x	64,254a
15.	Gmelina arborea	-	B,L,P	x	I,FI,PO,V	T,V	S	-	-	x	-	-	64,254a
16.	Hibiscus tiliaceum	-	-	x	PU,V	-	S	x	x	-	-	-	58,64,166
17.	Leucaena leucocephala	S,V	B,L,P	x	PO,V	I,T-	N,S	x	x	x	x	x	64,254a
18.	M.scabrella	-	-	x	PU,V	-	N,S	-	x	x	x	x	64,226
19.	Moringa oleifera	F,V	L	-	V	H		-	x		x	x	5a,64
20.	Sesbania bispinosa	-	L	x	PU	F,M	N,S	x	-	-	-	-	64,254a
21.	S.grandiflora	V	L,P	x	PU	F,T	N,S	x	x	x	-	-	64,254a
22.	Simarouba glauca	F,O,S	-	x	PO	M	-	x	-	-	-	x	
23.	Vernonia amygdalina	V	L,S	x	-	M	-	x	x-	-	-	-	64,275,298

SPECIES		PRODUCTIVE USES						SERVICE USE					
		food	fodder	fuel	other wood	other products	general service functions	orna-mental hedge	gard. hedge	wind break	secu-rity hedge	live fence post	source
no.	1	2	3	4	5	6	7	8	9	10	11	12	13
Arid and semi-arid regions:													
1.	Acacia albida	F,N,S,V	B,L,P	x	FI,UT,V	M,T	N,O,S	x	x		-	-	23a,328
2.	A.ataxacantha	-	B,L,P,S	-	C,UT	M	N,S	-	x	-	p	-	64,238
3.	A.cambagei	-	-	x	V	-	-	-	-	-	-	-	328
4.	A.catechu	-	L	x	FI,V	-	S	-	-	-	-	-	304
5.	A.constricta	N,S	B,S	-	-	-	S	-	-	-	-	-	328
6.	A.farnesiana	N,S,V	L	x	UT	H,M,T	N,D,S	x	-	-	-	-	64,177,338
7.	A.greggii	F,S	B	x	V	-	S	-	-	-	p	-	328
8.	A.longifolia	-	B	x	V		N,D,S	x	x	x	-	-	64,166,177
9.	A.macrostachya	V	x	x	V	M	-	-	-	-	-	-	328
10.	A.mellifera	V	B,L,P	x	C,V	M	N,S	-	-	-	p	-	64,238,328
11.	A.nilotica	-	B,L,P	x	C,UT,V	M,T	N,D,S	-	x	x	-	-	64,238,328
12.	A.saligna	-	x,B	x	PO,UT,V	M	N,D,S	x	x	x	-	-	64,328
13.	A.senegal	V	x	x	V	F,T	N,D,S	x	-	x	-	-	23a,64,166,
14.	A.tortilis	-	B,L,P	x	C,PO,V	F,M,T	N,S	-	-	-	x	-	64,166,328
15.	Agave americana	-	-	x	-	F	-	-	-	-	p	-	34,64,177
16.	A.sisalana	-	-	x	-	F	-	-	-	-	p	-	166
17.	Aloe arborescens	-	-	-	-	-	-	x	x	x	-	x	64
18.	Anacardium occidentale	B,N,V	B	x	V	M,T	D,S	x	-	x	-	-	64,238
19.	Atriplex halimus	V	L	-	-	-	S	x	-	-	-	-	23a,328
20.	A.nummularia	-	L	x	V		S	x	x	x	-	-	23a.328
21.	Azadirachta indica	-	B,L,P	x	C,PO,V	H,I,M,O,P	S	-	x	-	-	-	64,238,328
22.	Baccharis sarothroides.	-	-	x	V	M	S	-	-	-	-	-	34
23.	Balanites aegyptiaca	F,O,V	B	x	PO	M,P	S	-	-	-	-	-	23a,64,238,328
24.	Bauhinia rufescens	-	x	x	-	M	-	x	-	x	-	-	23a,64,332
25.	Caesalpinia bonducella	-	-	-	V	M	-	-	-	-	x	x	338
26.	C.pulcherrima	S	B,x	x	-	-	N	x	x	-	x	x	94,151,328
27.	Cajanus cajan	S,V	L,P,S	x	-	-	N,S	-	-	x	-	-	64,254a
28.	Capparis decidua	F,V	L	x	C	M,T	D,S	-	-	x	-	-	23a,328

SPECIES		PRODUCTIVE USES						SERVICE USE					
		food	fodder	fuel	other wood	other products	general service functions	ornamental hedge	gard. hedge	wind break	security hedge	live fence post	source
no.	1	2	3	4	5	6	7	8	9	10	11	12	13
29.	Cassia artemisoides	-	P	-	-	-	-	x	-	x	-	-	64
30.	C.siamea	-	B,x	x	PO,V	T	S,N	x	-	x	-	-	39,64,298,254a
31.	Chamaecytisus palmensis	-	B,L,P,S	x	-	N,S	-	x	-	x	-	-	64,328
32.	Colophospermum mopane	F	B,L	x	V	-	S	x	-	-	-	-	
33.	Combretum aculeatum	S,V	x	x	C	M,T	-	-	-	-	-	-	64
34.	C.micranthum	S,V	L	x	V	M,T	-	-	-	x	-	-	64
35.	C.paniculatum	-	L	-	UT	M	-	-	x	-	-	-	23a,64,238
36.	Commiphora africana	F	x	x	C,V	M,P	-	-	x	x	p?	-	64,177
37.	Cordeauxia edulis	S	B,L,S	x	-	T	S,N	-	-	-	p?	-	64,94
38.	Cotoneaster pannosa	-	B	-	-	-	-	x	-	x	-	-	94
39.	Cupressus lusitania	-	B	x	C,V	-	-	x	x	x	-	-	64,166
40.	C.sempervirens	-	x	-	-	-	-	-	x	x	-	-	166
41.	Dodonaea viscosa	N,S	B,x	x	C	M	S	x	x	x	-	-	338
42.	Duranta repens	-	B	-	-	-	-	x	-	-	-	-	166
43.	Eleagnus angustifolia	-	x	x	V	-	N,S	x	-	x	-	-	94,110
44.	Erythrina flabelliformis	V	L	x	-	M-	N,S	x	x	x	-	-	328
45.	Eucalyptus camaldulensis	-	B	x	I,PO,V	E,F,M,T	-	-	-	-	-	-	64,254a
46.	E.lehmannii	-	B	x	-	-	D	x	x	x	-	-	166
47.	Euphorbia balsamifera	V	x	x	-	T	D	-	x	p?	-	x	39,64,381
48.	Euphorbia tirucalli	-	-	-	-	M	-	x	x	x	-	-	64,177,298
49.	Ficus capensis	F	x	x	C	F,M,T	-	x	-	-	-	-	64
50.	Flacourtia indica	F	L	x	FI,UT	M		x	x	-	x	-	177,328
51.	Fouquieria splendens	F	P	-	UT	M	S	x	-	-	-	-	64,94
52.	Grewia flavescens	F	B,L	x	UT	-	S	x	x	-	-	-	328
53.	G.occidentalis	-	B,L	x	-	M	-	x	x	-	-	-	328
54.	Halleria lucida	-	B,L	-	C	-	-	x	x	-	-	-	64
55.	Harpephyllum caffrum	F	x	x	V	-	-	x	x	x	-	-	64

