PLASTIC APRONS AS MULCH

MAHMOOD IQBAL SHEIKH*
ABDUL ALEEM*
AND
MOHAMMAD HAFEEZ*

Summary. *Plastic aprons of different colours and thicknesses were used as a mulch for Dalbergia sissoo and Eucalyptus camaldulensis at Peshawar and Jallo. Results indicate:*

1. *Insignificant survival of plants.*
2. *Better rate of growth with aprons.*
3. *Significant effect on height by the material and colour of aprons.*
4. *Light resistant type of plastic was more durable.*

Introduction. Most of Pakistan falls in the arid and semi arid zones. Afforestation attempts with different species are usually frustrated on account of a combination of important factors which involve low precipitation on one hand and high rate of transpiration and evaporation on the other. In this Country a number of site preparation techniques such as contour trenching, pitting, daming etc. have been employed to conserve run off to the advantage of the plants.

In this study, plastic aprons of different colours and guages supplied by FAO were used to find out whether these aids had an effect on the survival/growth of tree species and also durability of the material.

Past Work. The mulches commonly used vary greatly. These include stones, pebbles, dust to pebbles, brushwood, litter etc. Chemicals as well as paper mulches have been successfully utilized in the past. Starting from the dust mulch, Swell concludedd that soil cultivation by tillage may be necessary only to kill weeds and to keep the soil in a receptive condition to absorb water (12). Chilcot and Cole found that deep tillage is futile as a means to overcome drought or to increase yields. (2). Call and Swell showed that mulching not only decreased the amount of water in the soil but also caused loss of more moisture than in the bare, undisturbed soils (1). In tank and field trials. Veihmeyer also found that mulching by thorough cultivation at weekly intervals failed to save soil moisture, but the surface shallow layer, by drying quickly, acted as a deterrent to further loss of moisture (13). Shaw, however, concluded that the soil mulch can reduce moisture loss, only when the water table, perched or permanent, is within the capillary rise of the surface (10).

* The authors are Director, Forestry Research Division, Assistant Silviculturist and Reader-in-Forestry respectively at the Pakistan Forest Institute, Peshawar.

In Piedmont region, U.S.A., green Pine branches were found to be superior to pine litter or *Lespedezia* hay. The mulch was used primarily to help establishment of vagetation for erosion control (7). In the same region in an experimental trial hardwood litter was applied at the rate of 58.5 tonnes/hectare during fall. It proved to be slightly more effective than pine needles in reducing both runoff and erosion (5).

Experimental work carried out by Russel in 1939 showed that from 12.2 tonnes of straw per hectare corresponding to depths of 1.25 cm to 7.5 cm were effective in reducing surface runoff and evaporation (9). For establishment of seedlings it had been recommended that the mulch should not be too thick and should cover only 50% of the area.

Covering the soil with paper to reduce evaporation was in considerable use in the late twenty's but is now rarely done. Smith reported that the effect of paper mulch was confined upto 10 cms. of the surface of the soil and was due to condensation of water beneath the paper (11).

Lemon found that chemical alternation of the soil moisture characteristics may decrease evaporation (6). Hendrick and Mowry state that addition of poly electrolytes to soils decreases the rate of evaporation and increases the water available to plants (3). Pebble mulch was reported to be in use for partial control of evaporation in some dry sections of China (4). Research workers of Flagstaff (Arizona) Forestry Experimental Station have found out that provision of 3-rock mulch for survival of Ponderosa pine seedlings significantly gave better results as compared with control.

Mulching of 3 years old spring planted Ponderosa Pine seedlings was done with different materials such as clear and black polythene, petroleum emulsion, volcanic cinders, wood chips and dead grass sod. These mulches generally proved ineffective and did not significantly improve survival. In a few cases, polythene increased height growth. Black polythyene was the only effective mulching material that persisted throughout the study; the other mulches deteriorated rapidly or were easily disturbed and became ineffective (8).

FAO started a research programme to find out a device that would reduce planting losses in arid and semi-arid areas and improve conservation of soil moisture to facilitate establishment and growth of the trees during critical periods. Plastic aprons were designed for the purpose in sixteen types of different guages and colours. Experiments were started at Yambawa, 67 km. north of Kano, in Nigeria on *Azadirachta indica* according to the instructions made by FAO.

