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USE OF PHYTO-MULCHES FOR IMPROVED PRODUCTIVITY IN MULBERRY UNDER RAIN FED CONDITIONS IN KASHMIR

Mir, M.R., Baqual, M.F., Noor Din, S., Khan, I.L. & Malik, M.A.
TSRI Mirgund, Sher-e-Kashmir University of Agricultural Sciences and Technology (K)

ABSTRACT
Three phyto-mulches namely dried weeds, paddy grass and mulberry twigs were used to ascertain their influence on soil moisture conservation, weed control, growth and yield attributing characters of mulberry growing under rainfed conditions of Kashmir. Observations recorded for a period of three years showed that all the mulches gave better results with respect to weed control and other mulberry growth and yield parameters as compared to control where no mulch was used. Besides reduction in weed growth and density there was improvement in the growth and yield in mulberry. Soil moisture improved by 2-3 percent, leaf moisture improved by 1, 2 and 3 percent respectively by the use of mulberry twigs, dried weeds and paddy grass in both Spring and autumn crops of silkworm rearing.

KEY WORDS: weeds, leaf yield, soil moisture.

INTRODUCTION

Mulberry (*Morus spp.*) in Kashmir is mostly grown under rain fed conditions where rainfall is quiet erratic and uneven. Intercultural operations like weed control, irrigation, fertilizer application *etc* are hardly attended which further compounds the problem. This results in reduction in leaf quantitatively and qualitatively as well. More so evopo-transpiration losses in the field also contribute to low leaf yield and poor quality of produce. Soil moisture conservation has been one of the most vital constraints which are confronted by many growers irrespective of the crop and this specifically holds good in mulberry whose foliage constitutes the only food for silkworm (*Bombyx mori* L.) and the optimal moisture present in foliage has a greater role to play in successful cocoon crop. The situation worsens further due to heavy growth of weeds. Consequently there is decrease in the availability and uptake of nutrients by the plants. The leaf is poor in moisture and nutrients as such unable to provide silkworm the nutritional requirements properly and adequately. Mulching has been proved very effective to conserve the soil moisture thereby leading to better yields in Sorghum (De *et al.*, 1983), Wheat (Mittal *et al.*, 1986) and mustard (Mondal *et al.*, 1987). Purohit *et al.* (1990) have reported 24.16-48.63% increase in leaf yield in mulberry by the use of mulches. Phytomulches which are ecofriendly and cost effective can also be used as effective mulches in mulberry. Purohit *et al*. (1992, 2006) have also tested certain phytomulches and found them very useful to Influences the soil temperature and moisture besides the growth and yield in mulberry under rain fed conditions of West Bengal. Weeds pose multiple problems to every crop with mulberry being no exception. In mulberry the leaf yield loss due to weeds was reported to the extent of 4.5-40 percent depending upon the weed flora, density, biomass and duration of the weed growth (Sikdar *et al.*, 1981; Srinivasan *et al*., 1987; Muniappa, 1990). Different methods used for weed control suffer from one or the other drawbacks like, increasing expenditure, polluting the environment, toxicity and residual effects *etc.* Use of mulches though better also cannot prove so if the material to be used is not selected properly. Locally available mulches which are cheap and ecofiendly could be the best option for soil moisture conservation and recedence in weed growth of mulberry as such the present study was, therefore an attempt to see the effect of three Phytomulches - paddy grass, dried weeds and mulberry twigs on soil moisture, weed growth, mulberry growth and yield under rainfed conditions of Kashmir.

MATERIALS & METHODS

The study was taken up at the mulberry farm of Temperate Sericulture Research Institute, Mirgund, SKUAST (K), Baramulla Kashmir on well grown plants of Goshoerami, the most popular variety of mulberry in the region. The plantation was maintained under rain fed conditions as per the recommended package of practices. The experiment was carried out as per the following experimental details:

Design	:	RBD
Variety	:	Goshoerami
Replications	:	05
Plants/treatment/ replication	:	06
Treatments	:	04

T-1: Paddy grass T-2: Dried weeds
T-3: Mulberry twigs T-4: No mulch (control)

Weeds uprooted before seed set were dried up completely and used thereafter for mulching. All the mulches were used from 15th of April till the end of growing season during all the three years of study (2006-2008). Plots were observed for weeds from time to time and for weed density and biomass observations were taken during the 3rd week of May when the weed infestation and growth is usually at its peak. For this in every treatment of each replication, three quadrants measuring 1×1 m^2 each were taken and the weeds counted manually and removed for recording their biomass. Weed samples were sun dried and later oven dried at 70°C till they registered constant dry weight. Data on weeds were subjected to square-root transformation (√X+1.0). Weed control efficiency (WCE) was calculated using the method of *Singh et al.* (2000); Maity and Mukherjee (2011) by the formula.

$$\text{WCE } \% = \frac{\text{DMC} - \text{DMT}}{\text{DMC}} x\ 100$$

Where DMC is dry matter of weeds in control and DMT is dry matter of weeds in a particular treatment.

