Economic Affairs, Vol. 63, No. 3, pp. 617-620, September 2018
DOI: 10.30954/0424-2513.3.2018.4

Cost and Return Analysis of Kinnow Mandarin (*Citrus reticulata* Blanco) with the Foliar Application of Potassium and Plant Growth Regulators

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ABSTRACT

Kinnow mandarin (*Citrus reticulata* Blanco) belongs to family Rutaceae. In India, Kinnow is being grown in Punjab, Rajasthan, Haryana, Himachal Pradesh, Jammu & Kashmir and Uttar Pradesh. To evaluate the most profitable treatment, economic analysis of treatments was worked out in terms of net return and Cost benefit ratio (C: B) ratio. The cost incurred on basin preparation per tree (₹ 40), Cost of FYM per tree (₹ 60), Cost of Urea per tree (₹ 3), Cost of DAP per tree (₹ 12.60), Cost of MOP per tree (₹ 30) and miscellaneous charges (Irrigation, plant protection measures, harvesting of fruits etc.) per tree (₹ 150) was found to be same in all the treatments. The cost incurred on the preparation of different solutions of potassium nitrate (KNO_3) in various treatments was found to be ₹ 18.60 for 3.0 % KNO_3 per tree followed by ₹ 12.40 for 2.0 % KNO_3 and ₹ 6.20 for 1.0 % KNO_3 and in preparation of different solutions of potassium sulphate (K_2SO_4) it was found to be ₹ 9.90 for 1.5 % K_2SO_4 per tree followed by ₹ 6.60 for 1.0 % K_2SO_4 and ₹ 3.30 for 0.5 % K_2SO_4. In case of preparation of ethrel in different treatments was found to be ₹ 6.75 for 450 ppm ethrel followed by ₹ 4.50 for 300 ppm ethrel and ₹ 2.25 for 150 ppm ethrel and the cost incurred for preparation of 75 ppm GA_3 was found to be ₹ 22.60. It was found that 75 ppm GA_3 treatment was best and showed highest net returns per tree ₹ 916.35. Thus, Kinnow mandarin trees treated with GA_3 75 ppm was found to be best treatment combination as evidenced by cost: benefit ratio of 1: 3.88.

Keywords: Kinnow mandarin, chemicals, PGR's, and net returns

Citrus is the leading tree fruit crop of the world. The genus citrus includes more than 162 species belonging to family Rutaceae. Mandarin (*Citrus reticulata* Blanco.), Sweet orange (*C. sinensis* (L) Osbeck), Grapefruit (*C. paradisi* Macf.), Pummelo (*C. grandis* Osbeck), Acid Lime (*C. aurantifolia* Christm) and Lemon (*C. limon* (L) Burn F.) etc. are commercially grown in the world. Citrus is mainly grown in United States, Brazil, Mexico, India and Argentina. In India, it ranks third in production after banana and mango. Among citrus crops, mandarin orange (Kinnow mandarin, Nagpur, Khasi, Darjling) covers largest area followed by sweet orange (Musambi, Pineapple, Blood Red and Jaffa) and Acid lime. Among these, Kinnow mandarin bears highest place in production, productivity, juice content and fruit quality. An interspecific mandarin hybrid Kinnow (*Citrus nobilis* Loureiro x *Citrus deliciosa* Tenore), evolved by H.B. Frost in 1915, has gained popularity among growers. The area under Kinnow is increasing at a faster rate due to wide range of adaptability, precocious bearing, high yield, excellent fruit quality and very high economic returns to the growers. Kinnow mandarin is commercially cultivated due to its good yield, high processing quality, fresh consumption, aromatic flavour and better adaptation to agro-environmental conditions (Sharma *et al*. 2012). It has assumed a special economic importance and export demand due to its high juice content, special flavour, and rich source of vitamin C, the factors which contributed to the success of this fruit are its beautiful golden-

orange colour, its abundant juice, excellent aroma and taste (Gurjar and Rana, 2014).

MATERIALS METHODS

The present investigation was carried out on 12 years old Kinnow mandarin trees spaced at 6 m × 6 m distance at Rainfed research station, Raya, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu during 2017-18. The experiment was laid out in randomized block design with three replications, comprising of 11 treatments including control.

Experimental details

T_1: GA_3 75 ppm	T_2: Ethrel 150 ppm	T_3: Ethrel 300 ppm
T_4: Ethrel 450 ppm	T_5: KNO_3 1.0%	T_6: KNO_3 2.0%
T_7: KNO_3 3.0%	T_8: K_2SO_4 0.5%	T_9: K_2SO_4 1.0%
T_{10}: K_2SO_4 1.5%	T_{11}: Control	

Preparation of potassium and plant growth formulations

Stock solutions of (1.0%, 2.0% and 3.0 % KNO_3) potassium nitrate and (0.5%, 1.0%, 1.5% K_2SO_4) potassium sulphate each prepared separately by dissolving 10 g, 20 g, and 30 g KNO_3 and 5 g, 10 g and 15 g K_2SO_4 each in 1000 ml water. Plant growth regulators (75 ppm GA_3 and 150, 300, 450 ppm ethrel) were prepared separately by dissolving 75 mg GA_3 with three to four drops of ethanol and then with distilled water. The Ethrel concentrations 150 mg, 300 mg and 450 mg each were dissolved in 1000 ml water for respective stock solution.

