Effect of different weed management practices on soil properties and soil and leaf nutrient content of plum (*Prunus salicina* L) cv Red Beaut

RAKESH KUMAR, DD SHARMA, GOPAL SINGH, BHAWNA KAUSHAL and MA KUCHAY

Department of Fruit Science, College of Horticulture
Dr YS Parmar University of Horticulture and Forestry
Nauni, Solan 173230 Himachal Pradesh, India
Email for correspondence: sharmadd61@rediffmail.com

 Received: 26.09.2020/Accepted: 30.10.2020

ABSTRACT

The present investigations were carried out in the experimental orchard of Horticultural Research and Training Station and Krishi Vigyan Kendra, Solan, Himachal Pradesh during the year 2016-17. The experiment was laid out in randomized block design with ten treatments comprising weedicides, mulching and hand weeding which were replicated thrice. Maximum soil organic carbon (1.73%), available soil nutrients content (N 283.29 kg/ha, P 27.12 kg/ha and K 255.56 kg/ha) and leaf nutrients content (N 2.62%, P 0.19% and K 1.95%) and yield (17.49 kg/plant) were recorded in treatment having grass mulching which was statistically at par with the treatment of pendamil @ 5.3 ml/l of water followed by gramoxone @ 5 ml/l of water among different weed management practices which was also found to be cost effective and most economical treatment.

Keywords: Plum; weed management; fruit yield; soil; leaf; nutrients

INTRODUCTION

Plum is an important stone fruit crop of temperate and sub-tropical regions of the world that belongs to the family Rosaceae, genus *Prunus* and has many species like *Prunus domestica*, *P salicina* and *P americana* etc. Most of the commercially grown plums fall into one of the two groups viz European or Japanese types. European plums are generally better adapted to cooler regions than Japanese types. Most of the Japanese plums are consumed as fresh fruit. Among deciduous fruits, the cultivation of plum is widely distributed in the world. This is because of wider adaptability among different species and cultivars of plum which are adaptable to varied agro-climatic and soil conditions.

Plum is consumed as dessert, processed and dried products. The cultivation of plum under Indian conditions is gaining considerable popularity and is occupying an important position as a commercial crop because of its great acceptance by the consumer either as a fresh fruit or its various products. Its area under cultivation in India is about 23,000 ha with a production of 89,000 MT and productivity of 3.86 MT/ha (Anon 2018). It is mainly cultivated in HP, J&K and Uttarakhand and to a smaller extent in sub-tropical plains of Punjab, Haryana and Uttar Pradesh. Himachal Pradesh is one of the major producers of plum in India. Area under plum cultivation in Himachal Pradesh is 8,816 ha with a production of 11,389 MT and productivity of 1.2 MT/ha (http://www.hpagrisnet.gov.in/hpagris/horticulture/pdf/At-a-Glance%2018-19.pdf).

Weed management in plum orchard is an important practice which is accomplished by mechanical means (tillage, mowing etc), mulching, use of herbicides, growing cover crops or combination of two or more methods. The conventional method of hand weeding is costly and time consuming. Cover crops compete for moisture with main fruit crop and affect crop production. Herbicides are more effective and an economical method of weed management. A number of pre- and post-emergence herbicides are effectively used in different fruit crops at different doses. Use of herbicides for weed management is effective if used judiciously. Improper use of herbicides

can lead to many problems like herbicide resistance, ground water contamination etc. For effective results, herbicides in combination or integration with organic and other weed management practices are the best option.

The present study was conducted to find out the effect of different weed management practices on soil properties and soil and leaf nutrients content of plum (*Prunus salicina*) cv Red Beaut.

MATERIAL and METHODS

The experiment was conducted in the experimental orchard of Horticultural Research and Training Station and Krishi Vigyan Kendra, Solan, Himachal Pradesh during the year 2016-2017. It is situated at an elevation of 1,344 m amsl at 30°58'1.339"N latitude and 77°5'44.626"E longitude. Thirty uniform plum plants of cv Red Beaut having uniform vigour were selected for the experiment. All the trees were subjected to different treatments viz T_1: Pendamil @ 5.3 ml/l of water, T_2: Gramoxone @ 4 ml/l of water, T_3: Gramoxone @ 5 ml/l of water, T_4: Gramoxone @ 6 ml/l of water, T_5: Pendamil @ 5.3 ml/l of water followed by gramoxone @ 4 ml/l of water, T_6: Pendamil @ 5.3 ml/l of water followed by gramoxone @ 5 ml/l of water, T_7: Pendamil @ 5.3 ml/l of water followed by gramoxone @ 6 ml/l of water, T_8: Grass mulching, T_9: Hand weeding at 30 days interval, T10: Control (unweeded check).