Soil moisture was estimated at four soil depths *viz*. 0-15 cm, 15-30cm, 30-45cm and 45-60 cm in the middle of every month from 15th of April to 15th of September by gravimetric method. Data on various growth parameters was taken during spring and autumn every year when the leaf was 70 days old. This coincided with the 5th stage of silkworm rearing when the leaf consumption is the maximum.

For moisture content in fresh leaf, composite leaf samples comprising tender, medium and coarse in almost equal proportion were harvested early in the morning. The leaves were then dried in hot air oven at 60^0C for 48 hours as per Ninge Gowda & Sudhakar (2002). The dry weight was recorded and the moisture content calculated as per the following formula:-

$$\text{Moisture content } (\%) = \frac{(\text{Fresh weight of leaf} - \text{Dry weight of leaf})}{\text{Fresh weight of leaf}} x\ 100$$

Three observations per treatment per replication were recorded for all the parameters under study and data for all the three years was pooled (season wise) and Analysis of Variance was done as per Singh and Choudhary (1977).

RESULTS & DISCUSSION

The observations recorded on weed growth are furnished below in brief. The weeds started to appear mostly from March 2nd week and grew very quickly. The different weeds found in the mulberry plots though more in the plots without any mulch are furnished in Table-1. Amongst these *Stellaria media*, *Veronica persica* Poir , *Capsella bursa-pastoris* (L.) Medie, *Trifolium pratense*-L, *Poa pratensis* L. *Cyanodon dactylon* (L.) Pers., *Taraxicum officinale* Weber were more prevalent during the Spring where as Amaranthus *spinosus* L., *Plantago major*, *Plantago lanceolata* L, *Convolvulus arvensis*, *Portulalaca oleraceae* L., *Cyanodon dactylon* (L.) Pers., *Cyperus rotundus* (L.) were more common during the Summer/Autumn. The remaining weeds were comparatively less in number. However the weeds *Plantago major*, *Trifolium pretense*-L, *Cyanodon dactylon* (L.) Pers., *Cyperus rotundus* (L.) were found throughout the year.

TABLE 1: List of weeds found in the experimental plot

S.No.	Weeds found	Family
1.	*Stellaria media* (L.) Cry.	Caryophylaceae
2.	*Sorghum halepense*	Gramineae
3.	*Euphorbia helioscopia*	Euphorbiaceae
4.	*Amaranthus spinosus* L.	Amaranthaceae
5.	*Plantago major*	Plantaginaceae
6.	*Plantago lanceolata* L.	Plantaginaceae
7.	*Erigeron canadensis* Li	Compositeae
8.	*Solanum nigrum* L.	Solanaceae
9.	*Cyanodon dactylon* (L.) Pers.	Gramineae
10.	*Cyperus rotundus* (L.)	Cyperaceae
11.	*Digitaria sanguinalis* (L.) Scop.	Gramineae
12.	*Capsella bursa-pastoris*(L.)Medie	Brassicaceae
13.	*Poa annus* (L.)	Gramineae
14.	*Poa bulbosa*	Gramineae
15.	*Poa pratensis* L.	Gramineae
16.	*Anthemis cotula* M	Compositae
17.	*Veronica persica* Poir	Scrophulariaceae
18.	*Anagallis arvensis* L.	Primulaceae
19.	*Vicia sativa* L.	Leguminosae
20.	*Oxalis corniculata* L.	Oxalidaceae
21.	*Trifolium pratense*-L.	Papilionaceae
22.	*Trifolium repense* L.	Papilionaceae

23.	*Fumaria vailantii* Lois	Fumariaceae
24.	*Veronica persica* Poir	Scrophulariaceae
25.	*Convolvulus arvensis* L.	Convolvulaceae
26.	*Portulalaca oleraceae* L.	Portulacaceae
27.	*Ranunculus arvensis* L.	Labiatae
28.	*Taraxacum officinale* Weber	Compositae
29.	*Cirsium arvense*	Compositae
30.	*Equisetum palustre* L.	Equisetaceae
31	*Cannabis sativa*	Geraniaceae
32	*Rumex nepalensis*	Polygonaceace

The observations recorded on the effect of different mulches on weed growth are furnished in Table-2. Phytomulches are observed to reduce weed population and their growth as the weeds attacked the plots without any mulch (T4) the most with an average population of 175 weeds per meter square having a total biomass of 79 grams. The weed density and their growth in the treatments using phytomulches were much less. The weed control efficiency was 54.82, 62.18 and 55.07 percent respectively in T-1, T-2 and T-3 respectively.

