



Effect of orchard floor management practices on growth, yield, leaf and soil nutrients in nectarine (*Prunus persica*)

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Nectarine [*Prunus persica* (L.)] is an emerging stone fruit crop of Himachal Pradesh. The lack of skin fuzz make nectarine skin more reddish than those of peaches, providing fruit's plum-like appearance. In recent years, the cultivation of nectarine is catching up in state due to its attractive appearance and better economic returns as compared to peaches. High moisture stress and erratic rainfall in Himachal Pradesh are some of the major constraints in nectarine growing. Therefore, it becomes essential to develop strategies to conserve the soil moisture during the growing period in nectarine orchard. A good orchard floor management practice enhances tree growth, fruit yield along with fruit quality. Keeping in view all these factors the present study was conducted to assess the impact of different orchard floor management practices on growth, cropping, leaf nutrients and soil properties in nectarine.

The present study was conducted in the experimental orchard of Dr YSP UHF, Himachal Pradesh (30° 51'N latitude and 76° 11'E longitude at 1250 m amsl, during 2016–17 on 10 years old plants of Snow Queen nectarine which were planted at a spacing of 5 m × 5 m. The experiment consisted of seven treatments having four replications and laid out in a randomized block design. Different orchard floor management practices, viz. black polythene mulch (100 µ) (T₁), bicolour polythene mulch (100 µ) (T₂), nylon mulch mat (90 GSM) (T₃), grass mulch (10-12 cm) (T₄), chemical weed control (Glyphosate @5 ml/l) (T₅), hand weeding (T₆) and control (T₇) were uniformly imposed in the first week of March. The growth (annual shoot growth, tree height, trunk girth and tree volume) and fruit yield were recorded as per as method suggested by Westwood (1978). The total fruit yield was expressed in kilograms per tree (kg/tree). Leaf area was recorded with CI-202 Portable Laser Leaf Area Meter. Total chlorophyll content in leaves was determined by DMSO method (Hiscox and Israelstam 1979).

Leaf samples were collected during first week of July from middle of current season growth around periphery of tree. After collection, leaves were washed and dried as per as procedure suggested by Chapman (1964). The digestion of sample for estimation of nitrogen was carried out in conc. H₂SO₄ in presence of digestion mixture, while for the estimation of P, K, Ca and Mg, the leaf samples were digested in diacid mixture prepared by mixing HNO₃ and HClO₄ in the ratio of 4:1. Total leaf N was determined by Foss Tecaror Kjeltex 2300 analyzer. Leaf P was estimated by Vanadomolybdate phosphoric yellow colour method (Jackson 1973). Leaf K, Ca and Mg were estimated on atomic absorption spectrophotometer. The collected soil samples were air dried and then kept in cloth bags for nutrient estimation. Soil organic carbon was determined by method outlined by Jackson (1973). Available soil N, P, K were estimated by alkaline KMnO₄ method (Subbiah and Asija 1956), SnCl₂ reduced ammonium molybdate method using Olsen's extractant (Olsen *et al.* 1954) and neutral normal ammonium acetate (Merwin and Peech 1951), respectively. Exchangeable Ca and Mg were determined by extraction with neutral normal ammonium acetate method (Jackson 1973). The two years data were pooled and statistically analyzed with the standard procedure (Gomez and Gomez 1984). The level of significance for different variables was tested at 5 per cent value of significance.

