IMPROVED TECHNIQUES
FOR
TREE PLANTATION IN THE ARID ZONE

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ICAR

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JODHPUR

FOREWORD

Our planet has been appropriately compared to a Space ship by Bukminister Fuller in order to stress the finite nature of its resources. We must not hence neglect natural laws that might deprive the future generations a good quality of life.

As it is, in India about 46 per cent of our land is under agriculture and about 22 per cent is under forest, of which hardly one per cent is under arid zone. Obviously, there is greater need for taking up tree plantation programme particularly in arid areas.

Arid areas are characteristic of uncertainties of rainfall, which as such is of low magnitude (300-400 mm), less vegetation cover and sandy soils with areas representing shifting sand dunes. It has invariably been realised that extreme arid conditions in these areas are the result of excessive exploitation of resources—especially the vegetation. Therefore, there is an urgent need to undertake resource utilization programmes in such areas in a balanced way and also to intensify efforts to maximise vegetation in an integrated manner so as to keep a proper balance among trees, grasses and crops.

The Central Arid Zone Research Institute, Jodhpur has done extensive research work in these directions and now is the stage to take up programmes to overcome the prevailing handicaps of people in the Arid Zones. For this, obviously there is an urgent need to have all available information of practical utility published in a consolidated form on each discipline. The present bulletin is an account on improved tree plantation techniques for the arid zone and it is hoped that all concerned in this discipline would find this publication of great value. I compliment Sh. K. D. Muthana and Dr. H. S. Mann for producing this booklet.

(M. S. Swaminathan)
Director General, ICAR

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INTRODUCTION

In India 46 per cent of the geographical area is under Agriculture and about 22 per cent is under Forests, whereas Rajasthan state has only 11.5 per cent of its area under Forest. Compared to this, Indian Arid Zone has hardly 1 per cent of the forest cover. Arid zone is nothing but the creation of man, who without any forethought indiscriminately over felled the forest wealth without making any attempt to regenerate the same. Added to this, over-grazing has been practised rather freely without any check. All these have led to the changes in agroclimatic conditions in arid zones. It is, therefore, considered that every farmer should be induced to feel that forestry is the foster mother of Agriculture and no longer its hand maid. Each farmer should be self-sufficient in small timber, fuel, fodder etc. by raising suitable trees in his farm holdings, especially along the farm roads, field boundaries and on waste or marginal lands. However, for any afforestation programme, the cooperation of the public is a must for success. Prevention of animal from grazing and browsing inside the afforested area before establishment of seedlings should be rigidly enforced. Lopping of trees for fodder and food should be banned till the trees develop to a good size with wider canopies. Government agencies should set up Extension machinery to educate the public in this direction so as to get their full cooperation, otherwise all the efforts are likely to go waste.

SELECTION OF THE SITES

All lands unfit for agricultural field crops should be brought under afforestation-cum-grassland development, irrespective of the topography.

In order to face the challenge in regard to the role of forestry in arid zone, the Central Arid Zone Research Institute has been conducting studies on various aspects and environment for evolving different afforestation techniques, resources utilisation etc. Some of the major findings in the field of arid zone forestry are presented in this bulletin in the form of package of practices which could be taken up by all those interested in forestry.

RAISING OF TREE SEEDLINGS

Tree seedlings are raised in the nurseries. A well balanced mixture of sand, silt and farm yard manure in equal proportion is essential for raising well developed plantable size seedlings. Seedlings can be raised directly in the nursery beds, in metallic containers, polythene bags, sun dried earthen bricks or in earthen pots. In arid zones, considering water economy, metallic containers have been found to be very economical though initially the cost of these containers is more. The best period for sowing seeds in nursery beds and in containers is August-September months to get well developed seedlings of 40 to 50 cm height.

