

Effect of Adoption Level of Package of Practices on Nutrient Status of Kinnow Orchard Soil and Plant

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ABSTRACT : The present study was undertaken with an objective “effect on nutrient status of soil and plant leaf with their adoption level of package of practices” in the blocks of Hisar, Sirsa and Fatehabad districts of Haryana during the year 2010-11. The average values of nutrient N, P, K and Zn irrespective of adoption level were 202.63, 50.48, 537.66 and 12.48 kg/ha up to 90 cm in soil depth. Whereas the average values of nutrients N, P, K and Zn irrespective of adoption level were 2.40%, 0.17%, 1.30% and 17.63 ppm. The N, P, K and Zn were obtained more in orchard plants where the levels of adoption were higher. The nutrient status in soil had positive but non-significant effect with adoption of package of practices, whereas in plant, the nutrient status was significant with adoption level of POP.

Key words : Package of practices, nitrogen, phosphorus, potash, zinc, kinnow

Kinnow mandarin is the most important fruit crop of India and it is commercially grown in north Indian states like Punjab, Haryana and Rajasthan (Ganganagar district). It requires more amount of essential nutrient for successful cultivation so citrus is also known as “micro nutrient loving” plant among all fruit crops (2). In most of the citrus species, a close relationship exists between leaf nutrient content and fruit production. Good yield in mandarin is obtained when leaf N, P, K, Ca, Mg and Zn contents range between 2.5-2.8, 0.19-0.20, 1.5-1.7, 2.5-3.0, 0.30-0.35% and 20-50 ppm, respectively (9). Under poor drainage, the soil becomes water-logged around the roots during heavy rain in the monsoon season even though the water-table may not be high. The failure of kinnow and sweet orange in several places in Punjab, Haryana and U. P. seems to be due to this factor because it causes loss of nutrient from soil due to leaching in the soil profile. Plant also can't be able to absorb essential nutrient from soil in this condition, therefore reduces the growth and development of plant and ultimately causes some disorders e. g. fruit cracking, granulation, pre-harvest fruit drops, under size fruit, little leaf and die back, etc. So, we need proper and full adoption of recommended package of practices for high yield and better fruit quality of kinnow.

MATERIALS AND METHODS

The study was carried out at Department of Horticulture, CCS Haryana Agricultural University during the year 2010-11. Thus, a total number of 20 farmers were selected for nutrient analysis of N, P, K and Zn in soil and plant leaf based on their adoption level of package of practices from selected farmers of

Hisar, Sirsa and Fatehabad districts of Haryana. The soil samples were collected from the farmers' field of the area between three-fourth of the radius of the tree canopy to the drip line of the tree canopy. The samples were collected with the help of soil auger from various soil depths (0-30, 30-60, 60-90 and more than 90 cm depths) in the months of June-July, 2010. The soil samples were collected from four sides of the trees and composite soil samples for each tree were prepared respective to the depth of soil profile from which the samples were taken. The samples were air-dried and ground with wooden pestle and mortar to pass through a 2 mm stainless steel sieve. The available nitrogen, phosphorus and potassium in soil samples were determined by the method of Subbiah and Asija (10), Olsen *et al.* (6) and flame photometer, respectively. The DTPA (Diethylene triamine pentaacetic acid) extract of soil was prepared (5) and the concentration (ppm) of Zn micronutrient was determined with the help of atomic absorption spectrophotometer (ASP). For determining leaf nutrient status, five to six months old healthy leaf samples from non-fruiting terminals were collected in the months of June-July and washed with running tap water followed by 0.1% HCl and two washings through distilled water. The washed leaf samples were surface-dried and then oven-dried at 700 C for 48 h. The dried leaf samples were ground and sieved. The ground leaf sample (0.5 g) was taken in 50 ml conical flask and 10 ml diacid mixture (H_2SO_4 : $HClO_4$ in 9 : 1 ratio) was added to flask. Digestion on a hot plate was carried out as described by Jackson (3) for determination of N, P and K. For digestion of Zn, 0.5 g of ground plant sample was taken in separate conical flask and this was digested on a hot plate by adding 15 ml of diacid mixture (HNO_3 : $HClO_4$ in 4 : 1 ratio) as per the procedure described by Piper (7).

The nutrient contents in the leaf samples were determined by following methods.

The nitrogen content was determined by the method described by Jackson (4). The phosphorus content was determined by vando-molybdophosphoric acid yellow colour method described by Jackson (4). Potassium content was determined from the digested extract on flame photometer. The content was calculated and expressed in per cent on dry weight basis. The digested leaf samples were analyzed for determining zinc concentrations on atomic absorption spectrophotometer and their contents were expressed in ppm.

The statistical analyses of data were carried out by two sampled t-tests. The correlation and regression analyses were also done to find out the relationship between fruit quality, yield and soil-plant nutrients (1).

