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Soil Management Amendments to Combat peach Replant Problem

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ABSTRACT: Replant problem is the situation resulting in suppression of growth and poor productivity of the replanted trees on old orchard sites which makes the plantation uneconomical. Peach has short life span of 20-25 years and most of the orchard planted during eighties and nineties have outlived their economic life span and are at the verge of decline. Due to limited land resources and choice of crops for diversification in hill states, orchardists are compelled to replant same fruit crop in old orchard site. However; repeated cultivation of the same plant species on the same field leads to replant problem. The new plantations experience low field survival, stunted, poor growth and death of plants even after few years of plantation. Among the treatments, maximum growth and vigour parameters as well assoil enzymatic activities were recorded with *Brassica* seed meal fumigation. Soils amended with PGPR had higher microbial activity.

Keywords: Peach replant disease, biofumigation, growth, soil viable microorganism count, enzyme activity.

INTRODUCTION

Peach [*Prunus persica* (L.) Batsch] is an important stone fruit grown in warmer zones of the world. It is believed to be originated in China. In 140-88 BC, it was introduced by way of the Silk route into Persia where it came to be known Persian Fruit. In India peach is commonly grown in the mid-hill zone of Himalayas extending from Jammu and Kashmir to Khasi hills in North-East. Low chilling peach cultivars are grown in sub-mountainous and plains of western Uttar Pradesh, Jammu, Himachal Pradesh, Punjab, Haryana and Uttrakhand. In India, peach cultivation extends from Northern plains up to an elevation of 2000 meter above mean sea level. The total area under peach cultivation in India is about 19.00 thousand hectare with a total production around 118.00 MT and productivity of 7.17 MT/ha (NHB, 2018). Replant problem of fruit crops is most important because it often suppress growth of young replanted trees appreciably up to the point of making fruit plantations uneconomical. Replant problem is a complex malady of temperate fruit crops. In one group of disorders of cultivated plants when a crop is grown in the same soil for long periods subsequent plantings often grow poorly in comparison with similar plantings in virgin soil or in soil never planted to the species concerned.

It is generally expected that soil sickness is a phenomenon brought about by a complex blend of biotic and abiotic factors upsetting the biological balance in soil, such as lack or unevenness of plant supplements, corruption of soil properties, lopsided improvement of different gatherings of miniature life forms in soil, expanded pervasion of pathogens, pests, weeds and accumulation of phytotoxic compounds (Benizri *et al*., 2005). A variety of microorganisms including bacteria, complexes of fungi, Nematode and oomycetes belonging to the well-known root rot complex, *Rhizoctonia solani*, *Phytophthora* spp., *Cylindrocarpon* spp. and *Pythium* spp. were also shown to be an important factor of replant problems in apple (Singh *et al.*, 2020) and peach (Thakur, 2017). Plant parasitic nematodes were not present in the replant site suggesting they may not be important factors in replant disease severity (Westerveld *et al*., 2023).

A natural phenomenon of release of secondary metabolites by plants or micro-organisms in the environment, normally termed as allelopathy, compound prunasin, a cyanogenic glycoside found in peach tissues, as the cause of reduced tree growth. Peach root extracts have been shown to inhibit respiration of root-tips; retard peach tree growth; cause pre-mature leaf chlorosis, necrosis and abscission; act as competitive inhibitors of nitrate reductase and reduce the overall size of the root system (Gur and Cohen 1989).

MATERIALS AND METHODS

The experiment was laid out at an elevation of 1250 m above mean sea level at 30° 51′N latitude and 76° 11′E longitude in the experimental filed of Department of Fruit Science, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India.

The suitable methodology has been used to understand the response of peach seedlings to replant soil. One year old seedling were planted in 50 liters plastic container and filled with soil and FYM (3:1) and application of ten soil management treatments viz., control (No treatment), soil fumigation (formaldehyde, H_2O_2, *Brassica* seed meal), PGPR (*Bacillus licheniformis*), Neem based granular formulation, Cow urine formulation and *Jeevamrut* in Completely Randomization Design under open field conditions, were given in first week of January, 2018.