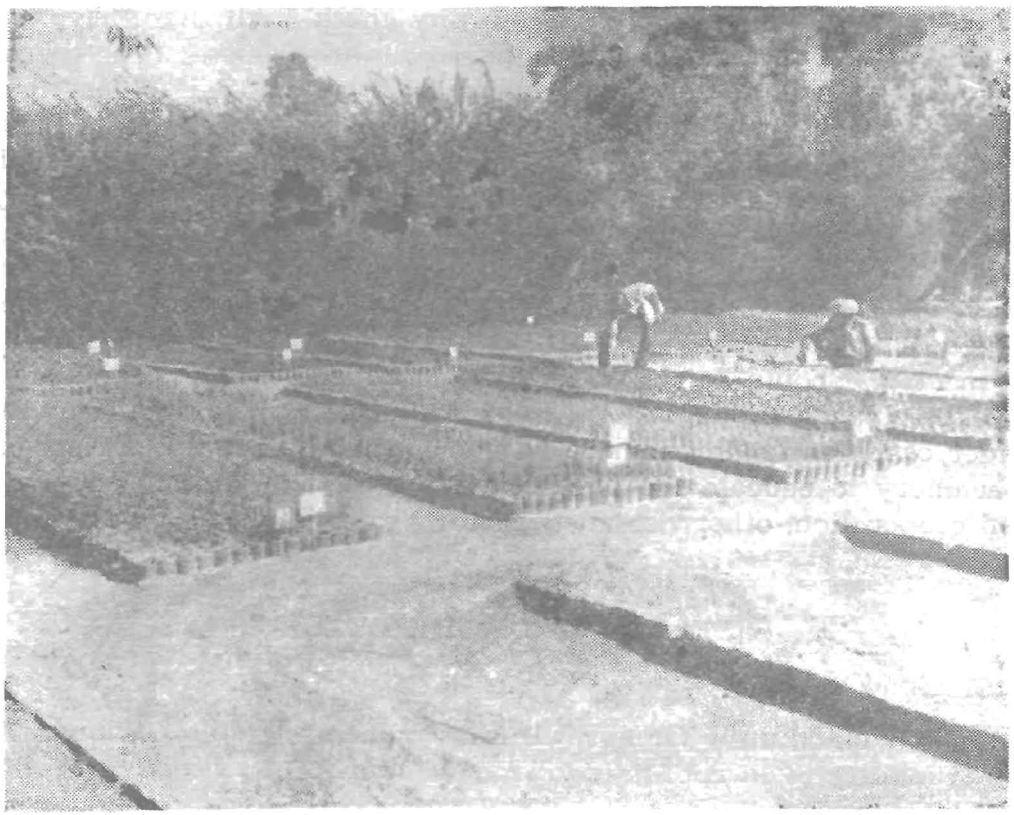

Fig. 1. Tree Nursery, Jodhpur

Earthen bricks are made of a mixture of sand, clay and farm yard manure in equal proportions and prepared in moulds of 30 cm high, 10 cm and 15 cm square at the top and bottom respectively with a cavity of 2.5 cm diameter at the top and 10 cm deep for dibbling seeds, planting seedlings, cuttings or stumps and sun dried. Seedlings raised in these earthen bricks have been found to be very successful for afforestation work on the shifting sand dunes.

AFFORESTATION TECHNIQUES

(a) **Sandy plains :** These sites comprise of deep sandy soils having soil depth ranging from 70 to 150 cm with concur pan beneath. Soil working in such areas need not be done well in advance of planting as it would affect the soil moisture build up. Planting pits of 60 × 60 × 60 cm. should be dug out and half filled with the loose weathered soil before planting with the onset of rains in the months of July. Sturdy seedlings of 9 to 10 months old, raised in Galvanised iron containers or polythene bags, should be planted in the pits provided with saucer like depressions around the plants in plains or crescent shaped ridges of 15 cm high are formed across the local slope if planting is to be done on slopes so as to arrest the run off water during monsoons.

Fig. 2. **Acacia tortilis** plantation in CRF, Jodhpur

Species recommended : Acacia tortilis (Israeli babool), **Prosopis juliflora** (Vilayathi babool), **Prosopis cineraria** (Khejdi), **Azadirachta indica** (Neem), **Albizzia lebbek** (Siris), **Acacia senegal** (Kumat), **Dichrostachys glomerata, Cassia siamea** (Kala siris), **Tamarix articulata** (Farash), **Holoptelia integrifolia** (Churel), **Colophospermum mopane** etc.

(b) **Shallow sandy loam soils :** These consist of shallow sandy loam soils overlying deep hard calcareous pan and in such sites it is

absolutely necessary to perforate the pan to a depth of 90 to 100 cm by using a post hole digger, or by manual labour to provide a deep rooting medium for proper development of the plant. After ripping open the pan, loose weathered soil should be filled in those pits before planting. With the onset of monsoons, sturdy nursery raised seedlings of 9 to 10 months old are planted providing saucer shaped depressions around the plant to store rainwater for a longer period.

Fig. 3. **Azadirachta indica** plantation on shallow sandy loam soils, Pati

Note : Luxurient Cenchrus grass cover under tree canopy

Species recommended : Acacia tortilis, Prosopis juliflora, Azadirachta indica, Albizzia lebbek, Zizyphus nummularia (Bordi), **Dichrostachys glomerata, Holoptelia integrifolia, Dalbergia sissoo** (Shishum) etc.

