

Effect of mulching material and herbicides on tree growth, yield and fruit quality of *ber*

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ABSTRACT

The investigation on effect of mulching material/herbicides on tree growth, yield and fruit quality of *ber* was carried out in New Orchard, PAU, Ludhiana during 2006-07. Three years and eight-month-old plants of *ber* cv. Umran planted at 7.5 m × 7.5 m were selected. The plants were mulched in the month of June 2006 by different type of mulch materials, *i.e.*, paddy straw, dry grass, *sarkanda*, black polythene, black polythene + glyphosate @ 1 l/ha and black polythene + gramoxone @ 1 l/ha. Tree volume and number of days to complete the flowering phase were recorded maximum with black polythene + gramoxone @ 1 l/ha. The maximum increase in pruning weight was observed under black polythene + glyphosate @ 1 l/ha (82.69%). Scion/stock ratio was found maximum with *sarkanda* mulch. The maximum leaf area and vitamin C in fruits from plants mulched with black polythene, black polythene + gramoxone @ 1 l/ha and black polythene + glyphosate @ 1 l/ha. The maximum fruit size, weight and yield were observed from the plants under black polythene mulch. The maximum TSS in fruits was recorded from plants mulched with black polythene + gramoxone @ 1 l/ha (12.16%) and black polythene + glyphosate @ 1 l/ha (12.00%). Black polythene and black polythene + herbicides are the ideal choice for *ber* orchards. Paddy straw was found to be the best natural mulch.

Key words: *Ber*, mulch, herbicide, black polythene, paddy straw.

INTRODUCTION

The *ber* is an important hardy fruit crop which can be grown under varying agro-climatic conditions. It is one of the most nutritious fruits being rich in vitamin C, protein and minerals like calcium, phosphorus and iron. Umran is the commercial cultivar grown in Punjab and its yield potential is higher, *i.e.* two quintals of fruit per tree. The *ber* is the fifth important fruit of Punjab after citrus, guava, mango and pear. Presently, the area in the state is approximately 2,500 ha having annual production of 42,847 mt (Anon, 3). It is extensively grown at commercial scale in Sangrur, Bathinda, Ferozepur, Ludhiana, Barnala, Patiala, Mukatsar, Mansa and Faridkot districts of Punjab.

Owing to very deep tap root system and xerophytic nature, *ber* plant is very hardy and once established, it needs little care and irrigation. However, *ber* orchard in arid region face a water deficiency problem and suffer severe weed competition during rainy season. One possible alternative of overcoming this problem is the use of different kinds of mulches like organic residue and polythene. The main objective of mulching is to prevent loss of water by evaporation, prevention of soil erosion, weed control etc. Mulching has been found to be an effective method for increasing the yield of tropical fruit crops. Keeping in view the above facts, the study was carried out to see the effect of mulching material/herbicides on the tree growth, yield and fruit quality of *ber*.

MATERIALS AND METHODS

The investigation on effect of mulching/herbicides on the growth, yield and fruit quality of *ber* was carried out in New Orchard, PAU, Ludhiana during 2006-07. Three years and eight-month-old plants of *ber* cv. Umran planted at 7.5 m × 7.5 m were selected. The plants were mulched in the month of June 2006 by different type of mulch materials, *i.e.* paddy straw, dry grass, *sarkanda*, black polythene, black polythene + glyphosate @ 1 l/ha and black polythene + gramoxone @ 1 l/ha.

The vegetative characters like increase in tree volume, stock/scion girth and leaf area were recorded in the month of September. Data on flowering were recorded during September to November and the duration of flowering was calculated by counting the total number of days required from commencement of flowering to end of flowering. The tree volume was calculated from the value of the height and spread by using formula $4/3 (3.14) (1/2 H)^2 (1/2 W)$. The pruning weight was measured during May before the spread of mulch material and also in the next year at the same time. The per cent increase of pruning weight was thus worked out. The scion/stock ratio was determined by dividing the scion girth with stock girth. The leaf area was measured in September with the help of leaf area meter (LiCor 3000, USA) and expressed as cm². The observations on various fruit characters, *i.e.* fruit size, fruit weight and yield were recorded at peak maturity,

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i.e. second fortnight of March. Total soluble solids were recorded with the help of hand refractometer. The acidity and vitamin contents were determined according to the methods of AOAC (2).