Soil from replanted orchard site at Thanoh, district Sirmaur was brought to the experiment field of Department of Fruit Science. The separate heaps of soil were sterilized with 500 ml of formaldehyde solution (1:9), H_2O_2 with silver (10ml/l, 20ml/l, 30ml/l) as well as 300 g of *Brassica* seed meal and covered by polythene sheet in case of formaldehyde and *Brassica* seed meal. After two weeks seedlings were transplanted in the treated basin along with soil ball adhering to the roots. Neem based granular formulation (Azadirachtin 0.15 %), Cow urine formulation were applied one weeks before planting and PGPR (*Bacillus licheniformis*) was at the time of planting.

In particular (Table 1), the data on tree growth and vigour characteristics were recorded to study the effect of different replant soil amendments. Observations regarding growth parameters, viz. increase plant height, increase stem diameter, number of feathers, leaf number, leaf area and chlorophyll content were recorded as per standard procedures during both the years of study. Plant height was measured from the ground level to the top with the help of a graduated scale and mean was worked out and expressed in centimeters (cm). Stem diameter of each replication of experimental plants was determined using Digimatic Vernier Callipers and results were expressed in millimeters (mm). Fully developed 20 leaves per tree were sampled in early August of each year from all around the periphery of the plant. The leaf area was determined using a portable Laser (CI-202), CID Bio-Science automated leaf area meter and expressed as square centimeters. Chlorophyll content was estimated with DMSO (Dimethyl Sulphoxide) method as suggested by Hiscox and Israeistam (1979). Microbial count was performed by standard plate count technique (Wollum, 1982) by employing different media for different groups of microorganisms. Suspension of 0.1ml from dilution blank was spread over pre-poured solid media *viz.*, Nutrient Agar, Potato Dextrose Agar and Kenknight'sMunaiers medium with the help of glass spreader under aseptic conditions for enumeration of bacteria, fungi and actinomycetes, respectively, as per the recommendations. Plates were incubated in inverted position at $28+2^{o}C$ for 48 hours. After the incubation period, the microbial count was expressed as colony forming unit per gram of soil (cfu g^{-1} soil). The method used for estimating urease enzyme activity was given by Tabatabai and Bremner (1972), phosphatase enzyme estimation was carried out by method given by Tabatabai and Bremner (1969) and Dehydrogenase enzyme estimation in soil was carried out by using the reduction of 2, 3, 5-triphenyltetrazolium chloride (3%) method given by Casida *et al*. (1964). The data were subjected to one-way analysis of variance (ANOVA). The averages were separated by means of tests of the Least Significant Difference (LSD) at $p<0.05$.

Table 1: Details of the treatments.

Treatment	Treatment Details	Time of application
T_1	Formaldehyde 37% (1:9)	5-weeks before planting (WBP)
T_2	Hydrogen peroxide with silver (10 ml/l.)	one weeks before planting (OWBP)
T_3	Hydrogen peroxide with silver (20 ml/l.)	one weeks before planting (OWBP)
T_4	Hydrogen peroxide with silver (30 ml/l.)	one weeks before planting (OWBP)
T_5	*Brassica* seed meal (*Brassica juncea*)	4-weeks before planting (WBP)
T_6	Neem based granular formulation (Azadirachtin 0.15%)	one weeks before planting
T_7	Cow urine formulation	one weeks before planting
T_8	PGPR (*Bacillus licheniformis*)	At the time of planting
T_9	*Jeevamrit* 10%	At the time of planting
T_{10}	Control	No treatment

RESULTS AND DISCUSSION

A. Plant height

The reconnaissance of data enumerated in Table 2, reveal considerable variation among different treatments apropos of increase in plant height during the year 2019; however, treatments didn't produce any consistent change in response to peach replant treatments under pot-cultivation during 2018. Data analysis in 2019 reveal that plants exhibited maximum (21.37 %) per cent increase in plant height on peach replant soil with treatment T_5 (*Brassica* seed meal), which was statistically on par with T_8 (18.93 %), T_3 (18.76 %) and T_2 (18.06 %) treatments. While, the minimum (12.56 %) plant height was observed in plants with T_{10} (control) replant treatment. Pooled analysis of data show similar trend and significantly higher (20.13 %) increase in plant height was recorded with T_5 treatments, which was found on par with T_3 (18.14 %), T_8 (17.77 %) and T_2 (17.57 %) treatments. The minimum (11.98%) was recorded in plants under T_{10} treatment.