(c) **Sand stone rocky sites :** These are mostly hilly areas devoid of vegetation except for sparce growth of **Euphorbia** sps. **Acacia senegal, Anogeissus pendula** (Dhokra), **Zizyphus nummularia,** etc. due to over felling and over grazing, with the result these are just barren rocky sites with hardly any top soil for reafforestation with tree species. It is, however, desirable to select out spots having

pockets of deeper soil depositions for planting seedlings. Further by adopting effective soil conservation measures, such as contour trenches, check dams etc. on slopes and foot hills, successful tree plantations could be established. Moreover, such depleted sites receiving less than 250 mm rainfall may not be considered suitable for tree plantation owing to adverse edaphic factors.

Wherever soil depositions exit, pits of 45 × 45 × 45 or 60 × 60 × 60 cm are dug out and half filled before planting the seedlings. The other half of the dug out soil is made into a crescent shaped ridge of 15 to 20 cm high across the local slope to collect the run off rain water. On shallow soil pockets, seeds of good variety grasses should be dibbled to develop such patches with grass cover.

Species recommended : Acacia tortilis, Prosopis juliflora, Acacia senegal, Butea monosperma (Dhak), **Azadirachta indica, Albizzia lebbek, Cassia siamea** etc.

(d) **Saline areas :** These are areas having highly saline soils with hardly any vegetative cover except for some salt bushes and few sparce tree growth of hummocky areas. Afforestation of such areas is only possible by ripping open the pan to a depth of a metre by a tractor (D.C. 8 crawler type) followed by cross harrowing. After the pan is broken, the area should be cross harrowed to break the crust formation. After this operation, ridges of 1 metre wide at the base and 1 metre high are constructed with the help of dosers. The interridge space is about 1.5 to 2.0 m. Planting is carried out on the crest of ridges in pits so that the salts get leached down from the ridges to lower depth providing better soil condition and rooting depth for increased transplant establishment and growth.

Species recommended : Prosopis juliflora, Tamarix articulata, Salvadora oleoides (Jal) and **Salvadora persica** (Kherajal) etc.

(e) **Shifting sand dunes :** Rajasthan alone has about 60% of the arid zone which needs greater emphasis on stabilization activities. There are 3 distinct types of dunes namely (i) longitudinal (ii) transverse and (iii) barchans. In low rainfall areas shifting dunes are often met with near habitations and townships.

Our studies on the soil moisture regime and micro climatic pattern over stabilised and shifting dunes revealed that high moisture concentration occurs below 1.5 m depth in shifting sand dunes through out the year and below 4 m in stabilized dunes during summer months. It has, therefore, been found that shifting sand dunes are the most suitable sites for afforestation even in low rainfall zones.

F.g. 4. Shifting sand dunes engulfed buildings Udaramsar, Bikaner

Techniques have been evolved for stabilization of shifting sand dunes by this Institute and over 1000 Ha sand dunes in different agroclimatic regions of Western Rajasthan have been successfully stabilized. For stabilizing the sand dunes we have to adopt the following processes (i) protection against biotic factors by fencing (ii) creation of micro-wind breaks from crest down to the heel of the dune against the prevailing wind direction (iii) planting trees and grasses in between the microwind breaks to provide a vegetative cover.

Microwind breaks or small barriers are erected across the wind direction 2 to 5 metres apart along the conouts on the slope and also as per the wind velocity. In areas where wind direction changes frequently and on steep slopes, barriers in checker board pattern to the size of 2 m $\times$ 3 m to be adopted. Barriers are erected by burying vertically brush wood, grass etc. with crown downwards, in lines. Suitable brush woods locally available near the site are :—

