



Response of Perlka (Calcium cyanamide) on Plant Growth and Production of Kinnow Mandarin (*C. nobilis* X *C. deliciosa*) in Sub Montane Low Hill Zone of Himachal Pradesh

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ABSTRACT

Perlka, a multifunctional fertilizer was tested in kinnow mandarin as a soil application at four different doses, 500 g, 1000 g, 1500 g and 2000 g per tree and its effect on plant growth and production was compared against the soil application of CAN (800 g and 1600 g/tree). Perlka and CAN were applied during the month of February & May in two equal splits. Effect of Perlka application on annual shoot extension, fruit production and fruit quality was recorded. Annual shoot extension in kinnow mandarin was observed significantly more with the Perlka treatment 1000 g per tree when compared to other Perlka treatment (500 g, 1500 g and 2000 g) and as well as the CAN application. Significant improvement in response to soil application of Perlka (1000 g) when compared to other Perlka treatments including the application of CAN was observed for fruit size, fruit weight and fruit volume. Bio-chemical analysis of fruits showed variable results for total soluble content of kinnow fruits in response to different treatment. Maximum TSS (10.3° B) was observed with the treatment of 800 g CAN and 2000 g Perlka individually. Maximum fruit yield (32.18 Kg) per tree was obtained with 1000 g Perlka application followed by 1600 g CAN. Perlka application at 1000 g per tree resulted in significant improvement in annual shoot growth and tree health particularly by exhibiting resistance against collar rot and root rot fungi caused by *Phytophthora citrophora*, *Phytophthora nicotianae* in all of the trees receiving perlka in comparison to CAN treatments, fruit yield and other fruit quality parameters of the fruits in kinnow mandarin. The highest BC ratio of 3.5 was obtained in trees of kinnow mandarin treated with 1000g of perlka per tree.

Key Words:

B C ratio, Collar rot, Growth and development, Perlka, Root rot, Yield

INTRODUCTION

Kinnow (*C. nobilis* X *C. deliciosa*) is an important member among citrus fruits. It is the heaviest bearer than

any other citrus fruit. It has an excellent taste, dietary values, rich in vitamin-C, large amount of juice and melting juice vesicles. Citrus occupies the second position in the

state with regard to its area and production. Kinnow mandarin shares the major part of the area and production under mandarins. Area under mandarins in the state is 8724 hectares with a production of 10960 Metric Tonnes (MT) (Anonymous 2015). Punjab is the leading state in area (38837 ha) and production (876358 MT) and has the highest productivity (22.6 MT ha⁻¹). Unfortunately, the production from kinnow orchards in the state is very low than standard due to fruit dropping, alternate bearing, insufficient plant protection measures and non judicious use of fertilizers. Different fertilizers for supplying Nitrogen like, CAN, Diammonium Phosphate and NPK (12:32:16) and are being used by the growers at any time of the year without knowing its impact on yield and fruit quality which has led to imbalance of NPK nutrients and consequently lowered the productivity of kinnow trees. Perlka, a multifunctional fertilizer not only supplies nitrogen and lime but also offers a range of other unique special effects like improving soil hygiene ensuring sustainable production. It is the first mineral fertilizer which enables atmospheric nitrogen to be used for plant nutrition. The nutrient element Nitrogen in the so called NCN binding form ensuring supply of nitrogen over a longer time period as and when required by the plant. It enhances biological activity of the soil. The second nutrient is Calcium which is mostly water soluble and so is easily available to plants whereas other nitrogenous fertilizer makes the soil more acidic, calcium cyanamide improves the lime balance of soil. Perlka formulations are in use in different parts of india like Maharashtra, AP, MP, West Bengal and HP in different horticultural crops including grapes, apple, citrus etc. The formulation is imported from Germany and its distributed in India By PNP Associates Pvt Limited. Therefore, the studies were undertaken at Regional Horticultural Research Station, Jachh to assess the Response of Perlka (Calcium Cyanamide) on plant growth and production of Kinnow mandarin (*C. nobilis* X *C. deliciosa*) in submontane low hill zone of Himachal Pradesh in order to correct management of N nutrient.

MATERIALS AND METHODS

The studies were carried out at Regional Horticultural Research Station, Jachh during 2011-2014 years. There were 6 treatments and four replications thus twenty four plants growing under similar agro climatic

conditions and of uniform size and age (8 years) of kinnow were selected for the studies. Various treatments of Perlka and CAN ie T₁ = 800 g CAN/tree, T₂ = 1600 g CAN/tree, T₃ = 500 g Perlka/tree, T₄ = 1000 g Perlka/tree, T₅ = 1500 g Perlka/tree, T₆ = 2000g Perlka/tree for supplying Nitrogen were applied during the month of February & May in two equal splits. The recommended doses of farm yard manure ie 45 kg per tree and other inorganic fertilizers SSP and MOP @ 2500 g and 800g/tree, respectively were applied as single application. In addition, all the other recommended cultural practices were applied to all the experimental trees. The experiment was laid out according to the randomized block design. Data on the growth, reaction of experimental trees to soil born fungi causing collar and root rot, physical and biochemical attributes and yield was recorded were recorded in a manner described below.