TABLE 2: Effect of Phytomulches on weed growth and density in mulberry

Treatment	Weeds/m ^{2}	Weed biomass (gm)	WCE (%)
T1	76 (8.77)	36 (6.04)	54.82
T2	63 (8.01)	30 (5.55)	62.18
T3	90 (9.52)	35 (6.03)	55.07
T4(Control)	175 (13.24)	79 (8.92)	-
CD (5%)	0.634	0.354	

The influence of phytomulches on the moisture status of mulberry plot upto a depth of 60 Centimeters is given in Table-3 and depicted in Figure-1.The moisture content at all the depths assessed was maximum (21.42 %) with T-1 (paddy grass),showing an improvement of 13.57 percent over the control. This was followed by T-2 (dried weeds) and T-3 (Mulberry twigs) showing respectively an increase of 12.57 and 7.69 percent over the control.

TABLE 3: Effect of mulching on soil moisture content

Treatment	Depth-1 (0-15 cm)	Depth-2 (15-30 cm)	Depth-3 (30-45 cm)	Depth-4 (45-60 cm)	Average	% improvement
T-1	20.27	20.93	21.77	22.70	21.42	13.57
T-2	20.29	20.75	21.71	22.18	21.23	12.57
T-3	19.11	19.75	20.69	21.68	20.31	7.69
T-4	17.60	18.17	18.96	19.84	18.86	-

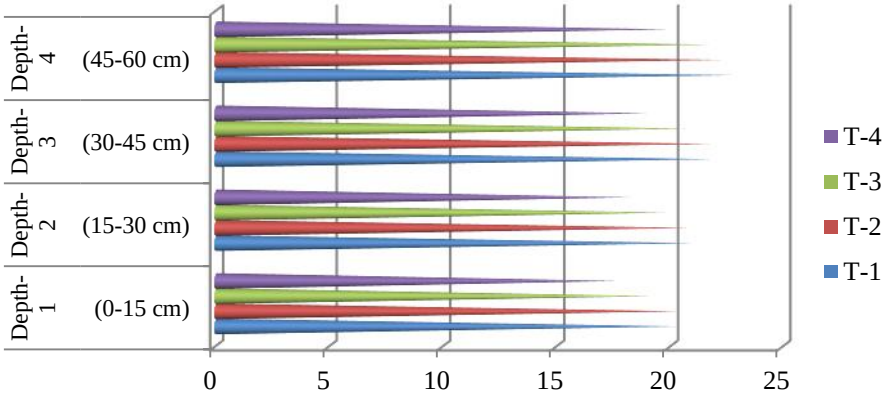

FIGURE 1

The growth and yield parameters recorded in mulberry during spring and autumn are furnished in Tables-4 and 5.

During spring, the Shootlets per plant were maximum (86.65) under T-1 (Paddy grass). It was statistically at par with T2 (dried weeds) and different from that of T-3 (Mulberry wigs) and the control. Total shoot length per plant, too was the maximum (25.38m) in T1 (Paddy grass) which was statistically at par with that of the other two mulches,i.e.,T-2 and T-3 but different from the values recorded under T-4 (the control).Fresh weight of leaf was the highest (385.18g) in T-2 which was statistically at par with T-2 but different from T-3 and T-4.Leaf yield per plant was the maximum (3.940kg) in T-1 which was statistically

at par with T-2 and T-3 but Significantly different from T-4 (the control).

TABLE 4: Effect of Phytomulches on growth and yield in mulberry during spring

Treatment	Shootlets /plant	Total shoot length/plant (m)	F.wt of 100 leaves(gm)	Moisture content in fresh leaf (%)	Leaf yield/ plant(Kg)
T1	86.65	25.38	382.33	75.33	3.940
T2	83.75	24.78	385.18	74.28	3.853
T3	78.66	24.54	360.38	73.63	3.874
T4 (Control)	71.33	22.73	347.23	72.59	3.458
G. Mean	80.10	24.36	368.78	73.96	3.780
CD (5%)	3.006	1.164	8.210	0.989	0.204

TABLE 5: Effect of Phytomulches on growth and yield in mulberry during autumn

Treatment	Branches /plant	Total shoot length/plant (m)	F.Wt of 100 leaves(gm)	Moisture content in fresh leaf (%)	Leaf yield/ plant (Kg)
T1	30.05	31.90	400.34	74.91	4.358
T2	31.59	32.46	395.95	74.48	4.173
T3	28.50	30.85	388.88	73.77	4.103
T4 (Control)	26.59	29.65	356.60	72.38	3.836
G.Mean	29.18	31.22	385.44	73.89	4.120
CD (5%)	1.228	1.108	6.092	0.938	1.274

CONCLUSION

During the study it was found that phytomulches had a significant impact on the reduction of weeds and growth parameters. These findings could support the use of phytomulches as an effective means of weed suppression so that our dependency on phytochemicals is reduced.

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