# EFFECT OF MULCHES ON THE ESTABLISHMENT OF TREE SPECIES IN ARID LANDS

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## Summary

To investigate the effect of different mulches on the survival and growth of tree species an experiment was laid out at Rakh Dagar Kotli in Thal desert. Acacia modesta and A. tortilis were planted with plastic apron, stone pitching, grass mulch and without mulch in March, 1981.

Observations after one year and two months revealed that the mulches did not have any effect on the survival of plants. However, out of the four treatments, plastic aprons were significantly effective in improving the growth rate of both the species; stone pitching and grass mulch had rather negative effect on growth.

#### Introduction

Only 1.3% of the total land area of Pakistan has productive Forest. There is thus a wide gap between supply and demand of wood. Position of fuelwood is highly critical. Natural gas, kerosene and coal meet only 13% of the energy requirements. For meeting the fuelwood, animal dung and agricultural waste make up for the rest of 87%. About 90% rural and 50% urban population depends on these non commercial fuels. Total consumption of wood for wood for domestic requirement of cooking and heating is 16.6 mm<sup>3</sup>. Against that the state forests provide only 0.25 mm<sup>3</sup>. The wastelands which used to be an erstwhile resource of fuelwood have gradually been denuded of all vegetation. Reforestation of such areas seem to be the only hope to build us reserves. Different techniques are being tried for dry zone afforestation in the world. One of these techniques is application of mulches to conserve moisture and avoid evaporation losses. From one-fourth to one-half of the water lost from crop is evaporated from the soil surface (Viets, 1966). The loss can be reduced and rain water saved by placing water light moisture barriers or water retardent soil mulches. Some soil surface moisture barriers are made of nonporous materials such as paper, asphalt, latex oil, plastic films or metal foil. In practice suitable porous materials are plant residues such as straw, sawdust, wood bark or cotton burs as well as gravel, sand or cinders (Annon, 1974). Hendrick (1952) states that addition of polyectrolyte decrease the rate of evaporation and increases the water available to the plant. Pebble mulch was reported to be in use for partial control of evaporation in some dry sections of China (Hide J.C. 1954). Paper and polythene plastic mulches are now widely used to control weeds, increase soil tempertaure and speed up plant germination and growth. Their use specifically to retard evaporation in arid region is now being researched. Plastic apron were evaluated to determine their ability to catch rainwater, reduce evaporation, supress weeds and promote the growth of seedlings of Azadirachta indica in the arid areas at Zambabwa, in Nigeria. The results showed that aprons increased the height of the surviving plants. The colour and type of material did not have any effect on the growth of plants. Similar

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experiments were conducted at Peshawar and Jallo in Pakistan to test plastic aprons having different colours and thickness as a mulch for *Dalbergia sissoo* and *Eucalyptus camaldulensis* (Sheikh M.I. 1975). The results indicated that they had insignificant effect on the survival of plants but had better effect on growth rate. The light resistant type of plastic proved to be more durable. Reitveld (1974) tried different mulches such as clear and black polythene, petrolium emulsion, volcanic cinders, wood chips and dead grass sod. These mulches proved ineffective and did not significantly improve survival. In a few cases polythene increased height growth.

Yields of irrigated corn per unit of water evaporated and transpired have been nearly doubled in one experiment where the soil was covered with plastic film, indicating that upto half the water used by unmulched corn may be lost through evaporation from soil surface (Doss et.al. 1970).

# Material and Method

The experiement was laid out on Ist March 1981 at Rakh Dagar Kotli (Bhakkar Range Management Division) in Thal desert. The annual average rainfall of the area is 200 mm, mostly received in monsoon season, with 32°C mean summer temperature; and 17.7°C mean winter temperature. Wind storms are common in summer months. The area consists of parallel sand dunes, some rising to more than 150 m with orientation to the direction of monsoon winds from North East to South West. In the intervening valleys, alluvial soil brought by the rain water in the depressions contain more clay. The site of the experiment is interdunal valley with alluvial soil.

