EFFECT OF NITROGEN ON NUTRITIONAL STATUS OF PEACH (*Prunus persica* L.) CULTIVAR 'PEREGRINE'

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ABSTRACT

Leaf and soil analyses on young peach trees indicate that application of nitrogen fertilizer as urea at the rate of 150 g/tree resulted in the most optimum leaf nitrogen content and vegetative growth but in the least amount of leaf phosphorus content. It did not have any effect on leaf potassium content. There was no significant effect of different nitrogen treatments on soil parameters such as Nitrogen, Phosphorus, Potassium and pH but the effect of nitrogen was significant on the organic matter content of the soil.

Key words: Nitrogen, phosphorus, potassium, pH, organic matter, leaf and soil analyses

INTRODUCTION

Nepal is the country with varied topography and climate, accommodating a variety of vegetations. The middle mountain region, which occupies 30 percent of the total land, has a warm temperate climate. Peach is one of the suitable fruit crops in the warm temperate region. It is grown mainly as a homestead fruit tree and still rarely cultivated on commercial scale. It is one of the niche crops with comparative advantage for Nepal. Peach fruit has ample amount of fibre and Vitamin C. Based on a study on characterisation of peach dietary fibre (DF) concentrate as a food ingredient, Nuria *et al* (1999) suggested that peach may not only be an excellent DF source but an ingredient in the food industry because it showed a high affinity for water (9.12-12.09 g water/g fibre) and contained low energy (3.723-3.494 kcal/g). Health magazines place peaches in the same category as strawberries and raspberries (Funt, 2001). Given due attention, it would not only contribute to better nutrition of Nepali people but also would help earn foreign currency. As it is still a neglected crop and grown as homestead fruit, it does not routinely receive any manures and fertilizers. Recommended doses of manures and fertilizers are not yet developed for peach in the context of growing condition of Nepal.

This study was conducted in the National Horticulture Research Programme Kirtipur during the Fiscal Year 1991-92 to find out the suitable dose of nitrogen fertilizer in Peach tree. As the trial was conducted on two- year old young trees, the yield was not yet of any economic value. The cultivar under study was Peregrine. The nutrient status in the leaves of the trees and in the soil of 2 depth levels (0-15 cm) and (15-30 cm) after three and half months of full bloom stage was studied. Jones (1984) expressed that soil testing probably had a greater agronomic application than plant analysis for annual row crops, but for perennial horticultural crops such as peach, plant analysis was more significant.

The main objective of this study was to determine the nutritional status of peach based on leaf and soil analyses as a result of nitrogen application in the soil.

MATERIALS AND METHODS

The experiment site at Kirtipur had a high level of available phosphorus and low levels of nitrogen and potash. Integrated use of organic and inorganic fertilizer was followed in order to have sustainable high yield.

The experiment was laid out in a completely randomised design (CRD) in 2 year-old standing orchard of peach with the following four levels of nitrogen (as urea) treatments, while fixed doses of compost, phosphorus, and potash fertilizers were applied. The amounts used were 15 kg compost, 12.5 gm phosphorus as triple super phosphate and 60 gm potassium as muriate of potash. The following four treatments were applied.

Treatments

1. N_0 Without Nitrogen (Control)
2. N_1 50 gm Nitrogen/tree (109 gm Urea)
3. N_2 100 gm Nitrogen/tree (218 gm Urea)
4. N_3 150 gm Nitrogen/tree (327 gm Urea)

The treatments were replicated 3 times, i.e. 4×3 = 12 trees were selected, and nitrogen was applied as per treatment with 3 replications each. Fixed doses of manures and other fertilizers were applied. Manuring was done in the month of Falgun, when the cultivar was at bud stage. Soil as well as leaf samples were collected three and half months after full bloom stage. Mature leaves were collected from mid or near base portion of current season terminal growth. Soil samples were collected at two depths of root zone area i.e. 0-15 cm and 15-30 cm depth. Eighty leaf samples were collected, weighed and unit fresh leaf weight/treatment unit was calculated. Leaf samples were oven dried at 65-70° C, while the soil samples were air-dried. Laboratory analyses were done as shown in Tables 1a and 1b. Samples were analysed at the soil laboratory of Horticulture Development Project, Kirtipur. Soil samples were analysed for pH, organic matter content, total Nitrogen, available P_2O_5 and available K_2O. Leaf samples were analysed for total Nitrogen, Phosphorous and Potash. The values were calculated on moisture free basis.

For statistical analysis, percentage content of N and organic matter in soil and percentage contents of total N, P and K in leaf were converted to Arcsine values. Other data were directly analysed using MSTAT. For making individual treatment comparison, mean values were separated using the least significant differences (LSD).

Table 1a: Methods of lab analysis for Soil Samples

Total Nitrogen	Semi-micro Kjeldahl method
Available P_2O_5	Olson's method using Spectrophotometer
Available K_2O	Flame photometer method, using Ammonium acetate as extract ant solution.
Organic Matter	Walkely and Black's method (Rapid titration method)
pH of soil	1:2.5 ratio of soil & distilled water.

Table 1 b: Methods of lab analysis for Leaf samples

1.	Total Nitrogen	Semi-micro Kjeldahl method
2.	Total Phosphorus	Amino-vanabdo-molybdo yellow colour method using wet digested leaf sample aliquots.
3.	Total Potash	Flame photometer method, using 0.1 N HCl as extractant; wet digested leaf samples were used.