1. Leptadenia pyrotechnica (Khimp)
2. Zizyphus nummularia (Ber)

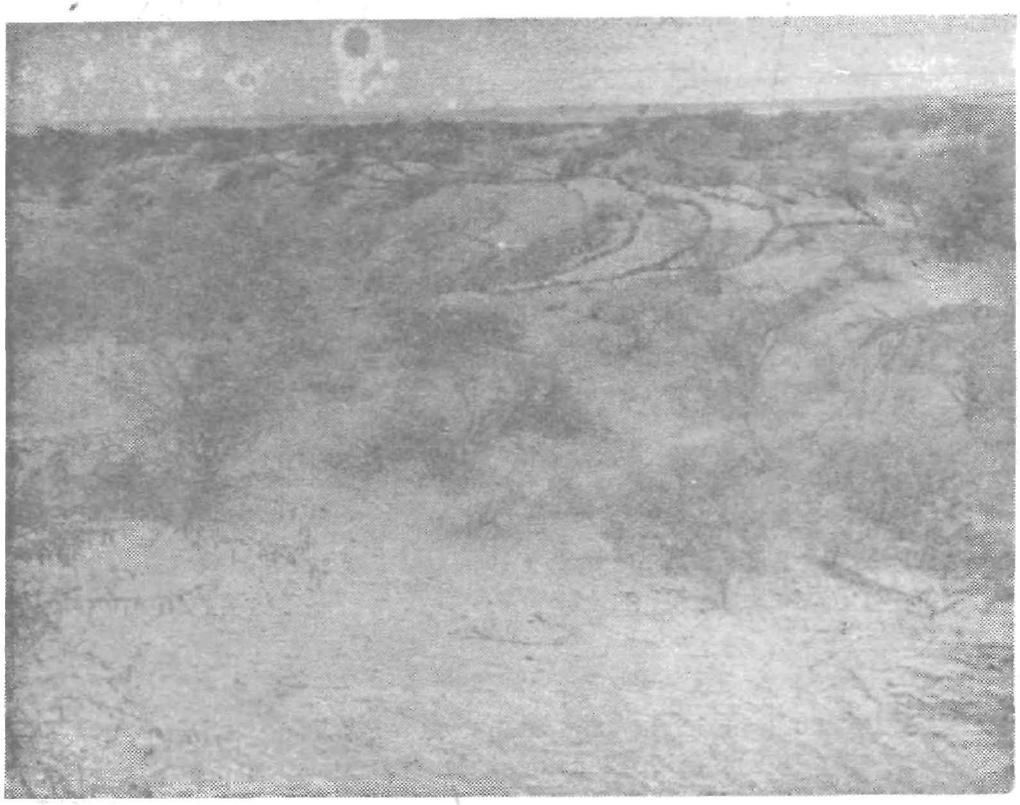

Fig. 5. Sand dune stabilization work in progress—Udaramsar, Bikaner

3. Crotolaria burhia (Sania)
4. Panicum turgidum (Murat)

Planting 9 to 12 months old seedings of drought hardy, adapted and fast growing species raised in sun dried earthen bricks should be done at 5m x 5m on receipt of a good shower after the 2nd fortnight of July to first fortnight of August.

Mixed seeds of grasses and legumes should be sown on the leeward side of the micro-wind breaks in order to bind the sand. It is desirable to plant tree species in strips of 20 m to 30 m wide at 40 m to 50 m apart across the wind direction for planting grasses in between these strips as grasses do not grow well under closed tree canopies. All the casualities should be replaced in the same season to take advantage of the moisture regime.

Species recommended : Acacia tortilis, Prosopis juliflora, Prosopis cineraria, Parkinsonia aculeata, Acacia senegal, Dichrostachys glomerata, Calligonum polygonoides, Albizzia lebbek, Tamarix articulata, Saccharum munja, Colophospermum mopane etc.

Fig. 6. Unstabilized (right) and stabilized (left) sand dunes and the effect of fencing. Barmer (Rajasthan)

(f) **Road side plantations :** Road side avenue plantations along the main high ways to the extent of over 200 km were established by this Institute with different tree species. The technique consisted of planting 3 staggered rows of trees on either side of the road.

Circular pits of 60 cm diameter and 90 cm depth with a circular ditch of 3 m diameter and 60 cm width and 60 cm depth have been found to be very effective for planting Road-side plantations. The soil from the circular ditch is pited on the berm. This operation should be completed before the end of June so that the dug out soil is thoroughly allowed to weather. During the middle of July i.e. prior to the commencement of rains, these pits are refilled with the weathered soil mixed with one tagari full of farm yard manure per pit. Planting is generally done on receipt of a good soaking shower sometime in July. Immediately after planting 9 to 12 months old tree seedlings, each pit has to be watered at 18 litres per pit. In case of failure of rains after the planting is done, regular watering at 18 litres per plant/pit may be given once a fortnight till the plants are established. Complete protection against browsing animals has to be ensured by fencing individual plant with thorns or with tree guards made out of used empty coal tar drums.

The plantings consist of a shade row at 9.6 m away from the centre of the road. The second and third rows are successively

staggered at 3.8 m intervals. The interspace being 10 m for shade rows (first row of trees) and 5 m for outer 2 rows. This type of plantings provide excellent avenues.

Wherever there is threat from sand accumulation on the roads, tree planting should be done at least 16 meters away from the road margin. Straight growing, single stem trees should be preferred. Trees which have a tendency to develop low branching should be avoided as their lower branches arrest the fine sand particles at the base of the trees, which later on cause road block.

Species Suitable: Azadirachta indica (Neem), **Albizzia lebbek** (Siris), **Dalbergia sissu** (Sisham), **Cassia siamea** (Kala siris) for shade rows and **Prosopis juliflora** (Vilayathi babool), **Acacia tortilis** (Israeli babool) and **Tamarix articulata** (Farash) for the 2 outer rows. Cuttings of **Euphorbia caducifolia** (Thor) may also be planted or thorns of **Zizyphus nummularia** (Bordi) or seeds of **Prosopis juliflora** may be placed along the outer edge of the circular ditches to provide protection for the plants from stray cattle. Moreover the circular ditches also help to store the rain water for a longer duration.