SPECIES		PRODUCTIVE USES						SERVICE USE					
		food	fodder	fuel	other wood	other products	general service functions	ornamental hedge	gard. hedge	wind break	security hedge	live fence post	source
no.	1	2	3	4	5	6	7	8	9	10	11	12	13
56.	Ilex aquifolium	-	B	-	PO	-	-	x	x	-	-	-	166,177,
57.	Jatropha curcas	S,V	-	x	-	M,T-	S	x	x	-	x	x	64,328
58.	Kiggelaria africana	-	B,x	x	PO,x	M	-	x	-	x	-	-	166
59.	Lannea discolor	-	x	-	C	M	x	-	x	-	-	-	64
60.	Lantana camara	-	-	-	-	-	-	x	x	-	-	-	54,94,166
61.	Laurus nobilis	-	B	-	-	-	-	x	x	-	-	-	
62.	Mimosa pigra	-	-	-	-	M	N,S	-	-	-	-	-	305a
63.	Morus alba	F	B,L,P,S	x	V	T	S	x	x	x	x	-	25,124,166,298
64.	Myrtus communis	F,V	B	-	UT	-	-	x	x	-	-	-	227,328
65.	Parkinsonia aculeata	F	B,L,P	x	PO	M	N,S	x	x	x	-	x	39,89,254a
66.	Pinus halepensis	F	-	x	PO,V	-	D,S	x	x	-	x	-	64
67.	Pithecelobium dulce	B,F,O,S	B,L,P,S	x	V	T	D,N	x	x	x	x	x	64,177,328
68.	Pittosporum viridifl.	-	B,L	-	-	-	-	x	-	-	-	-	64
69.	Prosopis chilensis	F,V	B,P,S	x	PO,V	T	N,S	x	-	x	x	-	64,298
70.	P.juliflora	F,V	B,P,S	x	PO,V	M,T	N,S	x	-	x	x	-	64,226
71.	P.tamarugo	-	L,P,S	x	UT	I,T	N,S	-	-	-	x	-	155
72.	Psidium guajava	F	P	x	V	T	S	x	-	-	x	x	254a
73.	Pterocarpus erinaceus	-	B,L	x	PO,UT,V	M	N,S	-	-	-	-	-	328
74.	P.lucens	V	x	x	C	M	-	x	-	-	-	-	272
75.	Punica granatum	F	B,x	-	-	-	-	x	-	x	-	-	166,304
76.	Rhus pyroides	F	-	-	UT	-	-	x	x	-	-	-	328
77.	Sesbania sesban	F	B,L,P,S	x	PO	M	N,S	x	x	x	-	-	64,298,254a
78.	Simondsia chinensis	-	B,L,P,S	x	-	I	-	x	x	-	-	-	64,94
79.	Tamarix aphylla	-	B,L,P,S	x	V	-	D,S	-	-	x	-	-	166,238
80.	Ximenia americana	B,F	x	x	C	M	-	-	-	-	-	-	177,238
81.	Ziziphus mauritiania	B,F,V	B,L	x	PO,C,V	M-	-	x	x	x	x	x	23a,64,238
82.	Z.mucronata	F	B,x	x	V	M	-	-	x	x	p?	-	64,177
83.	Z.spina-christi	F	B,L,P,S	x	V	M,V	D,S	-	x-	x	p?	-	47,64,188

Table 52: List of some hedge trees and shrubs with high potential for production of food, animal feed, fuel, and timber

FOOD		
Anacardium occidentale	Carica papaya	Moringa oleifera
Artocarpus altilis++	Citrus aurantifolia	Opuntia ficus-indica
Balanites aegyptiaca+	Cnidiscolus chayamansa	Psidium guajava
Bambusa spp.	Combretum micranthum	Sesbania grandiflora
Brosium alicastrum	Ficus spp.	Vernonia amygdalina
Caesalpinia pulcherrima	Gleditsia triacanthos	Ximenia americana
Cajanus cajan	Lannea spp.	Ziziphus mauritiania
Capparis decidua	Leucaena leucocephala	
FORAGE		
Acacia albida	Brosium alicastrum+	Gliricidia sepium++
Acacia nilotica	Cajanus cajan*	Grewia spp.+
Acacia senegal*	Cnidiscolus chayamansa+	Leucaena leucocephala
Acacia seyal+	Combretum aculeatum+	Morus alba+
Acacia tortillis++	Commiphora africana+	Opuntia ficus-indica*
Atriplex spp.	Dichrostachys cinerea++	Prosopis juliflora*
Balanites aegyptiaca+	Erythrina spp.	Ziziphus spp.++
Bauhinia rufescens+	Erythrina variegata++	
Beeforage	*Lac-Lice*	*Butterfly*
Acacia spp.	Acacia spp.	Bougainvillea spp.
Azadirachta indica	Albizia spp.	Hibiscus spp.
Calliandra calothyrsus	Butea monosperma	Ixora pinsettia
Grevillea robusta	Cajanus cajan	
Eucalyptus spp.	Croton spp.	
Prosopis spp	Ficus spp.	
Ziziphus spp.	Flemingia macrophyla	
FUELWOOD		
Acacia nilotica	Coccoloba uvifera	Melia azedarach
Acacia senegal	Combretum quadrangulare	Mimosa scabrella
Acacia tortillis	Erythrina poeppigiana	Parkinsonia aculeata
Anacardium occidentale	Erythrina senegalensis	Polylepis spp.
Azadirachta indica	Eucalyptus camaldulensis	Prosopis juliflora
Baccharis spp.	Gleditsia triacanthos	Psidium guajava
Balanites aegyptiaca	Gliricidia sepium	Pterocarpus lucens
Calliandra calothyrsus	Gmelina arborea	Simarouba glauca
Capparis decidua	Grevillea robusta	Syzygium cuminii
Cassia siamea	Hibiscus tiliaceus	Ximenia americana
Casuarina equisetifolia	Leucaena leucocephala	Ziziphus mauritiana
TIMBER		
Acacia nilotica	Cupressus lusitania	Lannea discolor
Acacia senegal	Cupressus macrocarpa	Leucaena leucocephala
Azadirachta indica	Cupressus sempervirens	Melia azedarach
Balanites aegyptiaca	Eucalyptus camaldulensis	Pinus halepensis
Brosium alicastrum	Eucalyptus eremophila	Polylepis spp.
Bursera simaruba	Eucalyptus lehmannii	Prosopis juliflora
Cassia siamea	Gmelina arborea	Ziziphus mauritiana
Casuarina equisetifolia	Grevillea robusta	