Data reveals that different orchard floor management practices had a significant effect on growth of nectarine (Table 1). Maximum increment in annual shoot growth (65.05 cm), increase in trunk girth (11.17%), tree height (13.25 %) and tree volume (41.10 %), was recorded in trees under the treatment T₁. However, minimum increment in trunk girth (9.43%), tree height (10.51 tree volume (33.16%) and annual shoot growth (58.12 cm) was recorded in treatment T₇. It might be due to good soil moisture availability and weed suppression under the black polythene mulch. Better moisture availability not only triggers the physiological processes in plants but also increases the solubility and availability of nutrients in soil solution, which increases the uptake of nutrients and ultimately leads to better plant growth. Similar results were

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Table 1 Impact of different orchard floor management practices on growth, yield and foliar macro nutrient content of nectarine

Treatment	Annual shoot growth (cm)	Trunk girth percent increase	Tree height percent increase	Tree volume percent increase	Leaf area (cm ²)	Total chlorophyll content (mg/100 fresh wt.)	Fruit yield (kg/tree)	N (%)	P (%)	K (%)	Ca (%)	Mg (%)
T ₁	65.05	11.17 (3.49)*	13.25(3.77)*	41.10(39.85)**	31.13	2.57	48.53	2.43	0.20	2.08	1.88	0.56
T ₂	64.54	11.13 (3.48)	12.81 (3.72)	40.21 (39.34)	31.40	2.62	46.78	2.55	0.18	2.04	1.84	0.57
T ₃	62.11	10.67 (3.42)	12.76 (3.71)	39.37 (38.84)	30.50	2.54	43.84	2.35	0.17	1.96	1.80	0.54
T ₄	62.11	10.53 (3.40)	12.48 (3.67)	38.66 (38.43)	29.74	2.45	40.30	2.73	0.22	2.17	1.90	0.59
T ₅	61.22	10.50 (3.39)	11.35 (3.51)	36.28 (37.02)	28.64	2.36	35.06	2.21	0.17	1.94	1.77	0.53
T ₆	60.04	10.35 (3.37)	11.17 (3.48)	35.78 (36.72)	27.85	2.32	33.39	2.18	0.16	1.89	1.74	0.52
T ₇	58.12	9.43 (3.23)	10.51 (3.39)	33.16 (35.13)	26.02	2.21	30.41	2.04	0.14	1.75	1.65	0.49
CD (P=0.05)	2.64	0.13	0.19	1.44	0.90	0.08	1.79	0.10	0.01	0.09	NS	0.02

*and** are square root and arc sine transformed values

observed by Sharma and Kathiravan (2009) who revealed that orchard floor management treatments had a significant influence on annual shoot growth and trunk girth in Santa Rosa plum and Bhanukaret *et al.* (2015) for height and trunk girth in Kinnow mandarin.

Different orchard floor management practices significantly influenced the leaf area and total leaf chlorophyll content of nectarine (Table 1). Maximum leaf area (31.40 cm²) and total chlorophyll content (2.62 mg/g fresh weight) was recorded in treatment T₂. Whereas, minimum leaf area (26.02 cm²) and total chlorophyll content (2.21 mg/g fresh weight) was recorded in trees under the treatment T₇. Bicoloured mulches selectively absorb photosynthetically active radiations (PAR), while transmitting solar infrared radiations thus bicolour mulches have the ability to increase the ratio of red: far red-infrared (R:FR) in the reflected plant canopy, which might have resulted in increased photosynthetic activity (Sharma *et al.* 2013) which might lead to increased leaf chlorophyll content under bicolour mulch. Further, good hydrothermal regimes and reflective nature of mulch might have induced better conditions conducive to attainment of maximum leaf area in the present study.

Different orchard floor management practices exerted a significant effect on fruit yield in nectarine during the present course of study (Table 1). Maximum fruit yield (48.53 kg/tree) was recorded in plants under the treatment T₁, whereas, minimum fruit yield (30.41 kg/tree) in plants under treatment T₇. Maximum yield under the black polythene mulch might be due to better moisture retention which in turn increased the flower primordial, carbohydrates and nutrients which are pre-requisite to promote flowering and fruit set which ultimately leads to increase in fruit yield (Negi 2015). The results of present study are in accordance with the findings of Sharma and Sharma (2018) in nectarine and Sharma *et al.* (2013) in strawberry. The perusal of data pertaining to leaf macronutrients (N, P, K, Ca and Mg) (Table 1), reveal that orchard floor management practices had a significant impact on foliar macro nutrient content in nectarine except calcium. Maximum amount of leaf N (2.73%), P (0.22%),