(g) **Wind break and shelter belt plantations:** In arid zone most of the farmers have been realising the usefulness of some sort of obstruction for protecting their crops against hot desiccating winds which are very frequent during the summer months. Wind breaks are essential for protecting nurseries, orchards, buildings, cattle sheds. etc. whereas shelter belts are essential to protect vast areas with field crops, highways, railway lines, canals, etc. from desiccating winds and moving sand dunes. Trees cause the wind to be deflected and to filter through, thereby reducing the velocities without turbulance. Lower growing vegetation such as grasses and shrubs offer considerably less resistance to the force of the wind.

For an effective shelter belt in the drier parts of this country, one of the most important requirement for good composition is a dense row of trees, shrubs and grasses on the windward side. The tall growing trees should be planted in the middle to ensure maximum height while those on either sides should be short and of a more busy variety to maintain a dense low barrier. Planting of these should be staggered to provide a compact barrier.

In shelter belts a certain amount of penetrability is advisable because a slight movement of wind serves to keep off the upper dry

air masses from descending to lower protected levels and shelter belts are always tend across the wind direction.

The following points may be kept in view while selecting species for shelter belt plantings :—

(i) The species selected should be capable of growing fast,

(ii) The species should be wind firm,

(iii) The species should be long lived,

(iv) The species should form a dense crown cover,

(v) The species should form litter in abundance on the plantation floor and

(vi) The species should be drought and frost resistant.

The technique of establishing shelter belts with a number of species were developed by this Institute after raising 103 kg long shelter belts at the Central Mechanised Farm, Suratgarh (Rajasthan).

This Institute has also evolved technology for raising avenue cum road side planting along highways (207 km) in arid regions of Rajasthan and also for raising shelter belt plantations at vulnerable places along railway track (5 km) to check the movement of sand blowing and covering over the tracks causing hinderance to the rail traffic.

Planting technique adopted consisting of digging 'V' shaped ditches of 45 cm wide and 45 cm deep along the planting lines. On either side of the ditches staggered planting pits of 30 x 30 x 30 cm were dug and seedlings planted during the onset of rains.

Species recommended for rainfall zones of 300 to 350 mm: Acacia tortilis, Prosopis juliflora (Israel variety), **Cassia siamea, Azadirachta indica, Albizzia lebbek, Acacia nilotica** spp. **cupressiformis** etc.

For all the above planting programmes, the best time of planting is from second fortnight of July to first fortnight of August depending on the commencement of monsoons and in any case planting should be done on receipt of good soaking rains. The replacement of casualities in all cases should be completed within the same season for better success.

CULTURAL OPERATIONS

Two weeding and soil working a year should be given round the plants for the first three years depending on the intensity of weed growth. It has also been found very useful to cut down the weed growth from the entire plantation by cross harrowing to check the moisture competition on the surface soil and also to provide more aeration to the roots.

MAINTENANCE AND AFTER CARE

After care of any tree planting programme is the most important operation and it should not be presumed that once planting is done, the responsibility is over. When once the planting of tree seedlings is completed, the following precautions are taken till their establishment.

Protection from biotic interferences. This is taken care of by (a) wire fencing or thorn fencing round the plantation, (b) fixing tree guards in case the planting is done on road sides as avenue trees, as shade trees in public places, school compound, near water pockets, wells, parks etc.

Tree guards may be any of the following: Empty coaltar drums are cut and made as tree guards, thorn fencing, circular trench round the planting pit and sown with seeds of fast growing thorny shrubs and trees on the ridges formed by the dug out soil from the trench. Planting cuttings of **Euphorbia caducifolia** round the planting pit also provides protection to the seedlings.

In case the rainfall distribution is unsatisfactory or fails completely, it is advisable to water the seedlings at 18 litres per plant fortnightly till end of March and weekly from April till a good shower is received in the month of July.

Watch and ward should be arranged for the proper maintenance of the plantation to check illicit entry of livestock and trespassers.

RESOURCE UTILIZATION

The rotation for felling trees for fuel wood may be fixed at 10 years under coppice with standard systems. At the end of the rotation a tree would yield about 80 to 100 kg of fuel wood in addition

to top feed for livestock and thorns for fencing. These trees also provide shade, leaves as fodder, pods as concentrate for the livestock population and also small timber for Agricultural implements.

There are many tree species with good fodder potentialities but their utility depends much on their palatability, nutritive value, availability, crude protein etc. Though some of the **Acacias** and **Prosopis juliflora** are rich in crude protein, are not palatable to livestock as they contain bitter substances.