RESULTS AND DISCUSSION

Following application of nitrogen in the soil, leaf analysis of the three major nutrients namely N, P, K and fresh leaf weight showed that N-content of leaf and unit fresh leaf weight were found significantly higher as we increased the dose of nitrogen fertilizer, while phosphorus content went on decreasing. On the other hand, content of potash was not found significantly different in the foliage among the different treatments (Table 2).

Total nitrogen content of leaf was the highest with the application of 150 g N per tree that was significantly different from the rest of the treatments. Conversely, total phosphorus content of leaf was significantly the highest in the absence of N application. The average unit fresh weights of leaf were also significantly the most in the presence of N application though among themselves they were not significantly different from one another. Application of nitrogen did not have any effect on leaf potassium contents.

Table 2: Leaf analysis of nitrogen, phosphorus and potassium and unit fresh weight of peach leaf at Kirtipur.

Treatment	% of N	% of P	% of K	Average unit fresh leaf weight (g)
N_0	2.31^{c}	0.34^{a}	1.93	0.49^{b}
N_1	2.48^{bc}	0.25^{b}	2.09	0.63^{a}
N_2	2.77^{b}	0.23^{b}	2.01	0.70^{a}
N_3	3.31^{a}	0.21^{b}	1.99	0.75^{a}
LSD0.05	0.45	0.05	NS	0.13

When the soil parameters such as N, P, K, pH and organic matters were analysed at two different depths of the peach tree basins following the application of nitrogen fertilizer (Tables 3 and 4), no significant effects were noticed on the first four parameters at either depth. There were however significant differences on organic matter contents in both depths due to different nitrogen treatments. Fifty gram of nitrogen application resulted in significantly lowest amount of OM in the shallow soil and significantly highest amount of OM in the deeper soil.

Table 3: Soil parameters at 0-15 cm depth on the basins of peach trees following nitrogen application at Kirtipur.

Treatment	% N	% P_2O_5	% K_2O	pH	% OM
N_0	0.20	0.75	0.35	6.14	3.23ab
N_1	0.18	0.81	0.23	5.88	2.92b
N_2	0.22	0.81	0.41	5.85	3.76a
N_3	0.21	0.92	0.35	6.00	3.64a
LSD0.05	NS	NS	NS	NS	0.69

Table 4: Soil parameters at 15-30 cm depth on the basins of peach trees following nitrogen application at Kirtipur

Treatment	% N	% P_2O_5	% K_2O	pH	% OM
N_0	0.13	0.78	0.33	5.76	2.12b
N_1	0.19	0.95	0.32	5.84	3.05a
N_2	0.16	0.71	0.25	5.77	2.58ab
N_3	0.14	0.57	0.19	5.76	2.32ab
LSD0.05	NS	NS	NS	NS	0.84

In this specific experiment, the yield was of no economic value yet. But the nutrient content of leaf was related to the yield of fruit. As per a study conducted in 39 peach orchards in Bulgeria by Stoilov and Stefanova (1973), average nutrient content of 2.61 % N, 0.543 % P, and 2.15 % K produced the best growth of tree, yield and fruit quality. In this experiment N_2 treatment i.e. 100 gm of N/tree resulted in 2.77% of nitrogen in leaves, which was nearly the best orchard as stated by them. Contrary to the above experiment, as per numerous trials with 5 levels of nitrogen conducted by Filippov *et al* in Sochi area (1974), a 3.0 – 3.4 % nitrogen content in the leaves of lower parts of the crown in mid summer indicated the optimal nitrogen fertilization rate for peach trees. The fourth treatment producing 3.31 % N in leaf matched with our experiment. Phosphorous level in the leaf was comparatively very low. The application of phosphorous was also low considering the high level of available phosphorous in the experimental site. The fruit trees did not seem to take up phosphorous sufficiently. Baxter (1974) found high nitrogen application increased growth only when combined with phosphorous fertilizers. Chaudhary (1990) also noted that high content of nitrogen in the leaves increased growth and yield of crops.

Themis Michailides (1994) found that use of urban waste compost reduced the incidence by three times of brown rot disease in peach compared to the trees that did not receive the treatment in San Joaquin Valley.

Based on the effect of timing of N application as 15N-enriched ammonium sulfate on the growth response and N uptake by vegetative and reproductive tissues in the low-chill peach cultivar Flordagem growing on a krasnozem soil at Alstonville, Australia, Huett and Stewart (1999) found that uptake of fertilizer N was most rapid when application preceded a period of rapid growth. In Nepal, manures and fertilizers application was usually done during the winter period just before spring time.

Jones *et al* (1971) and Jones (1984) recommended that the midseason leaves near the base of current year's growth or from spurs should be collected in order to have the best correlation between plant appearance or performance with elemental content; and the ease of identification and collection. Based on a study on diagnostic leaf nutrient standards for low-chill peaches in subtropical Australia, Huett *et.al* (1997) also found that the 2-week post-harvest period was the most convenient time to sample for leaf analysis.

In our study, application of N fertilizer at the rate of 150 g/tree three and half months after full bloom not only resulted in the most optimum level of leaf nitrogen but also in the overall vegetative growth as indicated by the unit fresh leaf weight of the peach tree. This treatment should be accompanied by simultaneous application of phosphorus. It also seemed to have a favourable effect on organic matter contents of the soil though it is difficult to link it to the application of nitrogen fertilizer.

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