(i) Stem diameter. Perusal of data presented in Table 2, clearly reveal that different replant treatments had a significant effect on increased stem diameter of peach seedlings grown on a replant soil under pot-cultivation.

Data analysis in 2018 demonstrated that plants exhibited maximum (24.89 %) increase in stem diameter under pot culture studies with treatment T_5 (*Brassica* seed meal), which was statistically on par with T_3 (24.66 %) and T_8 (21.71 %) treatments. While, the minimum stem diameter (16.95 %) was observed in plants with T_{10} (control) treatment. During 2019, significantly maximum (26.95%) increased stem diameter was recorded with treatment T_5 (*Brassica* seed meal), which was found on par with stem diameter noticed under T_3 (25.12 %) and T_8 (24.58 %) treatments. While, the minimal increase in stem diameter (17.16 %) was observed in plants with T_1 (Formaldehyde) treatment. Pooled analysis also showed that the different soil replant treatments had significant effects on the increase stem diameter. Significantly higher (23.22 %) stem diameter was recorded with T_5, which was found to be on par with T_3 (22.38 %) and T_8 (20.67 %) treatments. The significantly lower (15.66 %) stem diameter was observed with T_{10} (control).

(ii) Leaf area. The scrutiny of the data presented in Table 2, manifest that different replant treatments showed significant variation with reference to leaf area under pot-culture. Considering 2018 analytical results, significantly higher (26.17 cm^2) leaf area was recorded with replant soil treatment T_5 (*Brassica* seed meal), which was statistically on par with T_9 (25.70 cm^2), T_3 (25.54 cm^2) and T_8 (24.70 cm^2) treatments. While, the least (20.28 cm^2) leaf area was observed in plants under replant treatment T_{10} (control). Whereas, in the year 2019, leaf area recorded with T3 (26.82 cm^2), T_9 (25.93 cm^2) and T_8 (25.79 cm^2) treatments, stands on par with maximum (26.89 cm^2) leaf area recorded in treatment T_5 (*Brassica* seed meal). Meanwhile, the minimal (20.19 cm^2) leaf area was noticed with T2 treatment. Pooled analysis of the data also indicated the significant effects on leaf area of peach plants. The maximum (23.72 cm^2) leaf area was observed with T_5 treatment, which was statistically on par (23.41 cm^2) with T_3 treatment and minimum (18.09 cm^2) was observed with T_{10} treatment.

(iii) Chlorophyll content. The scrutiny of data shown in Table 2, indicated that different treatments exerted significant differences on the accumulation of leaf chlorophyll content of peach seedlings under pot-culture surveillance during course of investigation. During 2018 peach seedlings raised in pots containing replant sick soil accumulated highest (3.50 mg g^{-1}) leaf chlorophyll content with treatment T_5 (*Brassica* seed meal), which was statistically on par with T_3 (3.49 mg g^{-1}), T_9 (3.45 mg g^{-1}), T_8 (3.43 mg g^{-1}) and T_2 (3.38 mg g^{-1}) treatments. Whereas, the lowest (3.17 mg g^{-1}) chlorophyll content was recorded with T_7 treatment. However, during 2019, wherein chlorophyll values acquired by T_3 (3.47 mg g^{-1}), T_8 (3.46 mg g^{-1}), T_6 (3.42 mg g^{-1}) and T_2 (3.40 mg g^{-1}) treatments, stood on a level of equality with maximum value (3.53 mg g^{-1})with T_5 (*Brassica* seed meal). Whereas, the lowest (3.26 mg g^{-1}) chlorophyll content was recorded with T_1 (Formaldehyde) treatment. Pooled analysis of data showed that maximum (3.52 mg g^{-1}) leaf chlorophyll was recorded with T_5 treatment, which was statistically on par with leaf chlorophyll content obtained with T_3 (3.48 mg g^{-1}) and T_8 (3.44 mg g^{-1}) treatments. Whereas, minimum (3.24 mg g^{-1}) leaf chlorophyll content was recorded with T_7 treatment.