Palatability ratings for leaves of different top feed species are listed below :—

Species	Common names	Palatability ratings	Crude protein
Acacia nilotica	Babool	Good	13.9
Prosopis cineraria	Khejri	Good	13.9
Salvadora oleoides	Pilujal	Good	9.6
Salvadora persica	Kharajal	Good	14.2
Zizyphus nummularia	Bordi	Good	11.7
Acacia tortilis	Israeli babool	Good	12.0
Colophospermum mopane	—	Good	14.6
Dichrostachys glomerata	—	Good	20.9
Acacia senegal	Kumat	Moderate	10.3
Alibizzia lebbek	Siris	Moderate	29.2
Anogeissus pendula	Dhokra	Moderate	7.6
Calligonum polygonoides	Phog	Moderate	7.4
Azadirachta indica	Neem	Fair	12.4
Prosopis juliflora	Vilayathi babool	Fair	21.4
Grewia tenax	Gangana	Fair	10.3
Gymnosporia spinosa	Kankra	Fair	9.3
Tecomella undulata	Rohida	Fair	12.2

HOW TO INDENT FOR SEEDS/SEEDLINGS

All indents may be addressed to the Director or to the Head of Division (Plant Studies), Central Arid Zone Research Institute, Jodhpur at least a month in advance. Supply is made on cash payment. Packing materials such as gunny bags, pots etc. for transportation of material are to be arranged by the indentor.

SOURCE OF AVAILABILITY

1. Central Arid Zone Research Institute, Jodhpur
2. District Forest Officer, Jodhpur.
3. Officer Incharge of Public Park and Mandore Gardens, Public Park, Jodhpur.
4. M/S Bhagwati Nursery, Opp. Railway Hospital, Ratanada, Jodhpur.

Rates of seeds and seedlings supplied from the CAZRI are furnished in the Appendix I & II.

List of tree and shrub species with their various utility is furnished below

Fuel	Fodder/feed	Food/fruit	Fibre
Acacia senegal (Kumat)	Acacia senegal (Kumat)	Acacia senegal (kumat)	Agave americana (sisal)
Acacia nilotica spp indica (Kikar)	Acacia nilotica spp indica (Kikar)	Capparis decidua (kair)	Agave sisalana (sisal)
Acacia tortilis (Israeli babool)	Acacia tortilis (Israeli babool)	Prosopis cineraria (Khejdi)	Dichrostachys glomerata
Acacia raddiana	Albizzia lebbek (Siris)	Zizyphus nummularia (Bordi)	Dichrostachys nutans
Albizzia lebbek (Siris)	Albizzia amara	Moringa oleifera (Sanjana)	Boswellia serata (Salar)
Azadirachta indica (Neem)	Azadirachta indica (Neem)	Inga dulce (Jungle jeelabi)	Calotropis procera (Aak)
Anogeissus pendula (Dhokra)	Calligonum polygonoides (Phog)		Leptodenia pyrotecnica (Khemp)
Calligonum polygonoides (Phog)	Acacia raddiana		Saccharum bengalensis (Moonj)
Cassia siamea (Kala siris)	Capparis decidua (Kair)		
Capparis decidua (Kair)	Acacia aneura		
Cassia auriculata (Senna)	Colophospermum mopane		
Colophospermum mopane	Allanthus excelsa (Ardu)		
Dalbergia sissoo (Shishum)	Dichrostachys glomerata		
Dichrostachys glomerata	Braselettia mollis		
Dichrostachys nutans	Dichrostachys nutans		

Hardwickia binata	Moringa oleifera (Sanjana)
Gymnosporia montana (Kankara)	Aegle marmelos (Bhel)
Inga dulce (jungle jeelabi)	Holoptelia integrifolia (Churel)
Eucalyptus species (Safeda)	Moringa conconensis (Sanjana)
Holoptelia integrifolia (Churel)	Prosopis cineraria (Khejdi)
Prosopis cineraria (Khejdi)	Ficus bengalensis (Bur)
Prosopis juliflora (Vilayathi babool)	Zizyphus nummularia (Bordi)
Salvadora persica (Jal)	Salvadora oleoides (Jal)
Tamarix articulata (Farash)	Zizyphus spinachristi
Tecomella undulata (Rohida)	Inga dulce (Jungle Jeelabi)
	Hardwickia binata
	Leucaena leucopholla