++ = high forage value (palatability, nutritive value) and fast growth
+ = high forage value and slower growth
* = less satisfactory forage value, but fast growth

Table 53:List of some hedge trees and shrubs suitable for soil improving and amenity planting

SOIL CONSERVATION		
Acacia albida	Cajanus cajan	Leucaena leucocephala
Acacia farnesiana	Cassia siamea	Mimosa scabrella
Acacia longifolia	Casuarina equisetifolia	Parkinsonia aculeata
Acacia nilotica	Combretum micranthum	Prosopis juliflora
Acacia senegal	Erythrina spp.	Sesbania spp.
Anacardium occidentale	Flemingia macrophylla	Ziziphus spp.
Azadirachta indica	Gleditsia triacanthos	
Baccharis spp.	Gliricidia sepium	
ORNAMENTAL		
Acacia spp.	Carissa grandiflora	Hibiscus tiliaceus
Acacia macrostachya	Cassia artemisoides	Lagerstroemia indica
Adenium obesum	Cassia siamea	Lantana camara
Aloe arborescens	Combretum paniculatum	Myrtus communis
Baccharis sarothroides	Cotoneaster spp.	Opuntia spp.
Bambusa spp.	Dodonaea spp.	Parkinsonia aculeata
Bauhinia rufescens	Erythrina abissinica	Phoenix reclinata
Bougainvillea glabra	Erythrina senegalensis	Punica granatum
Caesalpinia pulcherrima	Erythrina variegata	Rhus spp.
Calliandra calothyrsus	Gleditsia triacanthos	Tamarix aphylla

Table 54:List of some trees and shrubs very suitable for filling gaps or strengthening an impenetrable barrier (security hedge) (167)

FILLER		
short:	*short:*	*tall:*
Acacia hebeclada	Maytenus capitata	Acacia nigrescens
Azima tetracantha	Maytenus polyacantha	Acacia senegal
Carissa bispinosa	Nylandtia spinosa	Balanites maughamii
Carissa haematocarpa	Phaeoptilum spinosum	Lebeckia macrantha
Carissa tetramera	Putterlickia pyracantha	Lycium oxycarpum
Commiphora africana	Rubus ludwigii	Parkinsonia africana
Commiphora pyracanthoides	Scutia myrtina	
Euphorbia grandicornis	Ximenia americana	
Lycium afrum	Ziziphus zeyheriana	
Lycium ferocissimum		
Lycium hirsutum		
Lycium prunus-spinosa		
IRRITANT:	**ENTANGLERS:**	**FENCE REINFORCERS:**
Euphorbia avasmontana	Capparis fasicularis	Acacia ataxacantha
Euphorbia cooperi	Capparis sepiaria	Capparis sepiaria
Euphorbia grandicornis	Dalbergia armata	Capparis tomentosa
Euphorbia ingens	Protasparagus spp.	Cassinopsis ilicifolia
Euphorbia ledienii	Protasparagus aethiopicus	Rhus gueinzii
Euphorbia pseudocactus	Protasparagus krebsianus	Rubus pinnatus
Euphorbia tirucalli	Protasparagus laricinus	Rubus rigidus
Euphorbia virosa	Protasparagus racemosus	Scutia myrtina
Mucuna coriacea	Rubus pinnatus	
Obetia tenax	Rubus rigidus	
Smodingium argutum	Scutia myrtina	
Synadenium cupulare	Smilax kraussiana	
Urtica lobulata		

Table 55: List of some trees and shrubs suitable for a garden, windbreak, security hedge, and living fence posts

GARDEN HEDGE		
Acacia albida	Curtisiana dentata	Lantana camara
Acacia ataxacantha	Diospyros spp.	Laurus nobilis
Acacia nilotica	Dodonaea spp	Leucaena leucocephala
Acacia longifolia	Erythrina spp.	Moringa oleifera
Acacia saligna	Eucalyptus lehmannii	Myrtus communis
Aloe arborescens	Euphorbia tirucalli	Parkinsonia aculeata
Bougainvillea glabra	Flacourtia indica	Pinus halepensis
Caesalpinia pulcherrima	Gliricidia sepium	Prunus cerasifera
Cassinopsis illicifolia	Grewia spp.	Rhus spp.
Chrysanthemoides mor.	Harpephyllum caffrum	Simondsia chinensis
Combretum paniculatum	Hibiscus tiliaceus	Tephrosia vogelii
Commiphora africana	Ilex aquifolium	Vernonia amygdalina
Crotolaria capensis	Jatropha curcas	Widdringtonia sp.
Cupressus spp.	Lannea discolor	Ziziphus spp.

WINDBREAK HEDGE		
Acacia albida	Cassia siamea	Grevillea robusta
Acacia nilotica	Casuarina equisetifolia	Kiggelaria africana
Acacia saligna	Combretum micranthum	Leucaena leucocephala
Acacia senegal	Commiphora africana	Morus alba
Aloe arborescens	Diospyros lycioides	Parkinsonia aculeata
Anacardium occidentale	Erythrina spp.	Polylepis spp.
Azadirachta indica	Euphorbia balsamifera	Prosopis juliflora
Bauhinia rufescens	Euphorbia tirucalli	Schinus molle
Capparis decidua	Gleditsia triacanthor	Tamarix spp.
Carissa grandiflora	Gliricidia sepium	Widdringtonia spp.
Cassia spp.	Gmelina arborea	Ziziphus spp.

GENERAL SECURITY HEDGE		
Aberia caffra*	Citrus aurantifolia	Parkinsonia aculeata*
Acacia ataxacantha**	Commiphora africana*	Phoenix reclinata**
Acacia greggii**	Dichrostachys cinerea	Pinus halepensis
Acacia mellifera	Euphorbia spp.	Pithecellobium dulce
Acacia tortillis	Flacourtia indica	Prosopis spp.
Agave sp.**	Jatropha curcas	Prunus cerasifera
Bougainvillea glabra**	Leucaena leucocephala	Punica granatum
Caesalpinia spp.	Lycium afrum**	Yucca elephantipes
Ceiba pentandra	Opuntia ficus-indica	Ziziphus spp.*

LIVE FENCE POST		
Aloe arborescens	Erythrina spp.	Jatropha curcas
Bombacopsis sepium	Erythrina americana	Leucaena leucocephala
Brosium alicastrum	Erythrina berteroana	Moringa oleifera
Bursera simarouba	Erythrina costaricensis	Parkinsonia aculeata
Caesalpinia spp.	Erythrina poeppigiana	Pithecellobium dulce
Ceiba pentandra	Erythrina variegata	Psidium guajava
Croton glabellus	Euphorbia spp.	Spondias purpurea
Diphysa robinioides	Gliricidia sepium	Yucca elephantipes

