International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(2): 447-449

Received: 24-01-2019
Accepted: 27-02-2019

Komal Dogra
M.Sc. student, Division of Fruit Science, SKUAST-Jammu, Jammu and Kashmir, India

Rakesh Kumar
Assistant Professor, Division of Fruit Science, SKUAST-Jammu, Jammu and Kashmir, India

Parshant Bakshi
Associate Professor, Division of Fruit Science, SKUAST-Jammu, Jammu and Kashmir, India

Kiran Kour
Assistant Professor, Division of Fruit Science, SKUAST-Jammu, Jammu and Kashmir, India

Correspondence
Rakesh Kumar
Assistant Professor, Division of Fruit Science, SKUAST-Jammu, Jammu and Kashmir, India

Effect of foliar application of potassium and plant growth regulators on vegetative characteristics of Kinnow mandarin under rain-fed condition

Komal Dogra, Rakesh Kumar, Parshant Bakshi and Kiran Kour

Abstract
An investigation was carried out at Rainfed Research Sub-station for Sub-tropical fruits, Raya, SKUAST- Jammu during the year 2017-18. The twelve year old plants were sprayed with GA_3 (75 ppm), ethrel (150 ppm, 300 ppm and 450 ppm), KNO_3(1.0 %, 2.0 % and 3.0 %) and K_2SO_4 (0.5 %, 1.0 % and 1.5 %) at two intervals *viz.*, first spray was performed during first week of May 2017 and second spray after six weeks from first spray on growth and yield of Kinnow mandarin. The results revealed that application of 75 ppm GA_3 showed superior results with respect in plant height (10.38 %), in plant spread (13.41 %), per cent increase in canopy volume (41.97 %), least fruit drop percentage (16.18 %), maximum number of fruits per tree (238.33) and yield (27.43 kg/tree) over control.

Keywords: Kinnow, growth, yield, potassium and plant growth regulators

Introduction
Kinnow mandarin (*Citrus reticulata* Blanco) belongs to family Rutaceae. It is one of the most popular fruit among different citrus species. Kinnow mandarin, a hybrid between King mandarin (*Citrus nobilis* Lour. ♂) and Willow leaf mandarin (*Citrus deliciosa* Tenore ♀) is the most important commercial cultivar of Citrus in Northern India. It was developed by H. B. Frost at California Citrus station in 1951 and was introduced in Punjab in 1966. In India, total area under citrus production is 1055 thousand hectare with an annual production of 12746 thousand metric tonnes (Anonymous, 2017) [2]. In the state of Jammu and Kashmir, citrus is successfully grown in sub-tropical areas of Jammu division covering an area of about 14542 hectares with production of about 34191 MT (Anonymous, 2017) [3]. Kinnow mandarin is gaining commercial importance due to its good yield, high processing quality, fresh consumption aromatic flavor and better adaptation to agro-environmental conditions (Ahmed *et al*., 2006) [1] as well as its multifold nutritional and medicinal values besides excellent desert quality, characteristic aroma, pleasant and outstanding appearance, relatively less granulation, precocious bearing habit and adaptability to even adverse weather conditions. It occupies a unique position among popular and extensively grown tropical and sub-tropical fruits of India.

Material and Methods
The present investigation was carried out on twelve years old Kinnow mandarin trees spaced at 6 m x 6 m distance at Rainfed research station, Raya, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu during 2017-18. Raya is situated in the sub-tropical zone at latitude of 32^0 39" North and longitude of 74^0 53" East. The experiment was laid out in randomized block design with three replications, comprising of 11 treatments including control. The experiment was laid out in Randomized Block Design with three replications. Experimental details GA_3 75 ppm (T_1), Ethrel 150 ppm (T_2), Ethrel 300 ppm (T_3), Ethrel 450 ppm (T_4), KNO_3 1.0 % (T_5), KNO_3 2.0 % (T_6), KNO_3 3.0 % (T_7), K_2SO_4 0.5 % (T_8), K_2SO_4 1.0 % (T_9), K_2SO_4 1.5 % (T_{10}) and Control (T_{11}).Plant height was recorded with the help of marked bamboo stick from the ground surface to the maximum height attained by the plant before application of different treatments and after fruit harvest (AFH) during investigation under rainfed condition. The same was recorded in centimeters (cm) and expressed as per cent increase in plant height. Plant spread (East-West and North-South) was recorded for each plant before by putting the marked bamboo stick horizontally with the plant from east-west and north-south and mean spread was worked out in centimeters (cm).