Annual growth of tagged shoots was measured and average was calculated and expressed in centimeters. The size of fruit in term of length and breadth of ten randomly selected fruits was measured with the help of vernier caliper and average fruit size was calculated. Average weight (g) of randomly selected ten fruits from each lot was measured with weighing balance and then their average weight was calculated in grams. Average fruit volume (cc) of randomly selected ten fruits from each lot was determined by displacement method. Total soluble solids (TSS) were measured with the help hand Refractometer and were expressed as degree bricks (°B). All the fruits from experimental trees were harvested and weighed fruit yield was calculated. The data collected for different treatment was analyzed by following Panse and Sukhatme (1961).

Soil analysis

The soil analysis of the experimental site was done prior to start of experiment. Soil samples were collected from the experimental field from a depth of 0-20 cm. The soil of the experimental field is sandy loam to clay in texture. Results of soil analysis of experimental site are presented in Table 1. It revealed that average soil pH was 6.56 and was near neutral. The electrical conductivity was observed to be 0.07 dSm⁻¹/sec. Organic carbon content 0.46 percent was recorded which is on lower side.

Table 1. Soil physiochemical properties of the experimental site of kinnow mandarin

Sites	pH	EC (d Sm ⁻¹)	Organic Carbon (%)	N (kg ha ⁻¹)	P (kg ha ⁻¹)	K (kg ha ⁻¹)
Mean	6.56	0.07	0.46	215.8	16.7	75.6
Range	6.4-6.7	0.06-0.08	0.43-0.48	206.9- 228.2	15.4-17.9	71.5-79.5

RESULTS AND DISCUSSIONS

Growth parameters

Effect of Perlka application on annual shoot extension, fruit production and fruit quality was recorded and was analyzed statistically and the following inferences were derived. The results are presented in Table 2. Annual shoot extension in kinnow mandarin was observed significantly more with the Perlka treatment of 1000 g/tree when compared to other Perlka treatments (500 g, 1500 g and 2000 g) and as well as in the CAN application. Maximum annual shoot growth was of 16.6 cm was obtained in treatment of 1000g perlka while the minimum (12.0 cm) in treatment of 800g CAN. Increase in vegetative growth in term of annual shoot growth is obvious as nitrogen application has resulted in better growth and development of kinnow plants. Similar observations for increased vegetative growth have been reported earlier by Shukla et al (2000), Dudi et al (2003) and Garhwal et. al (2014). Perlka application at 1000 g per tree resulted in significant improvement in tree health particularly

by exhibiting resistance against collar rot and root rot fungi caused by *Phthophora citrophora*, *Phthophora nicotiane* in all of the trees receiving perlka in comparison to CAN treatments.

Physical and biochemical parameters

The results on various physical parameters of kinnow mandarin like fruit size, fruit weight and fruit volume are presented in Table 2. Soil application of Perlka (1000 g) resulted into significant improvement when compared to other Perlka treatments including the application of CAN. Maximum fruit size in term of length and breadth (5.76 cm X 6.26 cm), individual fruit weight (93.0 g) and volume (90.4 cc) was recorded in trees supplied with Perlka @ 1000g/tree in comparison to other treatments. Bio-chemical analysis of fruit showed variable results for total soluble content of kinnow fruits in response to different treatment. Maximum TSS (10.3° B) was observed with the treatment of 800 g CAN and 2000 g Perlka individually. Monga et al (2004) have reported varying and significant impact on fruity quality of kinnow mandarin.

Table 2. Effect of Perlka on shoot growth, fruit quality and yield of kinnow mandarin

S. N	Treat ment	Annual shoot growth (cm)	Fruit size (cm)		Fruit weight (g)	Fruit volume (cc)	TSS (°B)	Reaction to collar rot and root rot fungi	Fruit yield (kg/tree)	BC ratio
			L	B						
1	T1	12.0	4.68	5.16	73.6	71.6	10.3	Susceptible	17.24	1.5
2	T2	14.4	4.96	5.54	79.4	77.1	8.4	Susceptible	23.70	1.9
3	T3	12.7	4.52	4.92	77.7	76.0	9.6	slightly resistant	20.28	2.8
4	T4	16.6	5.76	6.26	93.0	90.4	9.8	resistant	32.18	3.5
5	T5	13.6	4.62	4.88	78.5	75.9	9.6	resistant	22.98	3.0
6	T6	12.8	4.56	5.52	76.9	74.3	10.3	resistant	23.62	2.9
	CD _{0.05}	1.9	0.4	0.5	7.6	7.3	0.8		2.6	0.8

Fruit yield (kg/tree)

Significant differences were observed in fruit yield (Table 2) in different treatments. Maximum fruit yield (32.18 Kg) per tree was obtained with 1000 g Perlka application followed by 1600 g CAN. Monga et al. (2004) and Nasreen et al (2013) also reported that application of NPK fertilizer increased fruit yield of Kinnow mandarin significantly. Perlka application at 1000 g per tree resulted in significant improvement in annual shoot growth and tree health particularly exhibited resistance to all of the plants receiving perlka in comparison to treatments receiving CAN treatments, fruit yield and other fruit quality parameters of the fruits in kinnow mandarin. The highest BC ratio of was obtained in trees of kinnow mandarin treated with 1000g of perlka per tree.

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