* nearly stockproof

** stockproof

Table 56: List of potential hedge plants according to major agroecological zones

TROPICAL HIGHLANDS		
Aberia caffra [297]	Croton macrostachys [25]	Melletia dura [25]
Acacia decurrens [64,166]	Croton magalocarpus [25]	Milletia laurentii [25]
Acacia mearnsii1 [66]	Cyphomandra betacea [25]	Morus alba [25,166,298]
Acrocarpus fraxinifolia [25]	Entada abessinica [25]	Morus nigra [25]
Agave americana [34,166]	Erythrinia abissinica [64]	Opuntia ficus-indica [166,104]
Albizzia gummifera [25]	E. poeppigiana [64]	Passiflora edulis [25]
Alnus jorullensis [34]	Gleditsia triacanthos [64,166]	Persea americana [25]
Buddleia spp. [34]	Grevillea banksii [25]	Pinus radiata [25]
Caesalpinia tinctorera [34]	Grevillea robusta [25,318]	Podocarpus milanjianus [25]
Cammellia sinensis [166]	Inga spp.	Podocarpus usambarensis [25]
Cassia spectabilis [25]	Leucaena diversifolia	Robinsonia pseudoacacia [94]
Cedrela serrata [25]	Macadamia ternifolia [25]	Schinus molle [34,64]
Coffea arabica [166]	Maesopsis eminii [25]	Spartium junceum [34]
Cordia dentada [109]	Melia azaderach [64]	

HUMID TROPICS		
Albizia odorotissima [166]	Cocoloba uvifora [254a]	Manilkara zapota [166]
Baphia nitada [265]	Coffea spp. [166]	Mimosa scabrellas [64]
Bixa orellana [64,89]	Erythrina variegata [265]	Moringa oleifera [64]
Brosium alicastrum [64,216]	Erythrins assbissinica [64]	Nothopanax fruticosum [275]
Bursera simaruba [64]	Flemingia macrophilla [202]	Psidium guajava [318]
Calliandra calothyrsus [177]	Ficus benghalensis [64]	Sauropus androgy.[275]
Casuarina equisetifolia [643]	Gliricidia sepium [64]	Sesbania bispinosa [254a]
Ceiba pendantra [64]	Gmelina arborea [166]	Sesbania grandiflora [54,226]
Citrus aurantifolia [39,177]	Hibiscus tiliaceus [64]	Simarouba glauca
Cnidoscolus chayamansa [215]	Inga vera [265]	Vernonia amygdalina [275]
	Leucaena leucocephala [64]	Yucca spp. [254a]

ARID AND SEMI ARID REGIONS		
Abelia grandiflora [64]	Carissa grandiflora [94,177]	Ilex aquifolium [166,177]
Aberia caffra [297]	Cassia artemisoides [94]	Ipomea fistulosa [328]:
Acacia albida [328]	C. siamea [39,64]	Jatropha curcas [166,328]
A.ataxacantha [64,166]	Cassinopsis ilicifolia [64]	Lannea spp.
A. cambagei [328]	Casuarina equisetifolia [166,238]	Lantana camara [194,166,328]
A.catechu [304]	Chamaecyparis palmensis [328]	Laurus nobilis [166]
A. constricta [328]	Chrysanthemoides moniliferia [328]	Lawsonia inermis [177,328]
A.farnesiana [177,328]	Colophospermum mopane [328]	Mahonia swaseyi [328]
A. greggii [328]	Commiphora africana [177,238]	Maytenus polyacanthus [328]
A. karroo [166,328]	C.pyracanthoides [328]	Mimosa pigra [328]
A. longifolia [166,177,328]	Combretum aculeatum [328]	M.hamata [328]
A.macrostachya [328]	C. micranthum [328]	Miscanthus fuscus [328]
A.mellifera [64, 328]	C.paniculatum[328]	Moringa stenopetala [5a]
A.nilotica [215a]	Conocarpus lancifolius [215a]	Myrtus communis [94,166,328]
A.saligna [166]	Cordeauxia edulis [64,94]	Olea spp
A.senegal [177]	Cotoneaster pannosa [94]	Opuntia ficus-indica [94,166,177328]
A.tortillis [64]	Cupressus spp. [13]	Parkinsonia aculeata [166,304]
Adathoda vasica [87]	Cupressus sempervirens [166]	Pinus halepensis [64]
Adenium obesum [272]	Desmanthus virgatus [328]	Pithecellobium dulce [177,238]
Aegle marmelos [177]	Dodonaea angustifolia [328]	Prosopis chilensis [94,215a]
Agave americana [166,177]	D.viscosa [328]	P. juliflora [226]
A.sisalana [123,166,177]	Enchylaena tomentosa [328]	Punica granatum [166]
Albizia lebbek	Eucalyptus camaldulensis [94,166]	Rhus spp[94]
Aloe spp.[328]	E.forrestiana [328]	R. pyroides [328]
Aloe arborescens [328]	E. microtheca [215a]	Schinus molle [94,328]
Anacardium occidentale [77,318]	E. lehmannii [328]	Sclerocarya birrea [64]
Arundo donax [328]	Euphorbia balsamifera [39,177,272]	Sesbania sesban [328]
Atriplex nummularia [166,328]	E. kamerunica [177]	Simondsia chinensis [94]
Azadirachta indica [39,94]	E. pulcherrima [328]	Tamarix aphylla [166]
Balanites aegyptiaca [328]	E. tirucalli [177,328]	T. chinensis
Bauhinia rufescens [328]	Ficus capensis [64]	Westringia eremicola [328]
Bougainvillea [58,166]	Flacourtia indica [177]	Ximenia americana[177]
Caesalpinia bonducella [328]	Gleditsia triacanthos [328]	Ziziphus mauritiania[177,272]
Caesalpinia pulcherrima [94,328]	Grewia flavescens[328]	Z. lotus[177,328]
Cajanus cajan [151]	G. occidentalis	Z. nummularia[177,328]
Capparis decidua [328]	Haloxylon aphyllum	Z.spina-christ[43,64]

Table 57:Data sheet of some trees and shrubs suitable for hedge in the Andean Region