The experiment was laid out in a split plot design, tree species were the first split, mulches the second with five replications. The tree species put to test were Acacia modesta and Acacia tortilis. The mulches used were white plastic aprons, stone pitching, grass cover and control (without mulch). Stones were collected from road side and Cymbopogon jwaroncusa plants were uprooted, pressed and used as mulch in plant pits. Pits were prepared having 1 metre diameter and 0.2 metre depth. Each subplot comprised of eight plants.

Planting was done at a spacing of 2 x 2 metres with hand watering and the respective mulches were applied. No subsequent hand watering was done. An observatory was set up in the experimental area and climatic data recorded during the period are given in table - 1.

### Results and Discussions

Final observations on the survival of plants were taken on 20th May, 1982, one year and two months after planting. The data are presented in table - 2. There is no effect of different mulches on the survival of plants. The survival of the plants planted with plastic apron, stone pitching, grass cover and control was 61, 62, 61 and 62 percent respectively.

Acacia modesta proved to be more resistant species as compared to A. tortilis as in all the treatments it gave 96.25% survival while only 27.5% plants of A. tortilis survived. Hundred percent of plants of A. modesta survived with plastic apron and grass mulch while in case of stone pitching and control., their survival was 97.5 and 87.5% respectively. Maximum

survival (37.5%) of A. tortilis was observed in control followed by 27.5% with stone pitching and 22.5% in both plastic apron and grass mulch.

The data were statistically analysed and ANOVA shows that there is no significant effect of different mulches on the survival of tree species vhile the tree species are highly significantly different from each other. T-test showed that A. modesta was significantly better than A. tortilis as far as survival was concerned.

The low survival percent showed by A. tortilis in this experiment is also due to the condition of the planting stock. The plants were raised at Peshawar and were brought to site just before planting in February. As the species is frost tender most of seedlings planted had frost injury and the plants being leafless it could not be detected at the time of planting.

Height measurements of all the plants were also taken to see the effect of mulches on the growth. The data are presented in table-3, indicating that plastic aprons had a positive effect on the growth of the plants. Maximum average height attained by both the tree species was 92 cm planted with plastic aprons during the period. The stone pitching and grass mulch seems to have negative effect on the rate of growth of both the species as the average height gained by the plants with stone and grass mulch was only 60 cm repectively, while the average height gained by the plants without mulch was 78 cm. Acacia tortilis proved to be a fast growing tree species as compared to A. modesta. An average height of 79 cm was gained by the plants of this species in all the treatments while the average height gained by A. modesta was 66 cm only. With plastic aprons its plants gained an average height of 106 cm.

The data on growth was analysed statistically and by applying ANOVA it was found that effect of different mulches on the rate of growth of tree species is highly significantly different from each other. The tree species are also significantly different from each other at 5% level in respect of growth rate. The interaction of tree species and mulch treatment is non-significant i.e. the different mulches have similar effect on both the tree species in respect of growth rate.

To evaluate the performance of different mulches t-test was applied which revealed that plastic apron treatment was significantly better than others, while stone pitching grass cover and control were mutually non-significant.

In addition to increase in height, the survived plants with plastic apron have a healthy look and the crown diameter was also larger as compared to the plants in other treatments

The results of the experiment confirmed the results of similar studies made by M. I. Sheikh (1975) in Pakistan on Shisham and Eucalyptus camaldulensis, Reitveld (1974) on Ponderosa pine in Arizona, United States of America and studies made in Nigeria on Azadirachta indica that mulches have no effect on the survival of the tree species but the plastic apron have positive effect on the rate of growth.

In the light of the results of this study it can be recommended that the plastic aprons

can be used for the successful afforestation of dry zone area like Thal desert. To improve the survival rate it will be beneficial to give supplementary irrigation by hand watering at least two to three times the months of May and June in case of spring planting.