In the present study, different replant soil management amendments were found to exert significant ($p<0.05$) influence on tree growth and vigour. Pre-plant fumigation practices resulted in increased vegetative growth in terms of plant height, stem diameter, leaf area and leaf chlorophyll content under open field conditions (Tables 2). The betterment in plant growth might also result from the additive effect of nutrient suppliments by the biofumigation treatment (Mazzola *et al.*, 2001; Lazzeri *et al.*, 2010). Yim *et al.* (2016) found that the biofumigation could be an alternative strategy in place of chemical such as Basamid treatment for the plant growers. The effects of biofumigation evaluated by the apple plant growth were site-dependent and might resulted from suppression of soil-borne pests and pathogens, changes in soil microbial community compositions, and additional nutrients from the incorporated biomass.

Table 2: Effect of different soil management amendments on plant height, stem diameter, leaf area and total chlorophyll content of peach under pot culture.

Treatments	Plant height (% increase)			Stem diameter (% increase)			Leaf area (cm^2)			Total chlorophyll content (mg g^{-1} FW)		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
T_1	16.35	17.01	16.68	20.53	17.16	17.13	23.19	23.55	20.75	3.27	3.26	3.27
T_2	17.08	18.06	17.57	20.81	21.21	18.89	21.54	20.19	18.75	3.38	3.40	3.39
T_3	17.52	18.76	18.14	24.66	25.12	22.38	25.54	26.82	23.41	3.49	3.47	3.48
T_4	13.10	14.24	13.67	20.25	20.64	18.38	22.11	22.17	19.74	3.36	3.31	3.34
T_5	18.88	21.37	20.13	24.89	26.95	23.22	26.17	26.89	23.72	3.50	3.53	3.52
T_6	15.21	17.28	16.24	20.47	21.67	18.90	22.91	22.51	20.22	3.30	3.42	3.36
T_7	12.82	13.89	13.35	17.34	18.45	16.05	21.46	21.46	18.90	3.17	3.30	3.24
T_8	16.62	18.93	17.77	21.71	24.58	20.67	24.70	25.79	22.35	3.43	3.46	3.44
T_9	12.01	14.37	13.19	19.16	19.08	17.21	25.70	25.93	22.57	3.45	3.36	3.40
T_{10}	11.40	12.56	11.98	16.95	17.95	15.66	20.28	20.71	18.09	3.29	3.28	3.28
$CD_{(0.05)}$	**NS**	**3.89**	**3.56**	**3.23**	**5.27**	**2.55**	**1.91**	**1.20**	**1.04**	**0.13**	**0.15**	**0.10**

B. Total viable microbial count

(i) Bacterial count. It is evident from the data presented in Table 3, that population of soil bacteria was significantly affected by the different rhizosphere soil treatments during the course of investigation. Significantly highest (116.50×10^5cfu g^{-1} soil and 120.00×10^5cfu g^{-1} soil in 2018 and 2019, respectively) bacterial count was recorded in rhizosphere soil with T$_8$, statistically superior among different replant treatments. However, the lowest (69.00×10^5cfu g^{-1} soil and 74.00×10^5cfu g^{-1} soil during 2018 and 2019, respectively) bacterial count was observed in T$_1$ (Formaldehyde) treatment. Pooled data revealed that the highest (118.25×10^5cfu g^{-1} soil) bacterial count was recorded with T$_8$, which was also statistically superior to all other treatments. However, the lowest (71.50×10^5cfu g^{-1} soil) bacterial count was recorded with T$_1$ treatment.