The results showed that aprons made from polythene black and clear PVE were not durable under the conditions of the experiment, but other materials were all reasonably durable. The use of approns increased mean and total heights of survivors. Deep basins gave lower height growth than shallow basins due to being filled in with sand. In one experiment, intact aprons gave better growth than damaged ones, but this was not testified in the second experiment. In general, apart from two abnormal results, colour and type of material did not have very great effects on the growth of plants for although green or white aprons gave bettter height growth than those black or clear, the differences were not significant statistically.

Method. Two separate experiments were started in 1973; one at the Silvicultural Research Garden, Pakistan Forest Institute, Peshawar and the second at Research Station, Jallo, Lahore.

PA/1: Peshawar. Shisham (*Dalbergia sissoo*) stumps were planted at Peshawar. The following 16 materials were used for the study:—

1.	Polythene black	.. 0.10 mm.
2.	Polythene clear	.. 0.10 ,,
3.	Polythene clear perforated	.. 0.10 ,,
4.	PVC black standard	.. 0.10 ,,
5.	PVC black UV light resistant	.. 0.10 ,,
6.	PVC clear standard	.. 0.10 ,,
7.	PVC clear UV light resistant	.. 0.10 ,,
8.	PVC green, standard	.. 0.10 ,,
9.	PVC green, light resistant	.. 0.10 ,,
10.	PVC agricultural quality, broken white	.. 0.10 ,,
11.	PVC clear light resistant	.. 0.20 ,,
12.	PVC clear light resistant	.. 0.12 ,,
13.	PVC white polyester fibre	.. 0.12 ,,
14.	PVF green "Tedlar " type A	.. 0.0508 mm
15.	PVF white "Tedlar" type A	.. 0.0508 ,,
16.	Polyester film "Melinex" type O	.. 0.0508 ,,

The experiment was laid out in randomized block design. 18 treatments (16 apron types and two controls) were tried in 3 replications. Unit of replication was 3 plants. Shisham root shoot cuttings were planted in pits of 0.6 metre dia. Plastic aprons were put around the plants and pebbles placed on the aprons to keep them in place. Irrigation was provided at the time of planting only. No further watering was done. Observations on survival were recorded one month, 3 months and 6 months after planting. Final records were collected in March, 1974. Besides survival, heights of plants were also measured. Notes regarding the condition of aprons were also taken.

PA/2: Jallo, Lahore. The second experiment was laid out on 30th March, 1972 at Jallo. Here *Eucalyptus camaldulensis* was used as test species. Its details are as under:

Treatments: Major types of plastic aprons.

1.	Polythene black	.. 0.10 mm.
2.	Polythene clear	.. 0.10 ,,
3.	Polythene black light resistant	.. 0.10 ,,
4.	Polythene clear light resistant	.. 0.10 ,,
5.	Polythene green light resistant	.. 0.10 ,,
6.	Polythene agricultural quality, broken white	.. 0.12 ,,

Both shallow and deep basins were used for all the six types of aprons (12 treatments). In addition to that, 3 more treatments were used viz-a-viz 13, 14 and 15.

The experiment was laid out in randomised block design, 15 treatments were tried in 4 replications. Unit of replication was 5 plants. Planting was done at 1.8 x 1.8 metres. Nursery raised plants of *Eucalyptus camaldulensis* in polythene bags were planted in shallow and deep basins. Plastic aprons were put around the plants and pebbles placed on the aprons to keep them in place. Irrigation was given at the time of planting only. No further watering was done. Observations on survival were recorded one month, 3 months and 6 months after planting. Final records were collected in March, 1974. Besides survival, heights of plants were also measured. Notes regarding the condition of the aprons were also made.

Experiment at Peshawar.

TABLE I

Treatment No.	Intact	Slightly damaged	Demaged	Severely damaged	Destroyed	Durable	%	Non-durable	%
1.	3	6	—	—	—	9	100	—	0
2.	—	—	—	9	—	—	0	9	100
3.	—	3	—	6	—	3	33	6	67
4.	—	3	—	6	—	3	33	6	67
5.	3	3	—	3	—	6	67	3	33
6.	3	3	—	2	1	6	67	3	33
7.	6	3	—	—	—	6	67	3	33
8.	—	3	—	6	—	3	33	6	67
9.	3	6	—	—	—	9	100	0	0
10.	—	3	—	6	—	3	33	6	67
11.	6	3	—	—	—	9	100	0	0
12.	3	5	—	4	1	8	89	1	1
13.	9	—	—	—	—	9	100	0	0
14.	6	3	—	—	—	9	100	0	0
15.	3	6	—	—	—	9	100	0	0
16.	—	—	—	9	—	0	0	9	100
17.	—	—	—	—	—	—	—	—	—
18.	—	—	—	—	—	—	—	—	—

