NEW SPECIES FOR AFFORESTATION IN SEMI-ARID LANDS

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Summary

In the quest for finding out suitable methods of afforestation in arid and semi-arid areas of Pakistan, some studies have been conducted in Rakh Dagar Kotli (Thal desert of Pakistan) using different methods of site preparation and tree species. The water harvesting methods used involved preparation of trenches with and without catchments, sloping catchment without a trench, pits and flat ground to serve as control.

The tree species tested included *Acacia albida* (Sudan). *Acacia aneura* (Australia), *A. modesta, A. tortilis* (Sudan), *A. victoriae,* (Australia), *Parkinsonia aculeata, Prosopis cineraria* and *Tecoma undulata.* The results over a period of 7 years have indicated that trees can be successfully planted if some micro catchment is provided for harvesting extra quantity of water for the plants. *Acacia tortilis* and *A. victoria* turned out to be the most outstanding exotic species and *P. cineraria* and *T. undulata* which are local to our deserts but never tried before gave very indicative results. These species should be propagated on a large scale for bringing back the desert vegetation for fuel, fodder and food.

Introduction

In Pakistan it is estimated that about 57.10 million ha are arid and 17.11 million ha are semi-arid. Low rainfall and high summer temperature are characteristic features of these tracts. The common mode of life of people is pastoral farming with nomadic habits, moving from place to place wherever some greenery and water is found for livestock, sheep and goats. These areas in the past have been visited by thousands of tribesmen from the western border looking for grazing grounds and water points during the winter. Life of the people is really very hard, the most prominent feature of which is poverty. They manage to live on the poorest of diet. Scantiness of the rainfall and severity of the climate make them poorer still. Due to people's requirements of fuelwood, small timber and fodder all these areas have been under very heavy biotic pressure; vegetattion has almost disappeared and owing to poor site quality and increase in human and cattle population it is very difficult to re-green these desert areas without a scientific plan and some sustained effort. Nevertheless, in view of the afflication of once rich agricultural land with waterlogging, salinity and aridity some attention has to be paid to develop this potential resource through suitable techniques.

The methods usually employed for afforestation of the deserts include the following:

– Water harvesting through site preparational

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- Moisture preservation by mulching, etc.
- Deep planting to make moisture available to the plants; and
- Proper selection of species.

A number of studies have been conducted in this connection in Rakh Dagar Kotli in the Thal desert in Pakistan. The tract receives an average rainfall of 200 mm. The mean summer temperature is 32°C and the mean winter temperature 17.7°C. The area is characterized by windy deposits of sand dunes interspersed with level areas of land consisting of sandy loamy soils. The wind blows from the south in summer and from the north in winter.

The dominant vegetation types are the tree-scrub-steppe of *Salvadora oleoides, Capparis decidua, Eleusine compressa* and a desert scrub of *Haloxylon recurvum.* Tall grasses such as *Pennisetum, Eleusine* and *Cymbopogon* contribute maximum to the canopy cover whereas the trees from the upper canopy. Most common species seen on the sand dune is *Acacia jacquemontii* but in the flats *Prosopis cineraria* is dominant which has been preserved by the local population as an important source of fuelwood and fodder.

Materials and methods

The study was laid out in August, 1980, to assess the effect of different planting methods on the survival and growth of 8 tree species, using split-plot design with four replications, treatment being the first split and species the second. Four plants of each species were planted in each row at one metre spacing.

The following five rainwater harvesting methods were adopted:

- Sloping catchment, one metre slope (one in three), with a trench 0.3 metre deep.
- Sloping catchment, one metre slope (one in three), without trench.
- Trench 0.3. metre wide and 0.3 metre deep.
- Pit of 0.5 metre diameter and 0.3 metre depth.
- Flat ground (control).

Results

Survival and growth data recorded in May, 1981 and 1987 respectively are summarised in Tables 1 and 2.

Table 1. Survival of tree species planted in different rainwater harvesting techniques

Number of plants surviving out of 16 planted in four replications

Tree species	Sloping catchment with trench	Sloping catchment without trench	Trench	Pits	Surface	% Survival in all treatments
Acacia aneura	7	7	11	9	7	51
A. albida	13	15	14	12	9	79
A. modesta	12	16	13	15	14	87
A. tortilis	10	13	11	12	15	76
A victoriae	3	6	3	3	7	28
Parkinsonia aculeata	11	12	12	9	3	59
Prosopis cineraria	13	13	11	9	11	71
Tecoma undulata	16	16	14	16	16	97
Total	85	98	89	85	82	
Percentage Survival	66	77	70	66	64	

Survival

Maximum survival has been observed in sloping catchment without trench, i.e. 77%, followed by 70% of trench only. Trench with slope has given rather low survival because of flooding due to unprecedented flash rains, causing long submersion of plants under high temperature of the desert.