The same was expressed as percent increase in plant spread. Canopy volume (m^3) of the respective plants for each treatment was calculated as per the formula given by Westwood (1963) [16]. Number of fruits present on the randomly selected branches of the plant at the time of fruit set was recorded and number of fruits retained on these branches till maturity was recorded. The data that recorded was expressed as per cent fruit drop. Total number of fruits for each replication was recorded at the time of harvesting and the average was expressed as number of fruits per plant. The total number of fruits harvested per plant and average fruit weight were taken into consideration to work out the yield per plant in kilograms (kg/tree). The average fruit weight (g) was measured on electronic balance in research laboratory division of fruit science at chatha SKUAST-Jammu.

Results and Discussion

Vegetative characters

The application of potassium and plant growth regulators at different concentrations had significantly influenced various plant growth characteristics as compared to control. The perusal of data shows that GA_3 75 ppm (T_1) treated plants showed maximum per cent increase in plant height (10.38 %), plant spread (13.41 %) and canopy volume (41.97 %) as compared to untreated plants viz., (6.52 %), (9.71 %) and (27.15 %) respectively. The maximum per cent increase in plant spread and crown volume with the spray of GA_3 might be due to beneficial effect of 75 ppm GA_3 in cell elongation and enlargement. Exogenous GA_3 causes extreme stem elongation and has little direct effect on root growth. Spray with GA exerts significant effect on vegetative growth (Singh *et al.*, 1960, Singh and Singh, 1978 [15], Singh and Phogat, 1983). The increase in plant height is due to increased uptake of water and nutrients due to persuasive swelling forces leading the softening of cell wall and thereby favoured better development of plants resulting in greater height and number of branches per plant and ultimately the greater plant spread and canopy volume. These results are in close conformity with those reported by Choudhary *et al*. (2013) [7] in Nagpur mandarin (*Citrus reticulata* Blanco.), Saleem *et al*. (2007) [14] in 'Blood Red' sweet orange, Kumar *et al*. (2012) [11] in strawberry and Kacha *et al*. (2012) [10] in phalsa. Similar effect of GA_3 treatment on per cent increase in plant spread and crown volume was recorded by Eelkim *et al*. (2003) [9] who reported increase in the number of vegetative shoots with the increase in concentration of GA_3 during investigation.

Fruit drop and Number of fruits per tree and Yield

Maximum number of fruit per tree at harvest(238.33), Least fruit drop (16.18 %) and fruit yield (27.43 kg/plant) was found in again 75 ppm GA_3 treated plants followed by number of fruit per tree (228.67 %) and fruit yield (26.35 kg/plant) in plants treated with KNO_3 3.0 % (T_7) while minimum number of fruit per tree at harvest(175.33), maximum fruit drop (31.42 %) and minimum fruit yield (18.99 kg/plant) was registered in untreated plants during investigation under rain-fed condition. Application of GA_3 significantly reduced the pre harvest fruit drop in citrus species (Davies and Zalma, 2006 and Nawaz *et al*., 2008) [8, 12]. An imbalance of auxins, cytokinins and gibberellins may lead to formation of abscission layer at the stem point and eventually fruit drop (Chen *et al*., 2006) [5]. The results are in close conformity with the findings of Randhawa *et al*. (1959) [13] in phalsa; Shawky *et al*. (1978) [15] in mango cv. 'Taimour'; Choma and Himelrick (1983) [6] in strawberry and Bhat *et al*. (2000) [4] in Eureka lemon.

Table 1: Effect of foliar application of potassium and plant growth regulators on plant height, plant spread and canopy volume of Kinnow mandarin

Treatment	Per cent increase in plant height	Per cent increase in plant spread	Per cent increase in canopy volume
T_1: GA_3 75 ppm	10.38	13.41	41.97
T_2: Ethrel 150 ppm	7.24	9.98	31.18
T_3: Ethrel 300 ppm	7.39	10.71	32.26
T_4: Ethrel 450 ppm	7.56	9.87	35.10
T_5: KNO_3 1.0%	8.11	11.66	32.83
T_6: KNO_3 2.0%	9.07	12.24	34.51
T_7: KNO_3 3.0%	9.85	12.68	35.74
T_8: K_2SO_4 0.5%	7.69	10.67	32.23
T_9: K_2SO_4 1.0%	8.25	10.72	33.18
T_{10}: K_2SO_4 1.5%	8.69	12.11	33.74
T_{11}: Control	6.52	9.71	27.15
C.D. (at 5%)	0.69	0.15	1.30

Table 2: Effect of foliar application of potassium and plant growth regulators on number of fruits per tree at harvest, fruit drop and yield of Kinnow mandarin