Durable	Durability Percentage	Non-Durable	Durability Percentage
1. Polythene black	100	2. Polythene clear	0
5. PVC Black UV Light resistant	67	3. Polythene clear perforated	33
6. PVC Black clear, Standard	67	4. PVC Black Standard	33
7. PVC clear UV Light resistant	67	8. PVC Green Standard	33
9. PVC Green UV Light resistant	100	10. PVC AG. quality broken white 0.12 mm.	33
11. PVC clear standard .20 mm	100	16. Polyester film Melinex	0
12. PVC clear Light resistant	89		
13. PVC with Polyester fibre.	100		
14. PVF Green Tedlar 'Type A' 0.0508 mm.	100		
15. PVF White Tedlar 'Type A' 0.0508 mm.	100		

Experiment at Jallo

TABLE II

Treatments		Intact	Slightly damaged	Damaged	Severely damaged	Destroyed	Durable	Percentage	Non-Durable	%
S	1.	1	—	—	20	—	—	0	20	100
D	2.	—	—	—	19	1	—	0	20	100
S	3.	—	—	—	—	20	—	0	20	100
D	4.	—	—	—	10	—	—	0	20	100
S	5.	—	18	—	—	2	19	90	2	10
D	6.	—	20	—	—	—	20	100	—	0
S	7.	—	10	—	10	—	10	50	10	50
D	8.	—	20	—	—	—	20	100	0	0
S	9.	—	17	—	—	3	17	85	3	15
D	10.	—	19	—	—	1	19	95	1	5
S	11	—	13	—	5	2	13	65	7	35
D	12	—	5	—	15	—	—	25	15	75
S	13	Shallow	Basin	Without aprons						
D	14.	Deep	Basin	„	„					
F	15.	Flat	Ground	„	„					

S.No.	Durable	Durability Percentage	S.No.	Non-Durable	Durability Percentage
5.	Polythene Black Light resistant SB.	90	1.	Polythene Black S.B.	100
6.	Polythene Black Light resistant DB.	100	2.	Polythene Black D.B.	100
7.	Polythene clear light resistant SB.	50	3.	P. Clear S.B.	100
8.	Polythene clear light	100	4.	P. Clear D.B.	100
9.	Polythene green Light resistant SB.	85	7.	P. Clear light resistant SB.	50
10.	Polythene green Light resistant DB.	95	12.	Polythene Ag. broken white DB.	25
11.	Polythene broken white 0.12 mm. S.B.	65			

Results. Assessment was made regarding durability of plastic aprons and their effect on survival and height growth of plants.

A. *Durability of the material.* The durability of different materials used varied considerably. The degree of damage to the aprons was assessed in 5 categories:

(*i*) Intact

(*ii*) Slightly damaged, with a few small holes or tears, strength and effectiveness of aprons not seriously affected.

(*iii*) Damaged, large holes or tears and strength of material reduced, apron maintained its shape but effectiveness considerably reduced.

(*iv*) Severely damaged, shape of apron destroyed and effectiveness very small.

(*v*) Destroyed, only fragments of aprons left.

The material for the purpose of presentation of results was graded as (i) durable (including intact and slightly damaged) and (ii) non-durable (including damaged, severely damaged and destroyed).

PA/I: Peshawar. (*a*) Polythene black, PVC types of clear, green and black, light resistant and PVF green and white "Tedlar" type 'A' proved to be the most durable, whereas PVC clear standard and with polyester fibre were comparatively less durable.

(*b*) Polythene clear and perforated were found to be the least durable followed by PVC black and green standard polyester film "Melinex" type 0 and PVC Agricultural quality broken white.

PA/2: Jallo, Lahore. (*a*) The durability of the materials ranked as:Polythene black light resistant, polythene green light resistant, polythene clear light resistant.

(*b*) Simple polythene black and clear were found to be least durable followed by polythene agricultural quality broken white.

(*c*) Plastic aprons put in shallow basins were found to be less durable as compared to those applied to deep basins.