(ii) Fungal count. From the perusal of the data enumerated in Table 3, it is clear that different replant treatments had a marked influence on the accountability of soil fungal population during both the years of study. During the year 2018, notably highest (15.00×10^3cfu g^{-1} soil) fungal count was recorded in rhizosphere soils with treatment T$_8$ (PGPR), which was statistically on par (14.00×10^3cfu g^{-1} soil) with T$_9$ treatment. Similar trend was observed during the year 2019, as maximum (19.00×10^3cfu g^{-1} soil) fungal count was recorded in rhizosphere of plants with treatment T$_8$, which was statistically superior among all other treatments. However, the minimum (5.50 and 8.25×10^3cfu g^{-1} soil during 2018 and 2019, respectively) count was obtained from rhizosphere soil of plants with T$_1$ treatment. Pooled data revealed that the highest (17.00×10^3cfu g^{-1} soil) fungal count was recorded with T$_{8,}$ statistically superior to all other treatments. The lowest (6.88×10^3cfu g^{-1} soil) fungal count was recorded with T$_1$ treatment,

(iii) Actinomycetes count. Different peach replant treatments influenced soil actinomycetes count significantly as evident from the data given in Table 3, during both the years of study. In the year 2018, markedly highest (17.75×10^2cfu g^{-1} soil) actinomycetes count was recorded in treatment T$_8$ (PGPR), statistically on a par (16.25×10^2cfu g^{-1} soil) with T$_9$ treatment. Similarly, in 2019, significantly highest (18.50×10^2cfu g^{-1} soil) actinomycetes count was recorded with T$_8$, which was statistically on a par (18.00×10^2cfu g^{-1} soil and 17.75×10^2cfu g^{-1} soil) with T$_9$ and T$_{10}$ treatments, respectively. However, the minimum (5.00×10^2cfu g^{-1} soil and 6.25×10^2cfu/ g soil during 2018 and 2019, respectively) count was obtained from plants rhizosphere soil with T$_1$ treatment. Almost similar trend was also followed in pooled data where the highest (18.13×10^2cfu g^{-1} soil) actinomycetes count was recorded with T$_{8,}$ which was on par with T$_9$ (17.13×10^2cfu g^{-1} soil). The lowest (5.63×10^2cfu g^{-1} soil) was recorded with T$_1$ treatment.

The application of the PGPR registered a significant increase in total microbial population (Table 3). Their abundance in rhizosphere gives an indication of their possible role in decomposition of organic matter, fixation of atmospheric nitrogen, phosphate solubilization and transformations of nutrient elements. These results are also supported by the findings of Seo *et al.* (2009); Pesakovic *et al.* (2013) evaluated that increased microbial population with bacterial inoculation in strawberry. Moreover, the rhizosphere is known to be a site of increased microbial activity and consequently enzyme activity. Comparatively, of the three seed meals only BjSM was non stimulatory to *Pythium* sp. (Mazzola *et al.*, 2007). Other elements of the soil microbial community are preferentially enhanced by seed meal amendments including *Trichoderma* sp., *Mortierella* sp. (Weerakoon *et al.*, 2012), *Streptomyces* sp. (Cohen and Mazzola, 2006; Mazzola *et al.*, 2007), and *Pseudomonas* sp. which are enhanced by the seed meal application (Mazzola *et al.*, 2001).

Xu *et al.* (2023) concluded that hydrogen peroxide treatment improved replanted seedling growth and also inactivated a certain number of *Fusarium* sp., while the *Bacillus* sp., *Mortierella* sp. and *Guehomyces* sp. also became more abundant in relative terms and effectively prevent and control ARD.

Table 3: Effect of different soil management amendments on total viable microbial count in peach grown in pots.