Pendamil was applied as pre-emergence in treatments T_1, T_5, T_6 and T_7 during late February. This day was considered as '0' day of the experiment. Gramoxone in treatments T_2, T_3, T_4, T_5, T_6 and T_7 was applied at 30th day of experiment. Grass mulch of thickness 10 cm was applied in basins of treatment T_8 at '0' day. First hand weeding was done at 30th day of experiment and other at 30 days interval. In treatment T_{10} (Control) no weed management practice was followed.

The observations on various parameters like soil pH, organic carbon, electrical conductivity, available soil nitrogen, phosphorus and potassium, leaf nitrogen, phosphorus and potassium contents and fruit yield per plant were recorded. The data obtained from the investigations were appropriately computed, tabulated and analyzed by using MS-Exel and OPSTAT. The mean values of data were subjected to analysis of variance as per the procedures given by Gomez and Gomez (1984). Critical difference was calculated at 5 per cent level of significance.

All the recommended cultural practices were uniformly provided to all the experimental plants during the course of investigations.

RESULTS and DISCUSSION

Leaf nutrients content

The data representing leaf nutrients content given in Table 1 show that leaf nitrogen and potassium contents were significantly affected by various weed management treatments whereas leaf phosphorus content was not affected significantly. The maximum leaf N content (2.62%) was found in treatment T_8 (Grass mulch) which was statistically at par with T_6 (Pendamil @ 5.3 ml/l of water followed by gramoxone @ 5 ml/l of water) and T_7 (Pendamil @ 5.3 ml/l of water followed by gramoxone @ 6 ml/l of water). The minimum leaf N content (2.28%) was recorded under T_{10} (Control). Leaf phosphorus content ranged from 0.14 to 0.19 per cent among different treatments. It was not affected significantly by various weed management practices. The maximum leaf K content (1.95%) was found in treatment T_8 (Grass mulch) which was statistically at par with T_5, T_6 and T_7. The minimum leaf K content (1.74%) was recorded under T_{10} (Control).

Leaf nitrogen and potassium were significantly affected by different weed management practices. Higher leaf nitrogen, phosphorus and potassium were recorded in trees under grass mulching which may be due to better hydrothermal regimes maintained under grass mulching that made the nutrients available in soil solution and plant could take them properly and become sufficient in nutrient content. In addition the weed competition was also reduced by mulching in earlier days and in later days grass mulching also released nutrients on decomposition which fulfilled the requirement of nutrients. These results are in accordance with the findings of Meena et al (2015) who reported significantly higher leaf nitrogen content with grass mulching followed by glyphosate. Similar results were also reported by Shylla et al (1999) in plum who reported that leaf nutrients were significantly influenced by different orchard floor management practices. Sas-Paszt et al (2014) reported that grass mulch significantly increased leaf N content.

Table 1. Effect of different weed management practices on leaf nutrient content and yield of plum cv Red Beaut

Treatment	Leaf N (%)	Leaf P (%)	Leaf K (%)	Yield (kg/tree)
T_1	2.36	0.16	1.82	14.96
T_2	2.37	0.16	1.84	14.98
T_3	2.39	0.16	1.85	15.12
T_4	2.39	0.16	1.86	15.25
T_5	2.41	0.17	1.91	16.45
T_6	2.47	0.17	1.91	17.38
T_7	2.48	0.18	1.93	17.41
T_8	2.62	0.19	1.95	17.49
T_9	2.40	0.17	1.90	16.30
T_{10}	2.28	0.14	1.74	14.09
$CD_{0.05}$	0.15	NS	0.04	0.51

T_1: Pendamil @ 5.3 ml/l of water, T_2: Gramoxone @ 4 ml/l of water, T_3: Gramoxone @ 5 ml/l of water, T_4: Gramoxone @ 6 ml/l of water, T_5: Pendamil @ 5.3 ml/l of water followed by gramoxone @ 4 ml/l of water, T_6: Pendamil @ 5.3 ml/l of water followed by gramoxone @ 5 ml/l of water, T_7: Pendamil @ 5.3 ml/l of water followed by gramoxone @ 6 ml/l of water, T_8: Grass mulching, T_9: Hand weeding at 30 days interval, T10: Control (unweeded check).