Observations Recorded

Economic Analysis

In order to evaluate the most profitable treatment, economic analysis of treatments was worked out in terms of net returns and cost benefit cost (C:B) ratio. The net returns and C:B ratio was calculated as follows:

Net returns were calculated by deducting the cost of cultivation from the gross income.

$$\text{C:B ratio} = \frac{\text{Gross return}}{\text{Cost of cultivation}} \times 100$$

RESULTS

The actual costs were worked out for all the treatments which includes basin preapation, cost of FYM, Urea, DAP, MOP, Cost of plant growth regulators and chemicals and miscellaneous charges (irrigation, plant protection measures, and harvesting of fruits etc.). Gross returns with the foliar application of potassium and plant growth regulators in all treatments were obtained by sale value of Kinnow mandarin. Cost and return analysis of Kinnow mandarin with the different treatments of potassium nitrate (KNO_3), potassium sulphate (K_2SO_4), ethrel (150, 300, 450 ppm) and GA_3 75 ppm is presented in Table 1. It is obvious from the data the cost incurred on basin preparation per tree (₹ 40), Cost of FYM per tree (₹ 60), Cost of Urea per tree (₹ 3), Cost of DAP per tree (₹ 12.60), Cost of MOP per tree (₹ 30) and Miscellaneous charges (Irrigation, plant protection measures, harvesting of fruits etc.) per tree (₹ 150) was found to be same in all the treatments. The cost incurred on the preparation of different solutions of potassium nitrate (KNO_3) in various treatments was found to be ₹ 18.60 for 3.0 % KNO_3 per tree followed by ₹ 12.40 for 2.0 % KNO_3 and ₹ 6.20 for 1 % KNO_3 and in preparation of different solutions of potassium sulphate (K_2SO_4) it was found to be ₹ 9.90 for 1.5 % K_2SO_4 per tree followed by ₹ 6.60 for 1.0 % K_2SO_4 and ₹ 3.30 for 0.5 % K_2SO_4. In case of ethrel solution preparation in different treatments it was found to be ₹ 6.75 for 450 ppm ethrel followed by ₹ 4.50 for 300 ppm ethrel and ₹ 2.25 for 150 ppm ethrel and the cost incurred for preparation of 75 ppm GA_3 was found to be ₹ 22.60, respectively. The table further revealed that total cost of cultivation per tree and per hectare was observed to be highest (₹ 318.20 and ₹ 88459.60) with treatment 75 ppm GA_3 (T_1) whereas it was found to be lowest in control (T_{11}) (₹ 295.60 and ₹ 82176.80).

Cost and return analysis of Kinnow mandarin produced in different treatments of potassium and plant growth regulators is presented in Table 2. The table revealed that the cost incurred preparation of basins, FYM, Urea, MOP, DAP, irrigation, plant protection measures, harvesting of fruits etc. per tree was found to be same. The net returns were higher (₹ 916.35 per tree and ₹ 254746.60 per hectare) in treatment (T_1) 75 ppm GA_3 whereas it was found to be lowest (₹ 179.25 per tree and ₹ 49830.53) in

Table 1: Average cost of cultivation of Kinnow mandarin with the foliar application of potassium and plant growth regulators

Treatment	Cost of basin preparation per tree (₹)	Cost of FYM per tree (₹)	Cost of Urea per tree (₹)	Cost of DAP per tree (₹)	Cost of MOP per tree (₹)	Cost of PGR's and chemicals per tree (₹)	Miscellaneous (₹) (irrigation, plant protection measures, harvesting of fruits etc.)	Total cost per tree (₹)	Total cost per ha (₹)
T_1 : GA_3 75 ppm	40	60	3	12.60	30	22.60	150	318.20	88459.60
T_2 : Ethrel 150 ppm	40	60	3	12.60	30	2.25	150	297.85	82802.30
T_3 : Ethrel 300 ppm	40	60	3	12.60	30	4.50	150	300.10	83427.80
T_4 : Ethrel 450 ppm	40	60	3	12.60	30	6.75	150	302.35	84053.30
T_5 : KNO_3 1.0 %	40	60	3	12.60	30	6.20	150	301.80	83900.40
T_6: KNO_3 2.0 %	40	60	3	12.60	30	12.40	150	308.00	85624.00
T_7 : KNO_3 3.0 %	40	60	3	12.60	30	18.60	150	314.20	87347.60
T_8 : K_2SO_4 0.5 %	40	60	3	12.60	30	3.30	150	298.90	83094.20
T_9 : K_2SO_4 1.0 %	40	60	3	12.60	30	6.60	150	302.20	84011.60
T_{10}: K_2SO_4 1.5 %	40	60	3	12.60	30	9.90	150	305.50	84929.00
T_{11} : Control	40	60	3	12.60	30	0	150	295.60	82176.80