Treatments	**Bacterial count (10^5cfu g^{-1} soil)**			**Fungal count (10^3cfu g^{-1} soil)**			**Actinomycetes count (10^2cfu g^{-1} soil)**		
	2018	**2019**	**Pooled**	**2018**	**2019**	**Pooled**	**2018**	**2019**	**Pooled**
T$_1$	69.00	74.00	71.50	5.50	8.25	6.88	5.00	6.25	5.63
T$_2$	94.75	96.00	95.38	9.00	9.00	9.00	9.25	11.00	10.13
T$_3$	92.25	94.25	93.25	8.50	11.00	9.75	10.00	12.00	11.00
T$_4$	94.00	93.75	93.88	8.00	11.25	9.63	7.25	9.75	8.50
T$_5$	95.75	96.25	96.00	9.25	11.50	10.38	9.00	7.50	8.25
T$_6$	98.75	97.50	98.13	9.50	13.75	11.63	11.00	13.00	12.00
T$_7$	103.50	106.75	105.13	10.00	14.75	12.38	13.75	14.25	14.00
T$_8$	116.50	120.00	118.25	15.00	19.00	17.00	17.75	18.50	18.13
T$_9$	109.75	112.00	110.88	14.00	15.25	14.63	16.25	18.00	17.13
T$_{10}$	108.25	109.00	108.63	11.25	15.00	13.13	16.00	17.75	16.88
CD$_{(0.05)}$	**4.09**	**2.77**	**2.42**	**1.41**	**1.95**	**2.33**	**1.74**	**1.58**	**1.15**

C. Enzymatic activities

(i) Urease activity. Different peach replant treatments influenced soil urease activity significantly as evident from the data given in Table 4, during both the years of investigation. In the year 2018, markedly highest (26.14 µg urea g^{-1} soil h^{-1}) urease activity was recorded in treatment T_8 (PGPR), which was closely (24.75 µg urea g^{-1} soil h^{-1}) followed by T_9 treatment. On the contrary, least (11.05 µg urea g^{-1} soil h^{-1}) urease activity was obtained in rhizosphere soil with treatment T_1. Similar trend was observed during the year 2019, as treatment T_8 resulted in maximum (28.97 µg urea g^{-1} soil h^{-1}) urease activity, which was statistically superior to all other treatments. The minimum (12.93 µg urea g^{-1} soil h^{-1}) urease activity was recorded in T_1 (Formaldehyde) treatment. Pooled data reveal that highest (27.55 µg urea g^{-1} soil h^{-1}) urease activity in soil was recorded with T_8 treatment. The lowest (11.99 µg urea g^{-1} soil h^{-1}) urease activity was recorded with T_1 treatment.

(ii) Dehydrogenase activity. It is evident from the data presented in Table 4, that dehydrogenase activity was significantly affected by the different rhizosphere soil treatments during both the years of study. During the year 2018, significantly highest (21.37 µg TPF g^{-1} soil h^{-1}) dehydrogenase activity was recorded in rhizosphere soil with treatment T_8 (PGPR), which was statistically on par (20.74 µg TPF g^{-1} soil h^{-1}) with T_9 treatment. However, the lowest (11.49 µg TPF g^{-1} soil h^{-1}) dehydrogenase activity was observed in T_1 treatment. Whereas, in the year 2019, highest (22.63 µg TPF g^{-1} soil h^{-1}) dehydrogenase activity was recorded with treatment T_9, which was statistically on par (22.57 µg TPF g^{-1} soil h^{-1} and 21.56 µg TPF g^{-1} soil h^{-1}) with T_8 and T_{10} treatments, respectively. Minimum (13.34 µg TPF g^{-1} soil h^{-1}) dehydrogenase activity was observed in rhizosphere of plants raised on replant soil with T_1 (Formaldehyde) treatment. Pooled data reveal that the highest (21.97 µg TPF g^{-1} soil h^{-1}) dehydrogenase activity was recorded with T_8, which was found on par with T_9 (21.69 µg TPF g^{-1} soil h^{-1}) and the lowest (12.41 µg TPF g^{-1} soil h^{-1}) dehydrogenase activity was recorded with T_1 treatment.