Tecoma undulata had a maximum survival (97%) in all treatments followed by *Acacia modesta* (87%), *Prosopis cineraria* (71%), *A. tortilis* (76%), *Parkinsonia aculeata* (59%), *A. albida* (79%), *A. aneura* (51%) and *A. victoriae* (28%).

On the statistical analysis of the survival data, theANOVA revealed that the methods of rainwater harvesting treatments do not have any significant effect on the survival of the

planted species while the survival of species is highly significantly different from each other. *Tecoma undulata* is the best one, followed by *A. modesta, A. albida, A. tortilis, Prosopis cineraria, Parkinsonia aculeata* and *A. aneura, A. victoriae* has given the poorest survival.

Rate of growth

The growth measurements of plants were also taken in 1981, 1982, 1983, 1985, 1986 and 1987 as given in Table (2).

Results and recommendations

Following inferences can be drawn from the data.

1. Irrespective of any treatments, *Acacia tortilis* has shown the best growth, both on the average as well as the maximum by the end of 1987.

2. Most of the species have recorded plus 4 m growth under water harvesting treatments such as trench with slope, slope without trench (trough) and trench only. The only exceptions are *A. aneura* and *Parkinsonia aculeata*.

3. *Acacia albida* is a very promising species for the area and does very well when helped with harvested rain water.

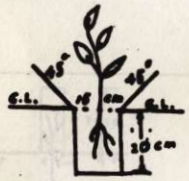
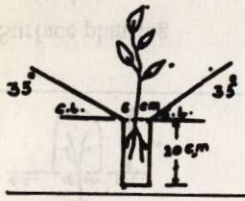
4. *Prosopis cineraria* locally known as "jand" has shown lot of promise and height grained is more than 4.5 metres with the water harvesting techniques.

5. *Tecoma undulata* which had never been tried by the foresters and marked as a slow growing species is also very promising and has a future.

6. *Acacia victoriae* is another new introduction from Australia which has established itself as a useful species for desert afforestation with the maximum growth of more than 4.5 metres under all the treatments except surface planting.

It is very clearly indicated that exotics such as *A. tortilis, A. victoriae, A. albida* and the indigenous species namely *P. cineraria* and *T. undulata* should be planted on a large scale in the deserts.

Table 2. Comparative rate of growth of eight xerophytic species raised in Thal desert (*Average annual rain fall 250 mm*) *under different site operation techniques.*

Treatment	year	Average height (cm) in 7 years (Planted 1980)							
		Acacia albida	*Acacia aneura*	*Acacia modesta*	*Acacia tortilis*	*Acacia victoriae*	*Parkinsonia aculeata*	*Prosopis cineraria*	*Tecoma undulata*
1	2	3	4	5	6	7	8	9	10
Slope with trench 	1981	44	81	69	62	19	69	81	94
	1982	81	131	75	162	131	87	100	100
	1983	246	181	142	320	218	284	149	316
	1985	342	235	331	520	388	330	400	331
	1986	409	260	406	590	416	404	455	400
	1987	475	260	420	610	515	410	475	425
	Aver:	266	191	240	377	281	261	277	278
Slope without trench 	1981	14	44	100	75	37	75	81	100
	1982	94	121	150	181	56	87	75	150
	1983	239	179	257	344	194	275	255	281
	1985	313	237	292	378	371	295	294	335
	1986	341	256	322	436	429	347	350	408
	1987	580	290	407	592	453	377	482	447
	Aver:	263	188	255	334	257	243	273	287
Trench only 	1981	69	75	81	69	20	75	69	87
	1982	87	87	87	146	37	94	75	100
	1983	126	167	200	247	196	237	211	253
	1985	240	208	271	368	384	303	322	334
	1986	412	278	332	526	453	368	401	407
	1987	520	307	427	637	470	493	467	412
	Aver:	242	187	233	332	260	262	257	265

1	2	3		5	6	7	8	9	10
Pit	1981	56	50	94	75	19	56	56	100
	1982	69	75	100	81	62	81	87	160
	1983	117	163	177	223	178	207	181	241
	1985	248	225	270	299	333	306	294	291
	1986	336	276	345	477	405	378	400	377
	1987	353	313	362	535	455	388	438	392
	Aver:	196	184	225	252	242	236	242	260
Surface planting	1981	44	56	87	81	44	19	69	80
	1982	81	69	100	94	94	69	100	100
	1983	94	119	122	163	145	157	134	243
	1985	230	206	236	350	252	367	250	260
	1986	312	281	324	428	326	402	300	312
	1987	315	370	353	570	400	412	370	352
	Aver:	179	183	204	281	210	238	204	224