RESULTS AND DISCUSSION

The data in Table 1 show that nitrogen, phosphorus, potassium and zinc level decreased with the soil depth. The average values of the nitrogen, phosphorus, potassium and zinc were found highest i. e. 139.42, 25.67, 263.88 and 6.16 kg/ha at 0-30 cm depth of the soil for the selected farmers, while the values for 30-60 cm soil profile were found to be 34.33, 13.64, 161.90 and 2.49 kg/ha for N, P, K and Zn. Soil profile of 60-90 cm showed the values of 18.42, 6.83, 77.68

and 1.69 kg/ha for N, P, K and Zn. The values of N, P, K and Zn for soil depth more than 90 cm were found to be 10.53, 4.10, 34.18 and 1.72 kg/ha.

The average values of nutrient N, P, K and Zn irrespective of adoption level were 202.63, 50.48, 537.66 and 12.48 kg/ha. The N, P, K and Zn were obtained more in orchard soil where the level of adoption was higher. The N levels were 218.12, 208.57 and 181.39 kg/ha for high, medium and low adopter, respectively. Similar trend was observed in case of P, K and Zn also (Table 2). The adoption level of package of practices had non-significant effect on the soil nutrient status of kinnow orchards.

The correlation coefficient ('t' value) was computed to know the associations between amount of nitrogen, phosphorus, potassium and zinc in the soil and the adoption levels package of practices of kinnow production technology (Table 3). All variables, namely, nitrogen, phosphorus, potassium and zinc were found to have a positive but non-significant relationship with adoption of package of practices. The correlation coefficient (r) was maximum for the K (0.13) followed by P (0.08), N (0.05) and Zn (0.01). The farmers having high adoption levels also had high concentration of nutrients in their soil. The nutrient status of nitrogen, phosphorus, potassium and zinc was found to have a positive but non-significant relationship with adoption of package of practices. It implies that as the adoption

Table 1. Nutrient status of the soil of kinnow orchards

S. No.	Adoption category of farmers				
	Soil depths (cm)	Low	Medium	High	Average
1. Nitrogen (kg/ha)					
	0-30	129.50	142.50	146.25	139.42
	30-60	28.58	35.86	38.56	34.33
	60-90	14.75	20.08	20.42	18.42
	>90	8.56	10.13	12.89	10.53
2. Phosphorus (kg/ha)					
	0-30	22.45	27.04	27.52	25.67
	30-60	12.03	15.04	13.86	13.64
	60-90	6.51	6.95	7.02	6.83
	>90	3.59	4.84	3.88	4.10
3. Potassium (kg/ha)					
	0-30	220.00	261.64	310.00	263.88
	30-60	130.00	167.21	188.50	161.90
	60-90	57.00	82.79	93.25	77.68
	>90	21.50	37.80	43.25	34.18
4. Zinc (kg/ha)					
	0-30	6.00	6.21	6.26	6.16
	30-60	2.43	2.52	2.53	2.49
	60-90	1.88	1.99	2.00	1.96
	>90	1.59	1.88	1.70	1.72

Table 2. Overall effect of adoption level of package of practices on nutrient status of soil

Category of farmers	N	P	K	Zn
Low	181.39	44.58	428.57	11.86
Medium	208.57	52.59	549.43	12.10
High	218.12	54.28	635.00	13.50
Average	202.63	50.48	537.66	12.48

Table 3. Association of nutrient status of soil with adoption level of kinnow cultivation

S. No.	Soil nutrient	Correlation coefficient (r)
1.	N	0.05
2.	P	0.08
3.	K	0.13
4.	Zn	0.01

Table 4. Regression analysis of nutrient status in soil with adoption of package of practices

S. No.	Soil nutrient	'a' value	Regression coefficient (b value)	't' value	R ²
1.	N	36.50	0.21	0.49 NS	0.01
2.	P	9.08	0.05	0.73 NS	0.00
3.	K	86.85	0.96	1.19 NS	0.02
4.	Zn	3.05	0.01	0.04 NS	0.00

NS—Not Significant.

Respective 't' values 0.49, 0.73, 1.19 and 0.04 for N, P, K and Zn were found non-significant in soil nutrient status with the adoption level.

The data in Table 5 exhibit that the nitrogen, phosphorus and potassium were highest with values of 2.87, 0.25 and 1.86% in orchard of Vivekanand (77.50%) who had high adoption level. The Zn values were maximum (23.10 ppm) in the kinnow orchard of Manohar Lal who had higher adoption level (80.00%). The nitrogen, phosphorus and potassium were lowest with values of 1.72, 0.13 and 0.99% in the high adoption level of Manphool (45.00%). The Zn values were minimum (12.41 ppm) in the kinnow orchard of Manphool who had lower adoption level (45.00%). The overall average values of nitrogen, phosphorus, potassium and zinc were observed to be 2.33, 0.16, 1.26%, and 17.05 ppm, respectively.

The average values of nutrient N, P, K and Zn irrespective of adoption level were 2.40, 0.17, 1.30% and 17.63 ppm. The N, P, K and Zn were obtained more in orchard plants where the levels of adoption were higher. The N levels were 2.62, 2.35 and 2.24% for high, medium and low adopter, respectively (Table

level of farmers increase, there is increase in nitrogen, phosphorus, potassium and zinc level in soil. Since soil is very huge mass, it would take decades to have any significant relationship with the adoption level. Sindhu (8) observed similar results that soil had lot of variation in nutrient levels in grape vineyards. Correlation coefficient among nitrogen, phosphorus, potassium and zinc was found to be non-significant relationship with adoption. Because soil is very huge mass so it would take decades for any significant relationship with the adoption level.