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Table No. 1
Climatological data, Rakh Dagar Kotli

	Tempera	ture (C°)	Rain	fall	Relative	Evapora- tion	Wi	nd d Km	Sun- Shine
Month/Year	Max.	Min.	No. of Rainy	mm	humidity at 9 a.m. (%)	(mm)/ day	hou 0.6	2.4 n)	Sinne
January, 1981	23	13	5	22	81	2.38	3	4	6.39
February, 1981	22	10	2	18	77	6.96	3	5	6.38
March, 1981	27	11	4	38	80	7.44	4	4	7.43
April, 1981	34	18	-	-	59	8.88	4	6	8.20
May, 1981	42	23	3	15	68	14.24	5	7	9.54
June, 1981	47.4	25.4	_	_	63.9	15.24	5.1	7.4	10.07
July, 1981	44.5	28.5	5	160	78.2	10.24	6	8	NA
August, 1981	41.0	27.7	4	74	77.2	9.54	4.5	7.0	9.26
September, 1981	41.1	24.4	1	45	67.5	10.16	2.8	5.0	9.43
October, 1981	35.1	18.8	-0	0-	61.0	8.05	2.3	4.1	9.40
November, 1981	27.3	8.45	1	7	66.0	3.82	1.5	3.0	NA
December, 1981	25.2	4.2	_	-	61.3	3.84	1.3	2.2	7.09

Table - 2. Effect of Mulches on the Survival of Plants

Number of plants survived out of 8 plants

Replica	4	Plastic Apron	uo	Sto	Stone Pitching	ng	23	Grass Cover	Ie		Control	agige agif	Total Survival	Total Survival
tions	Sp <sub>1</sub>	Sp <sub>2</sub>	Total	Sp <sub>1</sub>	Sp2	Total	Sp1	Sp2	Total	Sp1	Sp2	Total	Sp <sub>1</sub>	Sp2
R-I	∞	S	13	∞	1	6	8	2	10	9	2	8	30	10
R-II	∞	1	∞	∞	8	Ξ	00	8	1	7	1	00	31	7
R-III	∞	1	6	∞	-	6	80	7	10	7	5	12	31	6
R-IV	∞	7	10	7	4	=======================================	∞	-	6	7	4	1	30	=
R-V	∞	1	6	, <b>∞</b>	2	10	00	00E N	6	<b>∞</b>	·æ	F	32	7
Total	40	6	49	39	1	20	40	6	49	35	15	. 50	154	4
Survival percentage	100 %	22.5	61.25	97.5	27.5	62.5	100 %	22.5	61.25	87.5	37.5	62.5	96.25	27.5
Sp <sub>1</sub>	11	Acacia modesta	rodesta			5.2		0.1	1 2	2			dion	
Sp <sub>2</sub>	II	Acacia tortilis	ortilis											

Table - 3. Effect of Mulches on the Growth of Tree Species

Replications         Sp1         Sp2         Average height height         Sp1           R-I         97         125         111.0         71           R-II         79         -         79.0         52           R-III         78         105         92.5         55           R-IV         74         125         99.5         37	Sp <sub>2</sub> Average height 60 65.5 60 56.0	14 Sp <sub>1</sub> 74 66	Sp <sub>2</sub>	Average		Control		Average height in all treatment	height
97     125     111.0       79     -     79.0       78     105     92.5       74     125     99.5				height	Sp <sub>1</sub>	Sp <sub>2</sub>	Average	Average A. mod- A. tor- height esta tilis	A. tor-tillis
79     -     79.0       78     105     92.5       74     125     99.5			20	72.0	72	65	68.5	78.5	80.0
78     105     92.5       74     125     99.5			43	54.5	11	120	98.5	0.79	74.33
74 125 99.5	65 60.0	43	76	0.07	74	99	65.0	62.5	80.75
	58 47.5	55	65	0.09	92	85	80.5	60.5	83.25
R-V 87 70 78.5 42	100 71.0	49	90	49.5	11	85	78.0	62.25	76.25
Total Average 83 106 92.0 51	0.09 69	57	65	61.0	47	82	78,0	99	79.00

Acacia tortilis

 $Sp_2$