RESULTS AND DISCUSSION

The data on the effect of mulching material/herbicides on vegetative growth characters are presented in Table 1. All the mulching treatments increased the tree volume but the maximum tree volume was recorded under black polythene + gramoxone @ 1 l/ha which was closely followed by black polythene + glyphosate @ 1 l/ha and black polythene. These treatments increased tree volume by 37, 34 and 31 per cent, respectively. This increase in growth of plants was due to increased availability of soil moisture and less weed population. The least tree volume was obtained in control but it was par with the dry grass mulch. These results are in consonance with Hieke *et al.* (6) who also found that plastic mulch and cloche increased peach volume by 47 and 23 per cent, respectively as compared with control.

The maximum increase in pruning weight was observed under black polythene + glyphosate @ 1 l/ha (82.69%) followed by black polythene (80.79%) and black polythene + gramoxone @ 1 l/ha (79.41%). The per cent increase under *sarkanda*, dry grass and paddy straw was observed 67.33, 62.18 and 61.02, respectively. The minimum increase in pruning weight was observed under control (58.24%). The data show non-significant differences in scion/stock ratio under different mulching treatments. However, the maximum scion/stock ratio was found with *sarkanda* (0.95) which was closely followed by in control (0.92). The minimum scion/stock ratio (0.73) was observed under black polythene + gramoxone @ 1 l/ha. Mulching treatments had significantly effect on leaf area. The maximum leaf area was recorded in black polythene (32.33 cm²) followed by black polythene + gramoxone @ 1 l/

ha (32.25 cm²) and black polythene + glyphosate @ 1 l/ha (32.21 cm²). The results are in conformity with those reported by Mukherjee *et al.* (9) who observed the maximum leaf area of *ber* cv. *Mundia* under black polythene mulch. The leaf area was also increased under *sarkanda*, paddy straw and dry grass treatments. The minimum leaf area (25.34 cm²) was recorded under control.

The plants under black polythene + gramoxone @ 1 l/ha took maximum number of days (58) to complete their flowering phase followed by black polythene + glyphosate @ 1 l/ha (57), black polythene and *sarkanda* (56). The plants under paddy straw and dry grass took 52 and 51 days, respectively to complete the flowering phase. The plants under control took minimum number of days (43) to complete the flowering. The data pertaining to effect of mulching material/herbicides on fruit size, yield and quality of Umran *ber* are presented in Table 2.

The fruit length under all the mulching treatments was significantly higher than control. The maximum fruit length was recorded under black polythene mulch (4.37 cm) which was statistically at par with *sarkanda* (4.29 cm), black polythene + gramoxone @ 1 l/ha (4.28 cm), black polythene + glyphosate @ 1 l/ha (4.24 cm) and dry grass (4.06 cm). Similar trend was observed in fruit breadth and the highest breadth was recorded under black polythene (3.21 cm). The influence of mulching on fruit size may be attributed to the better moisture availability and nutrients conserved in the soil at the time of fruit development. In general, fruit size was recorded higher under black polythene and black polythene + herbicide treatments. Similarly, Kumar *et al.* (8) found the highest fruit size in apple with herbicide and mulching treatments.

The results indicates that fruit weight was significantly influenced by various mulching treatments over control. The maximum fruit weight was recorded under black polythene and black polythene + gramoxone treatments. Both these treatments were

Table 1. Effect of mulching/ herbicides on tree growth and flowering of Umran *ber*.

Treatment	Tree volume (m ³)	Increase of pruning weight (%)	Scion/stock ratio	Leaf area (cm ²)	Duration of flowering (days)
Paddy straw	36.19	61.02	0.82	29.18	52
Dry grass	35.30	62.18	0.79	28.58	51
<i>Sarkanda</i>	38.65	67.33	0.95	29.27	56
Black polythene (BP)	43.35	80.79	0.79	32.33	56
BP + glyphosate @ 1 l/ha	44.18	82.69	0.82	32.21	57
BP + gramoxone @ 1 l/ha	45.13	79.41	0.73	32.25	58
Control	33.04	58.24	0.92	25.34	43
CD _{0.05}	2.89	-	NS	2.68	-

Table 2. Effect of mulching material/herbicides on fruit size, yield and quality of Umran *ber*.