Oil seeds	Soil conservation/ stabilisation	Beautification	Gums/Oleo-resins
Azadirachta indica (Neem)	Acacia senegal (Kumat)	Delonix regia (Gulmohur)	Acacia senegal (Kumat)
Salvadora persica (Jal)	Acacia nilotica spp indica (Kikar)	Bauhinia alba (Kachnar)	Acacia nilotica spp indica (Kikar)
Salvadora oleoides (Jal)	Acacia tortilis (Israeli babool)	Bauhinia purpurea (")	Acacia leucophloea (Safed Kikar)
Pongamia glabra (Karanj)	Acacia raddiana	Bauhinia verigata (")	Anogeissus pendula (Dhokra)
Moringa oleifera (Sanjana)	Azadirachta indica (Neem)	Bauhinia racemosa (")	Albizzia lebbek (Siris)
Moringa conconensis (Sanjana)	Albizzia lebbek (Siris)	Cassia siamea (Kala siris)	Azadirachta indica (Neem)
	Calligonum polygonoides (Phog)	Cassia nodosa	Moringa oleifera (Sanjana)
	Colophospermum mopane	Cassia racemosa	Prosopis juliflora (Vilayathi babool)
	Dalbergia sissoo (Shishum)	Cassia fistula (Amaltash)	Cummiphora wightiana (Guggal)
	Dichrostachys glomerata	Cassia javanica	
	Dichrostachys nutans	Cassia auriculata (Senna)	
	Prosopis cineraria (Khejdi)	Eucalyptus species (Safeda)	
	Prosopis juliflora	Azadirachta indica (Neem)	

(Vilayathi babool)	
Tamarix articulata	Albizzia lebbek (Siris)
(Farash)	Glyricidia maculata
Zizyphus nummularia	Bougain-villeas
(Bordi)	
Agave americana (Sisal)	Roses
Cassia auriculata (Senna)	Other flowering plants

APPENDIX I

Silviculture Section

Price list of seeds during 1977 i.e., w.e.f. 1.1.1977

Seeds A

S. No.	Name of sps.		Approved price/kg
1.	Eucalyptus	camaldulensis	Rs. 50/-
2.	-do-	oleosa	Rs. 50/-
3.	-do-	coolabah	Rs. 50/-
4.	-do-	terminalis	Rs. 50/-
5.	-do-	intertexta	Rs. 50/-
6.	-do-	pachyphylla	Rs. 50/-
7.	-do-	brevifolia	Rs. 50/-
8.	-do-	hybrid	Rs. 50/-
9.	-do-	siderophloia	Rs. 50/-
10.	-do-	ochrophloea	Rs. 50/-
11.	-do-	largiforens	Rs. 50/-
12.	-do-	populifolia	Rs. 50/-
13.	-do-	microtheca	Rs. 50/-
14.	-do-	teriticornis	Rs. 50/-
15.	-do-	rostata	Rs. 50/-
16.	-do-	astringens	Rs. 50/-
17.	-do-	tessellaris	Rs. 50/-
18.	-do-	citriodora	Rs. 50/-
19.	-do-	lessuefii	Rs. 50/-
20.	Acacia	tortilis	Rs. 20/-
21.	-do-	gregii	Rs. 10/-
22.	-do-	ligulata	Rs. 40/-
23.	-do-	jacquemontii	Rs. 15/-
24.	-do-	salicina	Rs. 45/-
25.	-do-	raddiana	Rs. 20/-
26.	-do-	nubica	Rs. 15/-
27.	-do-	aneura	Rs. 35/-
28.	-do-	catechu	Rs. 25/-
29.	-do-	seyal var seyal	Rs. 20/-
30.	-do-	senegal	Rs. 15/-

S. No.	Name of sps.		Approved price/kg
31.	-do-	senegal (local)	Rs. 10/-
32.	-do-	farnesiana	Rs. 25/-
33.	-do-	gerradii	Rs. 15/-
34.	-do-	ciliata	Rs. 45/-
35.	-do-	drepanalobium	Rs. 25/-
36.	-do-	auriculiformis	Rs. 25/-
37.	-do-	calamifolia	Rs. 25/-
38.	-do-	nilotica	Rs. 15/-
39.	-do-	victoriae	Rs. 25/-
40.	-do-	benthamie	Rs. 20/-
41.	-do-	leucophioea	Rs. 10/-
42.	-do-	hockii	Rs. 25/-
43.	-do-	planifrons	Rs. 25/-
44.	-do-	cyclopsis	Rs. 20/-
45.	-do-	vereck	Rs. 20/-
46.	-do-	murrayana	Rs. 25/-
47.	Cassia	coryambosa	Rs. 15/-
48.	-do-	phyllodinea	Rs. 10/-
49.	-do-	cultiformis	Rs. 15/-
50.	-do-	eremopholia	Rs. 15/-
51.	-do-	auriculata	Rs. 20/-
52.	-do-	australis	Rs. 20/-
53.	-do-	artemisiodes	Rs. 20/-
54.	-do-	renigera	Rs. 20/-
55.	-do-	nodusa	Rs. 20/-
56.	Cassia marginata		Rs. 20/-
57.	Cassia fistula		Rs. 20/-
58.	Celasalpinia coriara		Rs. 30/-
59.	Cordia dischotama		Rs. 15/-
60.	Combretum aplicaletum		Rs. 15/-
61.	Colophospermum mopane		Rs. 20/-
62.	Albizzia lebbek		Rs. 10/-
63.	Ailanthus excelsa		Rs. 10/-
64.	Albizzia amara		Rs. 15/-
65.	Brasilettia mollis		Rs. 15/-
66.	Bauhinia alba		Rs. 15/-
67.	Bauhinia variegata		Rs. 15/-
68.	Dalbergia sissoo		Rs. 10/-
69.	Dodonea viscosa		Rs. 10/-
70.	Dichrostachys glomerata/nutans		Rs. 15/- each
71.	Grevillea pterosperma		Rs. 80/-
72.	Bauhinia purpurea		Rs. 15/-