The regression coefficients ('b' value) of all the non-significant independent variables were worked out with adoption of package of practices of the farmers. Their values have been presented in Table 4. The data revealed that the regression coefficients of the nitrogen, phosphorus, potassium and zinc status in soil were 0.21, 0.05, 0.96 and 0.00, respectively.

6). Similar trend was observed in case of P, K and Zn also. The level of N, P, K and Zn in plant had a positive relationship with adoption level of package of practices. It was observed that the farmers having higher adoption level of fertilizer application applied recommended doses of fertilizer resulting in better uptake by the plants. It was also observed that plant nutrients status in kinnow orchards of few farmers practicing low adoption level of package of practices was high. It may be due to the good fertility status of these orchards which was affected with high nutrient status in plant. Similar findings have been reported by Sindhu (8) in grape vine with the respect of adoption level of package of practices for the N, P and K.

The correlation coefficient ('t' value) was computed to know the associations between amount of nitrogen, phosphorus, potassium and zinc in the plants and the adoption levels of package of practices of kinnow production technology (Table 7). All variables, namely, nitrogen, phosphorus, potassium and zinc were found to have a positive and significant relationship with adoption of package of practices. It implies that level of nitrogen, phosphorus, potassium and zinc increase

Table 5. Nutrient status of leaf analysis of kinnow orchards

Name of the farmers	Adoption level (%)	N (%)	P (%)	K (%)	Zn (ppm)
Karam Chand	72.50	2.72	0.21	1.28	20.13
Balram	54.76	2.80	0.14	1.63	15.30
Om Prakash	52.50	2.00	0.15	1.17	15.49
Atma Ram	50.00	2.50	0.18	1.23	17.02
Subash	75.00	2.31	0.16	1.19	16.96
Kuldeep	52.50	2.41	0.18	1.21	17.45
Manphool	45.00	1.72	0.13	0.99	12.41
Amardeep	47.50	1.94	0.15	1.08	13.76
Jagdeesh	54.76	2.19	0.14	1.18	14.57
Leela Dhar	45.00	1.88	0.16	1.04	19.58
Harpal	32.50	2.31	0.16	1.21	17.72
Vineet Kumar	27.50	2.39	0.14	1.20	15.51
Vivekanand	77.50	2.87	0.25	1.86	21.10
Manohar Lal	80.00	2.56	0.19	1.48	23.10
Gaurav	50.00	2.12	0.14	1.14	13.23
Hetram	42.50	2.16	0.14	1.16	15.46
Ram Kumar	47.50	2.06	0.14	1.09	13.16
Vikas	52.50	2.31	0.14	1.20	14.98
Atmram	60.00	2.60	0.18	1.31	17.40
Sriram	57.50	2.73	0.20	1.48	21.40
Average	53.80	2.33	0.16	1.26	17.05

with the increased in adoption level of package of practices. The correlation coefficient (r) was highest for the P (0.5614) followed by N (0.51), Zn (0.05) and K (0.49).

Table 6. Overall effect of adoption level of package of practices on nutrient status of leaf analysis

Category of farmers	N (%)	P (%)	K (%)	Zn (ppm)
Low	2.24	0.15	1.21	16.19
Medium	2.35	0.16	1.24	16.62
High	2.62	0.20	1.44	20.07
Average	2.40	0.17	1.30	17.63

Table 7. Association of nutrient status of leaf with adoption levels of package of practices

S. No.	Leaf nutrient	Correlation coefficient (r)
1.	N	0.51*
2.	P	0.56*
3.	K	0.49*
4.	Zn	0.50*

*Significant at P=0.05 level.

The regression coefficient ('b' value) of all the significant independent variables was worked out with adoption of package of practices of the farmers. Their values have been presented in Table 8. The data revealed that the regression coefficient of the nitrogen, phosphorus, potassium and zinc status in plants was 0.01, 0.001, 0.007 and 0.105, respectively. The 't' values viz., 2.54, 2.87, 2.40 and 2.47 for N, P, K and Zn, respectively, were found significant in leaf nutrient status with the adoption level. The plant nutrient status showed significant relationship with the adoption level of package of practices. It implies that as the adoption level of package of practices was increased, an increase in the nutrient status in plant was also observed (11).

Table 8. Regression analysis of nutrients status of leaf with adoption of package of practices of kinnow

S. No.	Leaf nutrient	'a' value	Regression coefficient (b value)	't' value	R ²
1.	N	1.67	0.011	2.54*	0.26
2.	P	0.09	0.001	2.87**	0.31
3.	K	0.86	0.007	2.40*	0.24
4.	Zn	11.14	0.105	2.47*	0.25

*, **Significant at P=0.05 and P=0.01 levels, respectively.

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