Treatment	Fruit size		Fruit weight (g)	Fruit colour	Yield (kg/tree)	TSS (%)	Acidity (%)	Vitamin C (mg/100 g/pulp)
	Length (cm)	Breadth (cm)						
Paddy straw	3.72	2.87	20.4	YGG 150 B	32.11	10.50	0.19	78.64
Dry grass	4.06	3.06	20.5	YGG 150 B	33.59	11.50	0.21	90.75
<i>Sarkanda</i>	4.29	3.17	21.8	YGG 150 B	35.34	9.93	0.23	80.85
Black polythene (BP)	4.37	3.21	22.5	YGG 154 C	45.36	11.96	0.20	107.25
BP + glyphosate @ 1 l/ha	4.24	3.17	21.2	YGG 154 C	42.45	12.00	0.20	99.76
BP + gramoxone @ 1 l/ha	4.28	3.15	22.3	YGG 154 C	43.17	12.16	0.21	101.20
Control	2.34	2.26	16.8	YGG 149 C	25.23	9.50	0.24	77.00
CD _{0.05}	0.41	0.22	1.86		4.52	1.69	NS	10.76

statistically at par with sarkanda and black polythene + glyphosate 1 l/ha. The fruit weight from the trees provided with dry grass and paddy straw mulches was observed significantly better than control. Mukherjee *et al.* (9) also observed the highest fruit weight in *ber* under black polythene mulch as compared to other mulching treatments. The colour of fruits was observed light golden yellow (YGG 150 B) in organic mulch treatments, *viz.* paddy straw, dry grass and *sarkanda*. The fruits from polythene mulch and polythene mulch + herbicide treatments showed better colour development, *i.e.* golden yellow (YGG 154 C). The fruit yield was recorded maximum (45.36 kg/tree) under black polythene mulch followed by black polythene + gramoxone @ 1 l/ha (43.17 kg/tree) and black polythene + glyphosate @ 1 l/ha (42.45 kg/tree). Amongst the organic mulches, higher fruit yield was recorded under *sarkanda* mulch. The fruit yield under *sarkanda*, dry grass and paddy straw was significantly higher than control. The increased fruit yield under mulched condition was mainly attributed to increase availability of soil moisture for longer duration and control of weed growth. The lowest yield was observed in control is due to lower soil moisture regimes, more weeds and higher evaporation from soil surface. While working on *ber*, Jagtap and Wavhal (7) obtained the maximum fruit yield under sugarcane trash mulch. Sharma and Kathiravan (10) also reported that fruit yield in plum was significantly influenced by black polythene mulch.

The maximum TSS was recorded with black polythene + gramoxone @ 1 l/ha (12.16%). Higher TSS was also recorded from the fruits of trees mulched with black polythene + glyphosate @ 1 l/ha and black polythene. Although the TSS under paddy straw and *sarkanda* was recorded higher than control but the difference was non-significant. These changes in

quality attributes may probably be due to results of higher nitrogen availability and low temperature under organic mulches, whereas under black polythene mulch, higher soil temperature may be the principal cause as suggested by Tang *et al.* (11). Similarly, Agarwal *et al.* (1) in mango, and Ali and Gaur (2) in strawberry reported the highest TSS content under black polythene mulch. The effect of mulching was found non-significant on acidity of *ber* fruits.

The maximum vitamin C (107.25 mg/100 g pulp) was estimated in the fruits from the trees mulched with black polythene. However, it was statistically at par with the vitamin C content obtained from black polythene + gramoxone @ 1 l/ha and black polythene + glyphosate @ 1 l/ha. The vitamin C values of *ber* fruits obtained in these treatments were significantly higher than vitamin C values obtained from dry grass, *sarkanda*, paddy straw and unmulched treatments. Appreciable improvement in fruit quality in terms of vitamin C by various mulching treatments might be associated with the increase in conserving soil moisture which ultimately caused mobilization of soluble carbohydrates in the fruits. Hassan *et al.* (5), and Ali and Gaur (2) also noted the maximum ascorbic acid content of strawberry with black polythene mulch. Keeping into view the fruits and quality characters, black polythene and black polythene + herbicides are the ideal choice of mulch for *ber* orchards. Paddy straw was found to be the best natural mulch.

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