Species	Form	Height (m)		Thorns	Altitude	Precipitation (m)	Frost Resist. (mm)	Soils	Growth rate	Reprod.	Fuel	Wood	Medic.	N-fixation	Ornamental
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Agave americana	SS	1-2	x	0-3600	>400	t	i	s	CU	xx	T	x	-	x	
Alnus jorullensis	TR,TM	5-15	-	100-3700	>500	t	a,n	m-(s)	CU,DS	xxx	F,P,T,A	x	x	-	
Baccharis spp.	SS	2-3	-	0-3700	>500	t	i	m	DS	xx	x	-	-		
Buddleia spp.	TR,TM	3-10	x	3300-3700	>250	t	c,n(i)	m	CU	xxx	P,T,(F),A	x	-	x	
Buddleia coriacea	TR,TM,ST	1-5	(x)	3000-4200	>500	r	a,n	s	DS	xxx	P,T,A	-	-	(x)	
Caesalpinea tinctorea	TR,TM,ST	7-10	x	600-3300	>200	s	i	s	DS	xxx	P,A	x	x	x	
Cassia spp.	SM	3-5	x	2800-3900	>500	t	a,n	m-(r)	DS	xxx	T,A		x	-	
Colletia spinosissima	SS	2	x	2600-3800	>400	r	i	s	?	xxx	-	x	?		
Crataegus mexicana	TR,TM	7-12	-	2800-3300	500	t	n	s	CU	xxx	A	x	-	x	
Opunita ficus-indica	SS	1-2	x	0-3300	>200	s	n	s	CU	0	-	x	-	x	
Polylepis spp	TR,SM,ST	3-10	-	2800-4100	>500	r	a,n	s	CU,DS	xxx	P,T,(M),A	x	-	-	
Schinus molle	TR,ST	7-10	-	0-3300	>200	s	i	s	DS	xxx	-	x	-	x	
Spartium junceum	ST	2-4	x	0-3600	>400	t	c,n	m-(f)	DS	xx	-	x	x	-	
Tecoma sambucifo.	ST	2-5	-	2500-3300	>250	s	i	s	CU,DS	xxx	A	-	-	-	

Col(2): Live Form
TR= tree
TM= multi branched
SM= multi branched shrub
SS= small shrub
ST= tall shrub

Col(8): Soils
a= acid
c= calcareous
i= indifferent
n= neutral
0= not applicable

Col(10): Reproduction
DS = direct seeding
CU= cuttings

Col(13): Fuel
xxx= excellent
xx= good
x= possible
O= not used

Col(7):Frost resistant
r= resistant
s= susceptible
t= tolerant

Col(9): Growth rate
f = fast
m= medium
s= slow
A= Farm Tools

Col(14): Construction
F= Furniture
P= Poles
T= Thatches

source: 34

APPENDIX FIVE: RESEARCH AND DEVELOPMENT OF HEDGEROW TECHNOLOGIES

1.Research and development of hedgerow systems - diagnosis and design

Hedgerow systems need to be researched and developed further. How this can be achieved building on the current knowledge base is the core of the following discussion; within a farming systems perspective comments are also made on how extension can be linked with the land users.

Diagnosis and design of hedgerow technologies

Local people have developed interesting hedgerow systems. At the present still underdeveloped stage of scientifically organised hedgerow research and development this vernacular resource should be tapped.

With regard to research and development the specific context of a country or region has to be considered. Networking has been advocated as one cost-efficient way of research and development, and is successfully applied in agricultural research (288). The great potential but also the dangers of inefficient networking have been analysed (e.g 310).

Farming systems research including ICRAF's methodology is of great relevance to hedgerow investigation. It is multidisciplinary and uses a systems-analysis approach (see e.g. 187, 303). At present ICRAF is preparing a specific methodology on experimental hedgerow technologies.

Linking farmers with research and extension

Ideally extension should be the link between research and the land users. In many countries the links between research and extension are generally weak. The prevailing approach is the technology transfer from research to farmer; it is based on the assumption that only research can generate knowledge and that the role of extension is to transfer technology to the ignorant farmer. Generally this is a long-term process of adapting and adjusting technology for specific groups of farmers.

The most important aspect of adaptation, i.e. the point of view of the target groups, has to be the starting point of research, e.g. how different farm groups perceive hedges. The main question has to be what the target groups know (e.g. value of a specific tree and uses) and what they do not know (e.g. how to protect coppiced and young trees) and the reason for it (e.g. pressure from free-roaming animals, which the resource-poor farmers cannot control).

The effect of a technology not applied is zero. Hence a strong link between research, extension, and target groups is necessary.Two approaches should be considered. Approach one: from research field station to farmers and approach two: from the farm level to the research station

Both approaches have their merits in bridging the gap between research and land users. In a situation where farm forestry and agroforestry research is weak in a country, but farmers have developed hedgerow systems by trial and error, the latter approach is of pivotal importance.

From research field station to farmers: This approach uses agricultural field stations as the core to bridge the gap between research station technology and the farmers' reality through adaptive on-farm experimentation along the following lines:Identification of the most important production constraints in order to understand the ecological and socio-economic determinants better; identification of technical and scientific solutions to the farmers' problems at research stations; verification of research recommendations in farmers' fields and their modification and adaptation to suit the farmers' abilities and circumstances; together with the farmer, identification and selection of the best recommendations; extension of results through demonstration plots and field days, etc. In a situation in which unified work by various government agencies is possible this approach will most likely be accepted by researchers.

From the farm level to the research station: This approach consists of the following parts:analysis of decision-making context of selected individual farms (case studies) with the aim of identifying gaps in existing knowledge and challenges in technology transfer. The role of extension is to make the connection between what is known and what is not known. Find out what farmers perceive as problems and what solutions might be the rational bases for farm forestry intervention (Phase one). Experimental work on-farm and on village demonstration fields (use of simple methodologies, trial and error), application of first results through extension service and identification of research topics (Phase two). Research under controlled conditions (sound statistical field trials on experimental stations, component research etc) (Phase three) (see Figure 88).