Table 2: Cost: Benefit ratio analysis of Kinnow mandarin with the foliar application of potassium and plant growth regulators

Treatment	Average yield (kg/ tree)	Price/kg (₹)	Gross return per tree (₹)	Cost of cultivation per tree (₹)	Net return per tree (₹)	Cost: Benefit ratio	Net return per ha (₹)
T_1 : GA_3 75 ppm	27.43	45	1234.55	318.20	916.35	1 : 3.88	254746.60
T_2 : Ethrel 150 ppm	22.17	30	664.98	297.85	367.13	1 : 2.23	102061.00
T_3 : Ethrel 300 ppm	23.01	30	690.18	300.10	390.08	1 : 2.30	108441.20
T_4 : Ethrel 450 ppm	23.86	35	835.03	302.35	532.68	1 : 2.76	148085.60
T_5 : KNO_3 1.0%	23.92	30	717.59	301.80	415.79	1 : 2.38	115590.90
T_6 : KNO_3 2.0%	24.55	40	981.97	308.00	673.97	1 : 3.19	187364.00
T_7 : KNO_3 3.0%	26.35	45	1185.75	314.20	871.55	1 : 3.77	242291.20
T_8 : K_2SO_4 0.5%	22.95	30	688.54	298.90	389.64	1 : 2.30	108320,00
T_9 : K_2SO_4 1.0%	23.36	35	817.69	302.20	515.49	1 : 2.71	143307.50
T_{10}: K_2SO_4 1.5%	25.31	40	1012.56	305.50	707.06	1 : 3.31	196563.80
T_{11} : Control	18.99	25	474.05	295.60	179.25	1 : 1.61	49830.53

control (T_{11}). It is because of higher yield which was found to be 27.43 kg/tree with the treatment 75 ppm GA_3. The cost benefit ratio ranged from 1: 1.61 in control (water spray) (T_{11}) to 1: 3.88 with 75 ppm GA_3 (T_1) and thus indicated that plants treated with 75 ppm GA_3 returns ₹ 3.88 for each rupee invested on it. Similar results were obtained by (Rajput 2008) who found that application of 30 ppm GA_3 gave highest net realization (₹ 167164) and cost benefit ratio (1:6.0) in guava. Bhosale (2012) also reported highest net realization (₹ 50204.96) and cost benefit ratio (1:2.9) with 20 ppm GA_3. Results are also in consonance with the findings of Verma (2014) who recorded the highest net realization (₹ 23460 per hectare) with a cost benefit ratio of 1: 7.53 as compared to control.

CONCLUSION

It can be concluded from the results that GA_3 75 ppm treatment was best among all other treatments. The total cost of cultivation was found to be highest (₹ 318.20/tree and ₹ 88459.60/ha) with (T_1) and lowest in control (T_{11}) (₹ 295.60/tree and ₹ 82176.80/ha). The highest net return (₹ 916.35 per tree and ₹ 254746.60 per hectare) was registered under treatment (T_1) and lowest (₹ 179.25/ tree and ₹ 49830.53 per hectare) in control (T_{11}). Thus, Kinnow mandarin trees treated with GA_3 75 ppm was found to be the best treatment as it is evident from cost: benefit ratio of 1: 3.88.

REFERENCES

Bhosale, G.H. 2012. Effect of plant growth regulators on growth, yield quality of ber (*Zizyphus mauritiana* Lamk.) cv. Mehrun under Saurashtra region. *M.Sc. (Ag.) thesis subm. to Junagadh Agricul. Univ, Junagadh,* pp. 69-70.

Gurjar, P.S. and Rana, G.S. 2014. Influence of foliar application of nutrients and growth regulator on fruit drop, yield, and fruit size and quality in Kinnow mandarin. *Ind. J. Hort*, **71**(1): 109-111.

Rajput, R.P. 2008. Effect of boron and various plant growth regulators on yield and quality of guava (*Psidium guajava* L.) cv. Lucknow-49. *M.Sc. (Ag.) thesis subm. to Junagadh Agricul. Univ, Junagadh*, pp. 44-45.

Sharma, T., Khan, M.K. and Shukla, P.K. 2012. Micropropagation of Kinnow through nodal explants. *The Biosn*, **7**(2): 295-297.

Verma, S. 2014. Effect of $ZnSO_4$ and GA_3 on growth, yield and quality of sapota [*Manilkara achras* (Mill.) Forsberg] cv. Kalipatti. *Ph.D. thesis submitted to Junagadh Agricul Univ., Junagadh*, pp. 90-92.