Table 2. Effect of different weed management practices on soil pH, EC, organic carbon and soil N, P and K content of plum cv Red Beaut

Treatment	Soil pH	Soil EC (dS/m)	Organic carbon (%)	Soil N (kg/ha)	Soil P (kg/ha)	Soil K (kg/ha)
T_1	6.82	0.34	1.45	277.14	26.20	255.11
T_2	6.74	0.33	1.53	277.66	26.45	255.18
T_3	6.76	0.32	1.54	277.70	26.58	255.24
T_4	6.77	0.32	1.54	277.76	26.67	255.26
T_5	6.78	0.31	1.47	278.83	26.85	255.42
T_6	6.79	0.30	1.48	278.89	26.91	255.48
T_7	6.79	0.29	1.49	278.98	26.97	255.24
T_8	6.69	0.33	1.73	283.29	27.12	255.56
T_9	6.76	0.28	1.43	278.79	26.78	255.31
T_{10}	6.77	0.26	1.41	275.76	25.12	254.04
$CD_{0.05}$	NS	NS	0.03	0.54	0.91	0.34

T_1: Pendamil @ 5.3 ml/l of water, T_2: Gramoxone @ 4 ml/l of water, T_3: Gramoxone @ 5 ml/l of water, T_4: Gramoxone @ 6 ml/l of water, T_5: Pendamil @ 5.3 ml/l of water followed by gramoxone @ 4 ml/l of water, T_6: Pendamil @ 5.3 ml/l of water followed by gramoxone @ 5 ml/l of water, T_7: Pendamil @ 5.3 ml/l of water followed by gramoxone @ 6 ml/l of water, T_8: Grass mulching, T_9: Hand weeding at 30 days interval, T10: Control (unweeded check).

Yield per plant

Maximum fruit yield was recorded under treatment T_8 (Grass mulching) with 17.49 kg/tree which was statistically at par with T_7 (Pendamil @ 5.3 ml/l of water followed by gramoxone @ 6 ml/l of water) and T_6 (Pendamil @ 5.3 ml/l of water followed by gramoxone @ 5 ml/l of water). Minimum yield of 14.09 kg/tree was recorded under treatment T_{10} (Control) (Table 1).

Different weed management practices had exerted a significant effect on fruit yield. Highest yield was recorded under grass mulching treatment (T_8). These results are in agreement with the findings of Pandey et al (2005) who observed that yield was highest from the trees receiving dry grass mulch while minimum yield was under clean cultivation. Other workers (Duncan and Stapleton 1994, Lal et al 2003, Sharma and Kathiravan 2009, Kaur and Kaundal 2013, Bal and Singh 2011) also reported higher yield under mulch treatments in comparison to control.

Soil pH and EC

The data given in Table 2 reveal that different weed management treatments did not have any significant effect on soil pH and EC. The pH value of

soil under different treatments ranged from 6.69 to 6.82. The soil EC ranged from 0.26 to 0.34 dS/m. However Shylla et al (1999) reported that electrical conductivity of the soil was significantly higher under hay mulching treatment.

Soil organic carbon

Table 2 shows that levels of organic carbon in soil of different weed management treatments were statistically variable. Grass mulching (T_8) recorded maximum organic carbon of 1.73 per cent in soil. Minimum soil organic carbon of 1.41 per cent was recorded under T_{10} (Control). Soil organic carbon was highest under grass mulching (T_8) treatment. This may be due to the addition of organic matter to the soil on decomposition of the mulch materials. Delver (1980) also found increase in soil organic carbon with addition of organic material. Negi (2015) reported higher level of organic carbon under grass mulch as compared to herbicide treatment and control.

Available nutrients content in soil (N, P, K)

Data in Table 2 show that different weed management practices had a significant effect on available soil nutrients content. Maximum available N content in the soil (283.29 kg/ha) was recorded in treatment T_8 (Grass mulching) which was closely followed by treatments T_7 (Pendamil @ 5.3 ml/l of water followed by gramoxone @ 6 ml/l of water), T_6 (Pendamil @ 5.3 ml/l of water followed by gramoxone @ 5 ml/l of water), T_5 (Pendamil @ 5.3 ml/l of water followed by gramoxone @ 4 ml/l of water (278.83 kg/ha) and T_9 (Hand weeding at 30 days interval) whereas it was recorded minimum (275.76 kg/ha) in treatment T_{10} (Control).