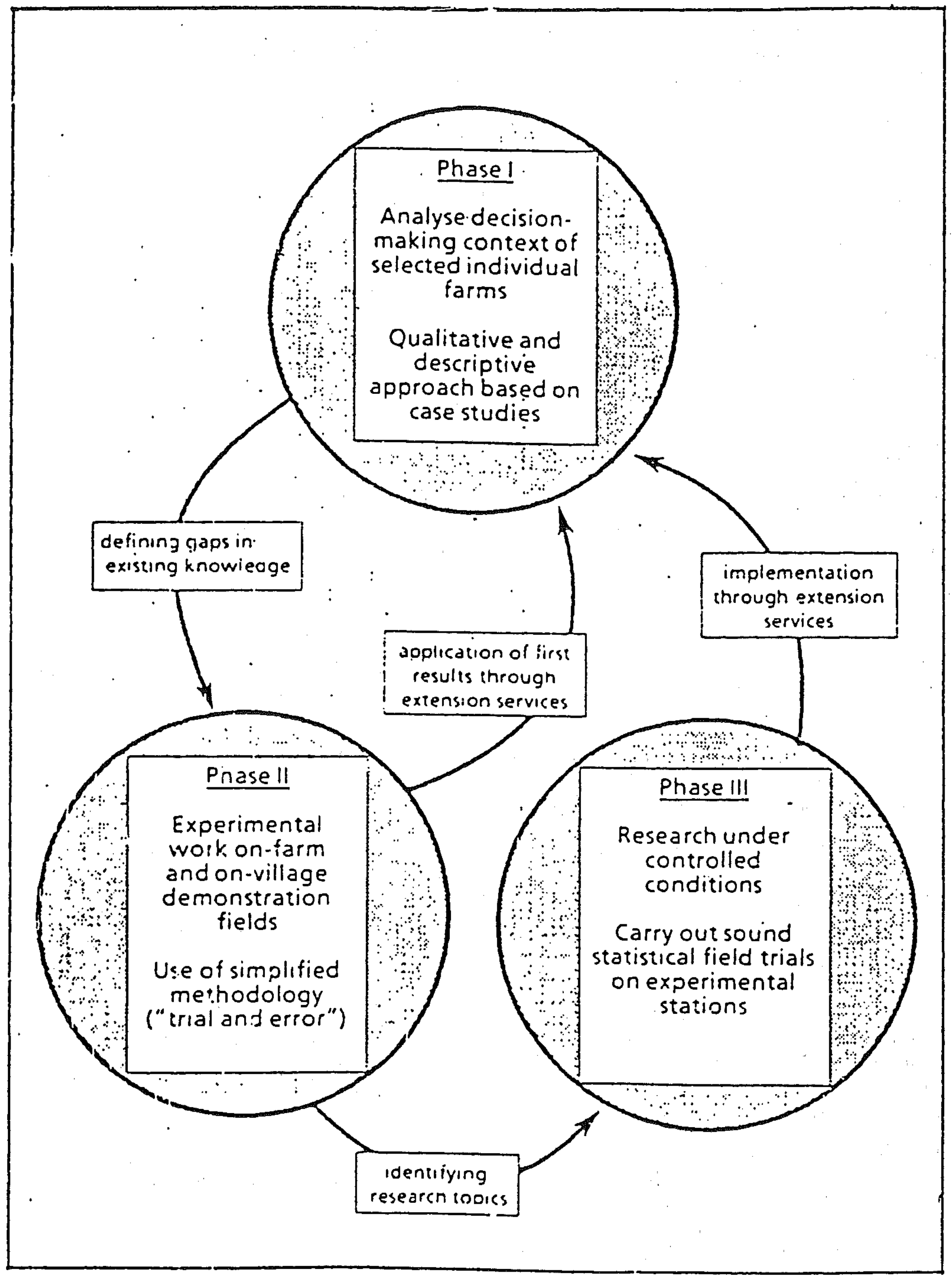


Figure 88: A farming systems research methodology (2)

2. On-station hedgerow research

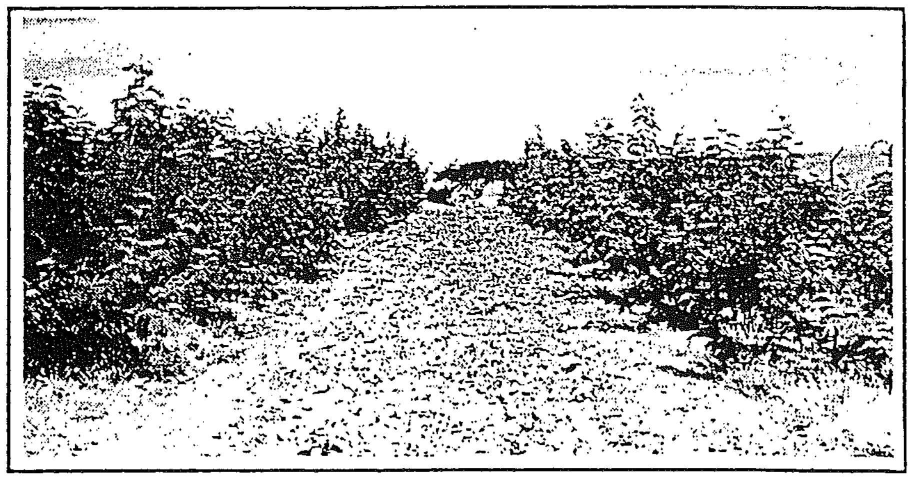


Figure 89: Hedgerow experiment on a large, uniform field typical of an agricultural experiment station (188a)

Suggested on-station experiments cover two aspects:

- Testing spacing for different, well-known species under standard management, and fence design and arrangement (prototype) for such species.
- Testing spacing changes for species of which not enough is yet known about responses to spacing.

The first type of experimentation will last 3-5 years, the second 2-5 years.

Experiment one: The experimental objective is to assess the suitability of different woody species or species mixtures (woody and non-woody) and to assess design and management features. The experimental treatments consist either of 3 to 10 species or species mixtures under standard management and spacing, or of several species either as single species hedges/fences, or as combinations in possibly several different line design structures. For experimental unit 7 m length of hedge/fence may be sufficient; fence width 1 m or 2 m plus 3 m of crop rows sown parallel to the hedge/fence and probably on one side of the fence only (Figure 90).

At beginning and end of each growing season (height, stem diameter at "collar", i.e. soil level) of woody species should be measured. Also crops harvested row-by-row of row-planted crop species sown parallel to hedge/fence (dry weights of total plant, and/or yield of grain, fruit, etc.) should be recorded as well. Labour inputs (for management) have to be documented as well.

Experiment two: The experimental objective is to find appropriate spacing s for several, previously untried species. The experimental treatments consist of woody species (probably 6 or more, could be more than 12); spacing between plants in the hedgerow/living fence varying over some of the range covered by the following systematic (20 %) changes in within-row distances (Figure 91). The experimental units consist of 12 to 30 m length of hedge/fence with systematic change of spacing along fence, with or without crop along hedge. Distance between hedges/fences up to 5 m depending on dimensions of experiment, type of (standardized) management and species used.

Orientation: East-West if possible, and/or along contour. Hedge/fence sections of different species arranged to form a compact block. Parallel rows of a suitable crop species can be sown at the appropriate date and at appropriate (standard) between and within-rows spacing alongside hedge/living fence to occupy approximately 1 to 1:5 m on either side. This is for the purposes of applying a standard additional plant-community stress to the hedge/living fence and ascertaining in a preliminary way the effects of this on the immediately adjacent crop plants (this is more thoroughly tested by using experiment 1). Otherwise the area is kept clean-weeded throughout.

The collar diameter of woody plants at beginning and end of each growing season, height similarly (until pollarded); amount of biomass removed should be measured. In case crops are sown fresh/dry weight of total crop plant, yield of grain etc. from sample plots of parallel-sown crop rows using sections of 1 m length, and a suitable width (181a).