TABLE III

S. No.	Treatments Types of Polythene	Thickness	No. of Dead Plants	Survival Percentage	Total Height (M)	Average Height (M)
1.	Polythene Black	0.10 mm.	—	100	5.664	0.635
2.	Polythene clear	0.10 mm.	—	100	6.426	0.711
3.	Polythene clear perforated	0.10 mm.	—	100	2.769	0.305
4.	PVC Black, standard	0.10 mm.	—	100	4.623	0.508
5.	PVC Black UV Light resistant	0.10 mm.	—	100	8.077	0.889
6.	PVC Clear, Standard	0.10 mm.	1	88.8	4.420	0.508
7.	PVC Clear, UV Light resistant	0.10 mm.	1	88.8	4.394	0.559
8.	PVC green, standard	0.10 mm.	1	88.8	3.977	0.453
9.	PVC green light resistant	0.10 mm.	2	77.7	4.369	0.635
10.	PVC Agricultural quality	0.10 mm.	—	100	4.343	0.483
11.	PVC Clear standard	0.20 mm.	1	88.8	3.708	0.457
12.	PVC Clear light resistant	0.12 mm.	1	88.8	4.318	0.533
13.	PVC with polyester fibre		—	100	3.785	0.406
14.	PVF green Tedlar Type A	0.0508 mm.	—	100	6.909	0.762
15.	PVF White Tedlar Type A	0.0508 mm.	—	100	5.004	0.559
16.	Polyester Film Melinex Type	0.0508 mm.	1	83.3	5.613	0.711
17.	Trees planted in centre basin of same size and shape as those in treatment 1-16, but with no aprons		1	8.8	4.064	0.203
18.	Control Trees planted as in Normal practice on flat ground without Basins and without Aprons.		6	88.3	0.940	0.305

TABLE IV

S. No.	Types of Polythene	Thick-ness	Types of Basin	No. of Dead Plants	Survival Percent-age	Total Height (M)	Average Height (M)
1	2	3	4	5	6	6	8
1.	Polythene Black	0.10 mm.	Shallow basin	8	60	13.483	1.143
2.	Polythene Black	0.10 mm.	Deep basin	4	80	20.599	1.295
3.	Polythene clear	0.10 mm.	Shallow basin	6	70	16.205	1.168
4.	Polythene clear	0.10 mm.	Deep basin	6	70	17.297	1.245
5.	Polythene light resistant	0.10 mm.	Shallow basin	7	65	18.669	1.422
6.	Polythene Black light resistant	0.10 mm.	Deep basin	8	60	15.646	1.295
7.	Polythene clear light resistant	0.10 mm.	Shallow basin	3	85	20.929	1.168
8.	Polythene light resistant	0.10 mm.	Deep basin	6	54	16.535	1.168
9.	Polythene green light resistant	0.10 mm.	Shallow basin	6	70	16.764	1.397
10.	Polythene green light resistant	0.10 mm.	Deep basin	9	55	15.341	1.295
11.	Polythene agricul-tural quality broken white	0.12 mm.	Shallow basin	6	70	18.085	1.295
12.	Polythene agricul-tural quality broken white	0.12 mm.	Deep basin	12	40	8.230	1.041
13.	No Apron	—	Shallow basin	6	70	15.849	1.143
14.	No Apron	—	Deep basin	4	80	19.939	1.245
15.	Control	—	Flat ground	10	50	10.744	1.067

B. *Effect on Survival and Height Growth:*

P.A. 1: Peshawar. Analyses of variance were made for survival and mean heights. The results have been summarized as follows:

1. Aprons did not show any significant effect on survival of plants.
2. Mean heights with aprons were significantly greater than mean heights without aprons.
3. PVC black UV light resistant quality proved to be the best as compared to others.
4. Polythene black, Polythene clear, P.V.F. Green UV light resistant P.V.F. Green "Tedlar" Type A, Polyester film" and P.V.C. clear UV light resistant types showed equally good results.
5. Polythene clear perforated showed the poorest results.
6. All treatments with aprons were better than the control (no aprons).

P.A. 2. Jallo, Lahore.

1. Aprons did not show any significant effect on the survival of plants.
2. Mean heights with aprons were significantly greater than mean heights without aprons.
3. All the aprons except polythene clear light resistant/Deep Basin and Polythene agricultural quality broken white/Deep basin were better than no aprons.
4. Polythene green light resistant (D.B) was the best as compared to the others.
5. Polythene black light resistant (D.B) and (S.B) both were the next best.
6. Treatments with no aprons and planting on the flat ground were the most inferior to the treatments with aprons.