S. No.	Name of sps.	Approved price/kg
73.	Kochigo tomentosa	Rs. 10/-
74.	Leucaena leucopholea	Rs. 10/-
75.	Mayoporum montanum	Rs. 15/-
76.	Moringa spps.	Rs. 10/-
77.	Prosopis juliflora (pods local)	Rs. 5/-
78.	Prosopis (exotic)	Rs. 15/-
79.	Prosopis (pure seeds)	Rs. 25/-
80.	Poinciana regia	Rs. 25/-
81.	Pithecolobium dulce	Rs. 15/-
82.	Parkinsonia aculeata	Rs. 15/-
83.	Prosopis cineraria	Rs. 10/-
84.	Prosopis siliquestrum	Rs. 35/-
85.	Salvadora spps.	Rs. 15/-
86.	Schinus molle	Rs. 35/-
87.	Tecomella undulata	Rs. 15/-
88.	Tecoma urgentina	Rs. 45/-
89.	Zizyphus nummularia	Rs. 10/-
90.	Zizyphus spinachristi	Rs. 15/-
91.	Tetragonia arbuscula	Rs. 15/-
92.	Azadirachta indica	Rs. 20/-
93.	Seasonal seeds packet (1 to 5 grams)*	Rs. 0.50 packet
94.	Glyricidia maculata	Rs. 15/-

*According to number of seeds/grams

APPENDIX II

Price list for flowering and other types of plants for the year 1977

A. Flowering Plants

S. No.	Name of plants	Approved price/plant
1.	China Rose	Rs. 1.00
2.	Budded rose (ord.)	Rs. 3.00
3.	Budded rose (special or bicolour)	Rs. 4.00
4.	Desi rose	Rs. 1.00
5.	Bougainvilleas (ord.)	Rs. 1.00
6.	B. (special) M. Palmer Lady bearing, Golden glowry	Rs. 3.00
7.	Jasmine (Mogra, Raibel, Juiee, Chameli, Night queen etc.)	Rs. 1.00
8.	Jasmine (Special-Hathi mogra)	Rs. 1.00
9.	Nerium (Kaner)	Rs. 0.75
10.	Hibiscus (Gudhal)	Rs. 0.75
11.	Chandani and Russelia	Rs. 1.00
12.	Nagchampa and Harsingar	Rs. 1.00
13.	Acalyphas	Rs. 1.00
14.	Cannas	Rs. 0.25
15.	Lillies	Rs. 0.25
16.	Lilly special (Rajnigandha)	Rs. 0.75
17.	Cactii (Special)	Rs. 2.00
18.	Chrysanthemum	Rs. 0.25
19.	Cactii (ord.)	Rs. 0.50
20.	Seasonals (Annuals) for 100 plant	Rs. 3.00
21.	Non-rooted cuttings (lantana-deshi rose, mehandi, clerodendron for 100 cuttings)	Rs. 5.00
22.	Bougainvilleas (uniques)-million dollar, thima	Rs. 5.00

B. Tree Species

1.	Acacia, Prosopis, Tamarix, Salvadora Shishum and other forestry plants	Rs. 0.20
2.	Neem, Siris and Eucalyptus	Rs. 0.30

S. No.	Name of plants	Approved price/plant
3.	Cassias, Bauhinias and other flowering tree species	Rs. 0.50
4.	Gulmohar	Rs. 1.00
5.	Pipal, Bad	Rs. 0.50
C.	**Fruit Plants**	
1.	Papita and Ber seedlings	Rs. 0.50
2.	Anar, Date, Guava, Grape and Nimbu seedlings	Rs. 1.50
3.	Grafted ber and mango seedlings	Rs. 3.00
4.	Grafted citrus seedlings	Rs. 2.00
D.	**Security Deposits**	
1.	G. I. Tubes	Rs. 5.00 (per tube)
2.	Earthen Pot	Rs. 2.00 (per pot)