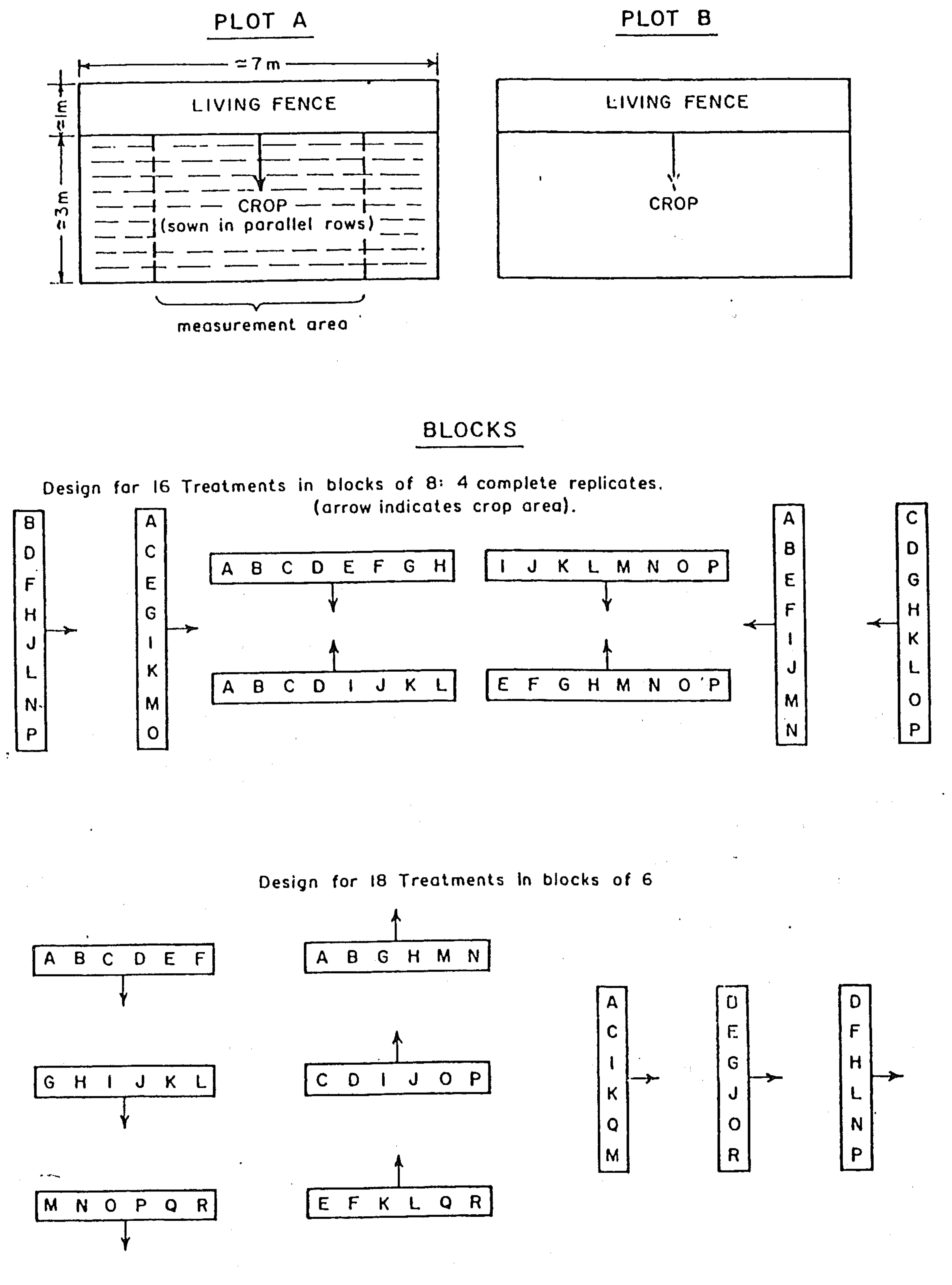


Figure 90: Living fence experiment 1 (181a)

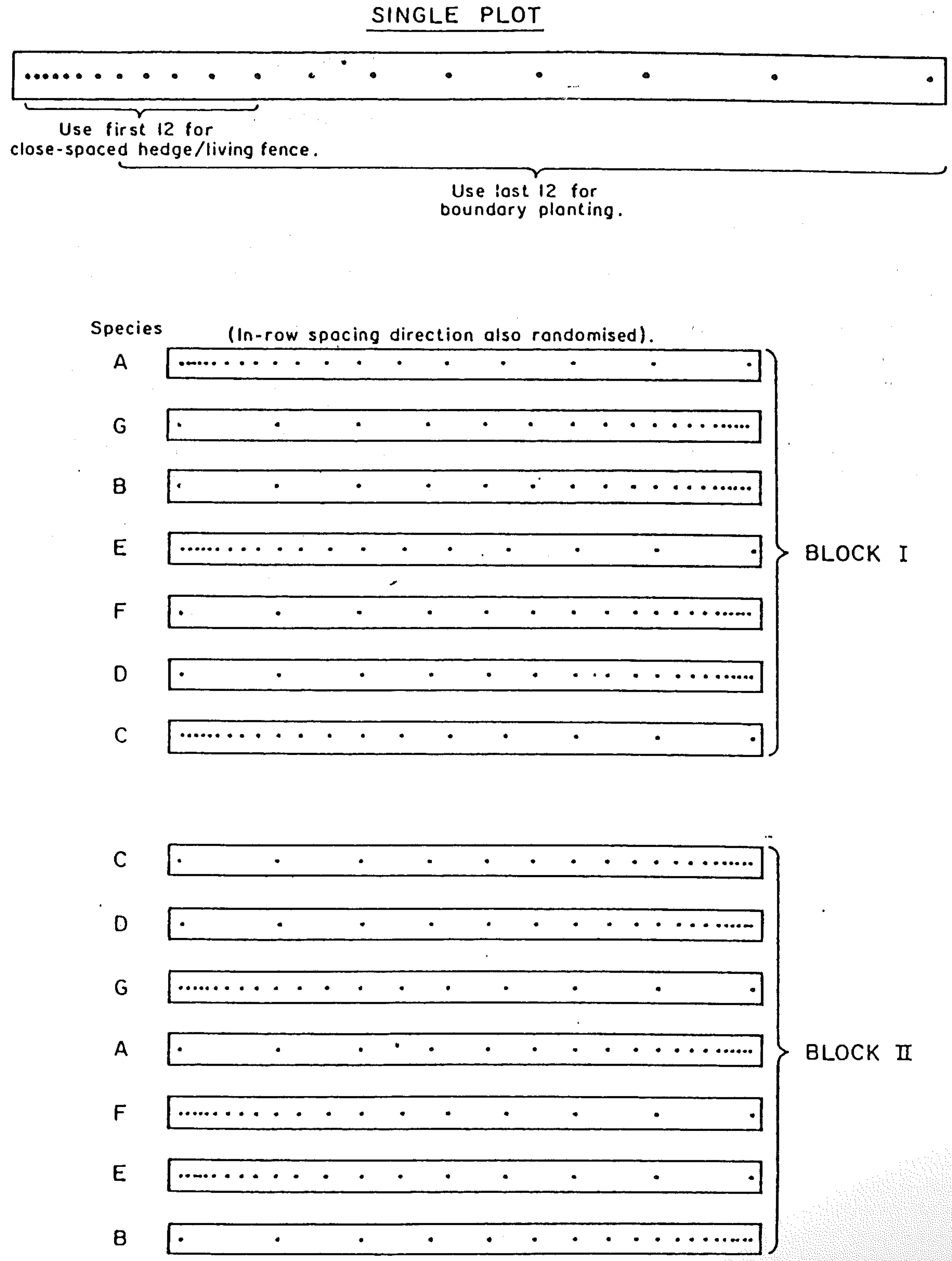


Figure 91: Living fence experiment 2 (single plot)