(iii) Phosphatase activity. Regarding phosphatase activity of soil, plants showed great variation among different replant treatments in the year 2019 as elucidated by the data given in Table 4; however, treatments didn't produce any consistent change in response to peach replant treatments during 2018. During the year 2019, notably highest (95.56 µmole p-nitrophenol g^{-1} soil h^{-1}) phosphatase activity was recorded in rhizosphere soil with treatment T_8 (PGPR), which was statistically superior to all other treatments. However, the lowest (87.84 µmole p-nitrophenol g^{-1} soil h^{-1}) phosphatase activity was recorded in T_1 treatment. Pooled data reveal that highest (94.43 µmole p-nitrophenol g^{-1} soil h^{-1}) phosphatase activity was recorded with T_8, which was on par with T_9 (94.10 µmole p-nitrophenol g^{-1} soil h^{-1}), T_7 (93.86 µmole p-nitrophenol soil g^{-1} h^{-1}) and T_{10} (92.99 µmole p-nitrophenol g^{-1} soil h^{-1}) treatments. The lowest (87.57 µmole p-nitrophenol g^{-1} soil h^{-1}) phosphatase activity was recorded with T_1 treatment.

Soil application of seed meals, as soil organic amendments, could represent an alternative to mineral fertilizers and the presence of glucosinolates in the seed meals of Brassicaceae, an alternative to chemical pesticides and a source of organic matter capable of stimulating soil biological activity. Many studies have investigated the effects of classic organic amendments on nutrient availability and on soil enzymatic activities (Fernández *et al*., 2009; Lahkdar *et al*., 2010). Soil enzymes can be considered a key tool for assessing soil quality, involved in the main geochemical processes of plant nutrients. Therefore, their activity in soil can be attractive alone as a measure of soil health (Dick, 1994). Although there are many studies on the effects of soil management and regular amendments on respiration and enzymatic activities of the soil (Trasar-Cepeda *et al*., 2008; Lahkdar *et al*., 2011), in particular to the effects of seed meals (Galvez *et al*., 2012).

Table 4: Effect of different soil management amendments on enzymatic activity in rhizosphere of peach grown in pots.

Treatments	Urease (µg urea g^{-1} soil h^{-1})			Dehydrogenase (µg TPF g^{-1} soil h^{-1})			Phosphatase (µmole p-nitrophenol g^{-1} soil h^{-1})		
	2018	**2019**	**Pooled**	**2018**	**2019**	**Pooled**	**2018**	**2019**	**Pooled**
T_1	11.05	12.93	11.99	11.49	13.34	12.41	87.30	87.84	87.57
T_2	13.13	15.14	14.13	15.96	18.63	17.29	90.60	92.16	91.38
T_3	12.93	15.36	14.15	16.40	17.90	17.15	88.26	90.65	89.46
T_4	11.56	14.00	12.78	14.95	16.33	15.64	87.56	88.54	88.05
T_5	14.44	16.19	15.31	16.23	18.82	17.52	91.65	90.44	91.04
T_6	15.67	17.11	16.39	16.98	19.61	18.29	92.34	92.89	92.62
T_7	17.80	19.65	18.72	18.20	20.30	19.25	92.59	95.13	93.86
T_8	26.14	28.97	27.55	21.37	22.57	21.97	93.30	95.56	94.43
T_9	24.75	27.27	26.01	20.74	22.63	21.69	93.16	95.03	94.10
T_{10}	20.40	23.67	22.03	19.43	21.56	20.49	92.66	93.32	92.99
$CD_{(0.05)}$	**1.50**	**1.46**	**1.02**	**0.99**	**1.51**	**0.89**	**NS**	**0.36**	**2.46**

CONCLUSIONS

The present investigation it concludes that treatment of *Brassica* seed meal was most effective on an individual basis to influence the plant growth traits, total viable microbial count and soil enzymatic activities in peach replant sick soil under pot culture studies.

FUTURE SCOPE

This research has presented the groundwork to combat peach replant problem with different soil amendments *viz*., soil fumigation (formaldehyde, H_2O_2, *Brassica* seed meal), PGPR (*Bacillus licheniformis*), Neem based granular formulation, Cow urine formulation and *Jeevamrut* as environmentally friendly management practices.

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Conflict of Interest. None.

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