The soil P content was also recorded maximum (27.12 kg/ha) in treatment T_8 (Grass mulching) which was statistically at par with treatments T_2, T_3, T_4, T_5, T_6, T_7 and T_9, whereas it was recorded minimum (25.12 kg/ha) in treatment T_{10} (Control). Soil K content was also recorded maximum (255.56 kg/ha) in treatment T_8 (Grass mulching) which was statistically at par with treatments T_3, T_4, T_5, T_6, T_7 and T_9. Minimum available K (254.04 kg/ha) was observed under treatment T_{10} (Control).

Different weed management practices significantly affected the N, P and K content in the soil. Grass mulching treatment had high level of N, P and K in the soil. This may be due to the addition of nutrients by grass mulching on its decomposition. These results are in agreement with the findings of Rao and Pathak (1996) who reported highest level of nitrogen and potassium under paddy straw mulch.

CONCLUSION

On the basis of results obtained in the present investigations it is concluded that grass mulch was most effective in improving soil physical properties; soil pH, EC and OC; soil and leaf nutrients content (N, P and K) which was statistically at par with treatment T_6 (Pendamil @ 5.3 ml/l of water followed by gramoxone @ 5 ml/l of water) and fruit yield of plum cultivar Red Beaut. This treatment was also found to be cost effective and most economical one.

REFERENCES

Anonymous 2018. Horticultural statistics at a glance 2018. Horticulture Statistics Division, Department of Agriculture, Cooperation and Farmers' Welfare, Ministry of Agriculture and Farmers' Welfare, Government of India.

Bal JS and Singh S 2011. Effect of mulch material and herbicides on tree growth, yield and fruit quality of ber. Indian Journal of Horticulture **68:**189-192.

Delver P 1980. Uptake of nutrients by trees grown in herbicide strips. In: Mineral nutrition of trees (D Atkinson, JE Jackson, RO Sharples and WM Waller eds), Butter Worths, London and Botson, pp 229-240.

Duncan RA and Stapleton JJ 1994. Mulching in young *Prunus* trees with black polythene film increases blossoming and yield, reduces needs for irrigation, eliminates weeds and controls pathogenic nematodes. Conference Proceedings, 25th National Agricultural Plastic Congress, 23-27 September 1994, Lexington, Kentucky, pp 147-150.

Gomez KA and Gomez AA 1984. Statistical procedures for agricultural research. John Wiley and Sons, New York, 680p.

http://www.hpagrisnet.gov.in/hpagris/horticulture/pdf/At-a-Glance%2018-19.pdf (Retrieved: 12.10.2020)

Kaur K and Kaundal GS 2013. Economics and effect of various herbicidal treatments on fruit quality and yield of plum cv Satluj Purple. Asian Journal of Horticulture **8(1):** 101-105.

Lal H, Rao VK and Singh VP 2003. Effect of various mulches on growth and yield of apple cv Starking Delicious orchard. Progressive Horticulture **35(1):** 100-103.

Meena MK, Sharma DD and Meena OP 2015. Effect of different weed management practices on weed population, yield potential and nutrient status of peach cv July Elberta. Research on Crops **16 (3):** 519-525.

Negi PK 2015. Effect of orchard floor management practices on growth, cropping and quality of nectarine [*Prunus persica* (L) Batsch var *nucipersica*] cv Snow Queen. MSc Thesis, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India, 83p.

Pandey KK, Dimri DC and Kamboj P 2005. Effect of various mulches on growth, yield and quality attributes of apple. Indian Journal of Horticulture **62(2):** 145-147.

Rao VK and Pathak RK 1996. Effect of mulches on soil properties in aonla orchard established on sodic land. Indian Journal of Horticulture **53(4):** 251-254.

Sas-Paszt L, Pruski K, Żurawicz E, Sumorok B, Derkowska E and Głuszek S 2014. The effect of organic mulches and mycorrhizal substrate on growth, yield and quality of Gold Milenium apples on M.9 rootstock. Canadian Journal of Plant Science **94(2):** 281-291.

Sharma JC and Kathiravan G 2009. Effect of mulches on soil hydrothermal regimes and growth of plum in mid-hill region of Himachal Pradesh. Indian Journal of Horticulture **66(4):** 465-471.

Shylla B, Chauhan JS, Awasthi RP and Bhandari AR 1999. Effect of orchard floor management practices on leaf nutrient status of plum. Indian Journal of Horticulture **56(1):** 34-37.