Treatment	Number of fruits per tree	Pre harvest fruit drop (%)	Yield (Kg/tree)
T_1: GA_3 75 ppm	238.33	16.18	27.43
T_2: Ethrel 150 ppm	199.33	24.68	22.17
T_3: Ethrel 300 ppm	205.67	24.11	23.01
T_4: Ethrel 450 ppm	211.99	21.95	23.86
T_5: KNO_3 1.0%	209.33	24.57	23.87
T_6: KNO_3 2.0%	214.67	21.08	24.55
T_7: KNO_3 3.0%	228.67	18.08	26.35
T_8: K_2SO_4 0.5%	202.33	27.39	22.95
T_9: K_2SO_4 1.0%	204.67	21.00	23.36
T_{10}: K_2SO_4 1.5%	220.33	17.06	25.31
T_{11}: Control	175.33	31.42	18.99
C.D. (at 5%)	2.38	-	0.26

Conclusion

It can be concluded that foliar application of 75 ppm GA_3 is superior for enhancing the plant growth characteristics in terms of plant height, plant spread, canopy volume, with least fruit drop and maximum yield per plant.

References

1. Ahmed W, Amjad MA, Ayyub CM, Nawaz MA. Effect of stionic combinations on growth and yield of Kinnow mandarin (*Citrus reticulata* Blanco.) Pakistan Journal of Botany. 2006; 38(3):603-612.
2. Anonymous. Directorate of Horticulture Kashmir, Jammu (Jammu and Kashmir), India, 2017.
3. Anonymous. Horticultural statistics at a glance 2017, Ministry of Agriculture and Farmers Welfare, India, 2017.
4. Bhat A, Kher R, Gupta SP. Effect of growth regulators and nutrients on fruit cracking and quality in lemon. Haryana Journal of Horticultural Sciences. 2000; 30(3-4):207.
5. Chen H, Dekkers KL, Cao L, Burns JK, Timmer LW, Chung K. Evaluation of growth regulators inhibitors for controlling post bloom fruit drop (PFD) of citrus induced by fungi (*Colletotrichum acutatum*). Hort Science. 2006; 4(5):317-321.
6. Choma ME, Himelrick DG. Responses of day-neutral, june-bearing and everbearing strawberry cultivars to gibberellic acid and phthalimide treatments. Hort Science. 1984; 22:257-264.
7. Choudhary HD, Jain MC, Sharma MK, Bhatnagar P. Effect of plant growth regulators on growth and yield of Nagpur mandarin (Citrus reticulata Blanco.). The Asian Journal of Horticulture. 2013; 8(2):746-750.
8. Davies FS, Zalman G. Gibberellic acid, fruit freezing, and post-freeze quality of Hamlin oranges. Horticultural Technology. 2006; 16(2):310-305.
9. Eelkim MY, Hokim Y, Kho CM, Sangook. Effect of foliar application of GA_3 on flowering and fruit quality of very early-maturing Satsuma mandarin. Korean Journal of Horticultural Science and Technology. 2003; 21(2):110-113.
10. Kacha HL, Viradia RR, Leva HM, Jat G, Tank AK. Effect of NAA, GA_3 and ethrel on yield and quality of phalsa under South- Saurashtra condition. Asian Journal of Horticulture. 2012; **7**(2):242-245.
11. Kumar R, Bakshi M, Singh DB. Influence of plant growth regulators on growth, yield and quality of strawberry under U.P. sub tropics. Asian Journal of Horticulture. 2012; 7(2):434-436.
12. Nawaz MA, Ahmad W, Ahmad S, Khan MM. Role of growth regulators on preharvest fruit drop, yield and quality in Kinnow mandarin. Pakistan Journal of Botany. 2008; 40(5):1971-1981.
13. Randhawa GS, Singh JP, Khanna SS. Effect of gibberellic acid and some other plant growth regulator on fruit set, size, total yield and quality in phalsa. Indian Journal of Horticulture. 1959; 16:202-205.
14. Saleem BA, Malik AU, Farooq M. Effect of exogenous growth regulators application on June fruit drop and fruit quality in *Citrus sinensis* cv. Blood Red. Pakistan Journal of Agricultural Sciences. 2007; 44(2):289-294.
15. Shawky L, Elmoi A, Nasar A. Effect of urea, Gibberellic acid and 2, 4-D, sprays on Washington Novel Orange. Egyptian Journal of Horticulture. 1978; 5(2):115-121.
16. Westwood MN. *Temperate Zone Pomology*, W. H. Freeman and Company, San Franciso, California, USA, 1993, 227.