3. Experimental on-farm hedgerow research or modifying research design for farm conditions

The following is an example of how to modify research design for farm conditions. The following procedures have been suggested:

- Identification of a large number of observation units or identical size (several farms);
- Classification of units according to relevant environmental variables;
- Selection of random units.

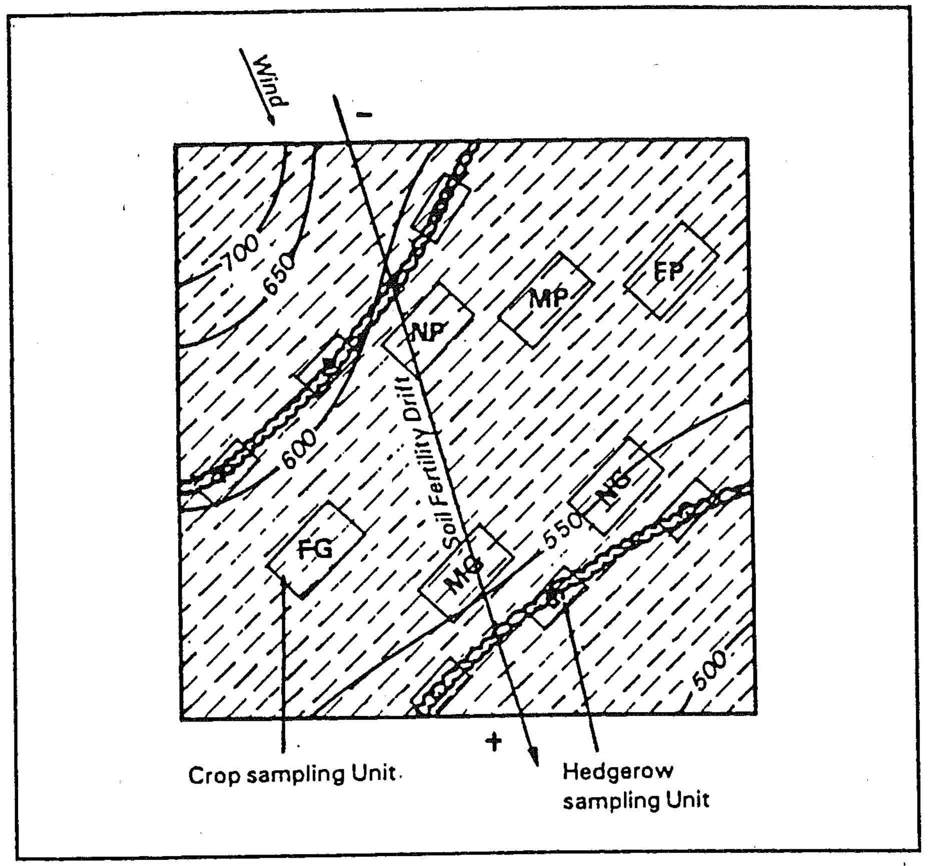
The challenge is the accurate identification of similar production units. It is essential to work closely with the farmers who provide sites for experimentation. The farmers' classification of factors such as soil fertility at different sites - based on experience - will require less time and resources than scientific measurement and will also be more closely linked to practical management considerations and expectations of productivity.

Example of the effect of a hedgerow on the surrounding cropland

A researcher wishing to evaluate the effects of *Leucaena leucocephala* hedgerows interplanted with field beans might begin with the farmers' evaluation of this crop association and the management practice required. Based on this discussion the researcher could then design a study to compare hedgerows and crop productivity in term of three variables, e.g. two environmental factors: soil quality and distance from the hedgerow, and one management intervention: hedgerow lopping at different intervals. Variables are classified in broad terms: soils are classified as good or poor, based on the assessment of the farmer, distance from the hedgerow is classified as "near, medium or far" and the hedgerow is lopped or not lopped.

The researcher selects sampling units at random from all the sites with the appropriate combination of characteristics. This is shown in Figure 92. Simultaneously the researcher should make every effort to keep other relevant vaiables, such as position of the sheltered or exposed side of the hedgerow, constant.

If available, additional testing units may be chosen on a random basis. These could be sites where either the crop or the hedgerow is growing in isolation. The farmer could also test other interventions elsewhere on the site, as long as this does not interfere with the experimental units (188a).



The demarcation of 12 test units for an experiment in hedgerow intercropping. The study is designed to determine the effects of lopping a *Leucaena leuceoceophala* hedgerow on the productivity of adjacent field beans. The effects on crop productivity of two environmental factors will be monitored, too: soil quality and distance from the hedgerow. Dotted lines indicate crop rows and convoluted lines the hedgerows. Distance from the hedgerow is described as near (N), medium (M) and far (F). Soil quality is categorized as poor (P) or good (G).

Figure 92: On farm experimental hedgerow research: investigation of the effect of a hedgerow on the surrounding cropland (188a)

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Code definition for Table 50:

Col (2): Live form
C = climber
S = tall shrub
T = tall tree

Col (7): Growth rate
xxx= fast
xx= medium
x= slow

Col (11): Applied management
CO = coppicing
GR = grafting
LO = lopping
PO = pollarding
PR = pruning, general
TR = trimming

Col (4): Foliage
D = deciduous
E = evergreen
S = semi-deciduous
W = decidu.wet season

Col (10): Reproduction
CO = coppicing
CU = cuttings
DS = direct seeding
SE= seedlings
SU = suckers

Code definition forTable 51:

Col (2): Food
B = beverages
F = fruits
N = nuts
O = oil/fats
S = seeds
V = vegetables

Col (5): Other wood
C = conversion wood
FI = farm implements
UT = utensils
PO = poles
PU = pulp
V = various timber

Col (7): General service functions
D = dune fixation
N = nitrogen fixation
S = soil conservation

Col (3): Fodder
B = bee forage
P = pods
S = seeds

Col (6): Other products
C = cosmetics/hygiene
E = essential oils/waxes
F = fibre
I= insecticides/poison
M= medicine
O = oil/fats
P = palatable exudates

Col (11): Security hedge
p = stock proof
p? = nearly inpermeable
x = general security hedge