K (2.17%), Ca (1.90%) and Mg (0.59%) content was recorded under the treatment T₄, while minimum amount of leaf N (2.04%), P (0.14%), K (1.75%), Ca (1.65%) and Mg (0.49%) content was recorded in treatment T₇. Bhat and Khokhar (2009) and Negi (2015) also found that grass mulch significantly increased leaf N content. Higher leaf P, K and Mg under grass mulch may be due to the higher amount of these nutrients in grass mulch as well as higher nutrient uptake with sufficient soil moisture under grass mulch (Shylla *et al.* 1999). Foliar nutrient status was found to increase with mulches in comparison to untreated control reported by various workers; Yin *et al.* (2007) with polypropylene cover relative to no cover in cherry, Hussain *et al.* (2018) in apple.

Significantly higher organic carbon (2.09%), available nitrogen (355.92 kg/ha), phosphorus (40.74 kg/ha), potassium (367.78 kg/ha), exchangeable Ca [2.86 cmol (P⁺)/kg] and Mg [2.91 cmol (P⁺)/kg] was recorded in treatment T₁, whereas minimum amount of organic carbon (1.58%), available nitrogen (320.31 kg/ha), phosphorus (33.49 kg/ha), potassium (328.06 kg/ha), exchangeable Ca [2.65 cmol (P⁺)/kg] and Mg [2.45 cmol (P⁺)/kg] was recorded under the treatment T₇ (Table 2). The result of present study confirmed

Table 2 Impact of different orchard floor management practices on organic carbon and soil nutrient content in nectarine

Treatment	OC (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)	Ca [cmol (P ⁺)/kg]	Mg [cmol (P ⁺)/kg]
T ₁	1.95	346.69	39.14	355.96	2.82	2.84
T ₂	1.91	344.38	38.45	353.51	2.80	2.79
T ₃	1.88	340.08	37.17	350.66	2.75	2.70
T ₄	2.09	355.92	40.74	367.78	2.86	2.91
T ₅	1.74	335.97	36.06	343.80	2.72	2.61
T ₆	1.89	329.89	35.38	339.71	2.70	2.59
T ₇	1.58	320.31	33.49	328.06	2.65	2.45
CD (P=0.05)	0.18	12.50	0.84	10.80	0.04	0.05

the findings of Negi (2015) who also found increment in soil carbon with addition of organic materials. Grass mulching resulted in increased soil N build up probably on account of higher organic carbon and low leaching losses of N from the soil. Also, the decomposition of grass mulch over the time leads to increment in exchangeable soil calcium and magnesium (Shylla *et al.* 1998).

Black polythene and bicolour polythene mulches are the best orchard floor management practices in rainfed areas of Himachal Pradesh as they not only increased the tree growth and fruit yield but also play a vital role in maintaining optimum soil and leaf nutrient levels.

SUMMARY

The present investigation was carried out to assess the impact of different orchard floor management practices on growth, yield, leaf and soil nutrients in nectarine cv. Snow Queen. The maximum increase in annual shoot growth (65.05 cm), trunk girth (11.17%), tree height (13.25%), tree volume (41.10%), yield (59.59% was recorded under black polythene mulch. Maximum leaf area (31.40 cm²) and total chlorophyll (2.62 mg/g fresh weight) were observed under bicolour polythene mulch. Maximum leaf macro nutrient [N (2.73 %), P (0.22%), K (2.17%), Ca (1.90%), Mg (0.59%), soil nutrient [available N (355.92 kg/ha), P (40.74 kg/ha), K (367.78 kg/ha), exchangeable Ca (2.86 cmol (P⁺)/kg) and Mg (2.91 cmol (P⁺)/kg)] and soil organic carbon (2.09%) content were recorded under grass mulch. Black polythene mulch and bicolour polythene mulches are the best orchard floor management options for rainfed areas of Himachal Pradesh.

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