Treatments showed no significant differences in number of survivors. Mean heights and total heights were significantly greater when aprons were used as compared to the treatments without aprons. Material and colour of the aprons had significant effect on mean heights. Clear and perforated types showed the poorest results. Mean heights were significantly greater in case of durable aprons as compared to the non-durable aprons. No significant differences were found regarding the depth of basin.

Conclusion. It is concluded that plastic aprons are useful as mulch and show their effect on height growth. They can be made use of in areas with arid climate to conserve water for the better growth of surviving plants.

Appendix I

Lahore

Latitude: 31° 35′ N, Longitude: 74° 20′ E, Altitude: 211 M.

N.M.	TEMPERATURE C°						Relative Humidity. Observations of		Precipitation	
	Average Daily		Av. of	Av. of	Absolute		0800	1630	Av monthly	Max fall
	Max.	Min.	Highest each month	Lowest each month	Max.	Min.	Percent		Fall Cms.	24 H. Cms.
Jan	20.6	4.4	23.3	0.6	25.6	2.2	83	46	2.8	7.4
Feb	22.2	6.4	27.2	3.3	32.2	0.0	74	41	2.3	5.3
Mar	28.3	11.7	35.0	7.2	37.8	5.6	58	21	2.3	3.1
Apr	35.0	17.2	40.6	12.8	46.1	10.0	44	23	1.3	4.1
May	40.0	22.2	45.6	17.8	47.2	16.1	36	20	1.8	1.8
Jun	41.1	26.1	46.1	21.7	47.2	18.9	47	22	4.3	6.9
Jul	37.8	26.7	42.8	22.2	45.0	20.6	67	50	14.0	8.9
Aug	36.1	25.6	40.0	22.2	42.2	19.4	72	58	13.5	11.4
Sep	37.1	22.8	39.4	18.9	41.7	17.2	65	42	6.1	6.9
Oct	35.0	15.0	37.8	12.2	40.0	9.4	52	33	0.8	2.3
Nov	28.3	8.3	32.2	5.6	34.9	2.8	60	41	0.3	1.0
Dec	22.8	4.4	26.7	1.7	27.8	0.6	81	49	1.0	2.0
Year	31.7	16.1	46.7	0.0	47.2	2.2	62	39	50.2	11.4
No. of year	23	23	10	10	10	10	23	8	23	10

Peshawar

Latitude: 34° 01′ N, Longitude: 71° 34′ E, Altitude: 348 M.

N.M	TEMPERATURE C°						Relative Humidity. Observations of		Precipitation	
	Average Daily		Av. of Highest each month	Av. of Lowest each month	Absolute		0800	1530	Av. monthly fall Cms.	Max fall 24 H Cms.
	Max.	Min.			Max.	Min.				
Jan	17.2	4.4	21.7	0.0	24.4	3.3	73	45	3.6	4.8
Feb	18.9	6.1	24.4	4.4	30.0	0.6	75	43	3.8	4.1
Mar	23.9	11.1	31.1	5.6	33.9	2.2	68	43	6.1	15.2
Apr	29.4	15.6	36.7	10.6	42.2	5.0	59	39	4.6	3.6
May	36.7	26.1	43.9	15.6	47.8	11.1	41	28	2.0	2.5
Jun	41.1	25.0	46.1	21.1	48.9	18.3	43	25	0.8	5.6
Jul	39.4	26.1	45.6	22.8	50.0	20.6	61	38	3.3	3.6
Aug	37.2	25.6	41.7	22.2	47.8	20.0	70	45	5.1	3.1
Sep	35.6	21.7	38.9	17.2	43.3	14.4	65	39	2.0	2.3
Oct	31.1	14.4	35.6	11.1	38.3	11.1	60	32	0.5	1.3
Nov	25.0	7.8	29.4	3.9	32.8	0.6	63	40	0.8	1.0
Dec	19.4	3.9	23.9	0.6	28.3	2.2	73	42	1.8	3.8
Year	29.4	15.0	46.7	0.6	50.0	3.3	63	38	34.3	15.2
No. of Year	33	33	30	30	30	30	30	30	60	39

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