The Pharma Innovation Journal 2022; 11(3): 1280-1283

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(3): 1280-1283

www.thepharmajournal.com
Received: 13-01-2022
Accepted: 22-02-2022

SV Sable
PG Student, Department of Horticulture, College of Agriculture, Badnapur, Jalna, Maharashtra, India

SD Temak
PG Student, Department of Horticulture, College of Agriculture, Badnapur, Jalna, Maharashtra, India

LA Girase
PG Student, Department of Horticulture, College of Agriculture, Badnapur, Jalna, Maharashtra, India

UM Naglot
Assistant Professor, College of Agriculture, Badnapur, Jalna, Maharashtra, India

Corresponding Author:
SV Sable
PG Student, Department of Horticulture, College of Agriculture, Badnapur, Jalna, Maharashtra, India

Effect of different chemicals on growth and yield parameters of sweet orange (*Citrus sinensis* L. *Osbeck*) Var. Nucellar

SV Sable, SD Temak, LA Girase and UM Naglot

Abstract
A field experiment was conducted to study the effect of different chemicals on growth and yield parameters of sweet orange (*Citrus sinensis* L. *Osbeck*) var. Nucellar during the season 2019-20 at the experimental farm Sweet Orange Research Station, Badnapur, Jalna (M.H). The experiment was laid out in randomized block design (RBD) with seven treatments and three replications.
The experimental results revealed that, In respect of growth and yield parameters *viz.,* height of tree, plant spread, tree canopy, per cent fruit set, number of flower per branch, fruit drop, fruit diameter, fruit volume, fruit weight, number of fruits per plant and yield per plant significantly influenced by different chemical treatments. Among the different treatments, T_6 (Kaolin 8%) increased the tree height (0.67 m) and tree canopy (13.72 m^3) significantly, whereas the effect of different chemicals on increase in plant spread shows non-significant effect. While, T_4 (KNO_3 2%) shows positively significant effect on number of flower per branch (2726.15), per cent fruit drop (61.50%).
The yield parameters *viz.,* fruit weight (319.67 g), fruit diameter (9.36 cm), fruit volume (295.15 ml) and yield per tree (102.98 kg) were significantly maximum in T_4 (KNO_3 2%). however, significantly maximum number of fruits per plant (343.04) were recorded in T_6 (Kaolin 8%).
On the basis of overall performance for growth character T_6 (Kaolin 8%), and for yield parameters T_4 (KNO_3 2%) was found to be best management strategy for getting higher quality production and productivity. It can be beneficial for effective and economic management practices for sweet orange.

Keywords: Sweet orange, yield, quality, survival, Nucellar, kaolin, KNO_3

Introduction
Citrus is the leading fruit crop of the world. The genus *Citrus* includes more than 162 species belonging to the order Geraniales, family Rutaceae and sub family Aurantoideae. Citrus fruits are a fair source of vitamin C and their daily consumption protects mankind from scurvy, a disease commonly associated with inadequate availability of vitamin C in the dietary foods.
The Sweet orange fruit is processed commercially into various forms mainly juice, frozen concentrates, squash, RTS drinks, nectar, dry mixes, canned segments, juice blends, marmalades and other value added products like pectin and essential oils from peel, natural colours, candied peel, feed yeast etc. Fresh juice of Sweet orange is an important nutritious product providing 45 Kcal energy, moderate quantity of vitamin "C", potassium, bioflavonoid, folic acid and essential items of breakfast.(Syed *et al.*, 2012) [19].
The fruit of sweet orange (*Citrus sinensis* L. *Osbeck*) are subglobose to round or oval in shape, diameter ranges from (5.7 to 9.5 cm), greenish yellow to orange in colour and tightly skinned. The fruit constitute about 40-50% juice, 8-10% flavedo and 15-30% albedo. The fruit consists of an outer peel, which includes epidermis, flavedo, oil glands, albedo and vascular bundles. The flavedo is the outer yellow sub epidermal layer containing carotenoid pigments and numerous oil glands filled with aromatic essential oils. The albedo is the inner white spongy layer of paranchymatus cells closely adherent to outer walls of segments and of (0.16 to 1.43 cm) thickness. It is rich in glucosides, bitter principles, pectin and pectic enzymes.
Cellular growth appears to be the most sensitive in response to water stress (Salisbury and Ross, 1992) [14]. Reduction in growth during stress is attributed to loss of turgor and according to Hsiao (1973) [8], it is this loss of turgor which is responsible for decrease in the rate of cell division, cell elongation and host of other metabolic processes. At higher levels of moisture stress, respiration, photosynthesis and translocation of assimilates drops to levels near zero, besides increasing the activity of hydrolytic enzymes and slow down of ion movement and all these adverse effects eventually lead to serious loss in the net productivity of fruit

accompanied with a considerable reduction in fruit quality (Kriedemann and Bars, 1981) [10]. However, stress symptoms in citrus species are reported to develop 60-65 days after bloom, at a stage when cell division ceases completely and cell growth has yet to take off (Holtzhansen and Duplessis, 1970) [7].

Potassium plays unique role in osmotic regulation and opening and closing of stomata. It improves the colour, flavour and size of fruits. Bangerth *et al.* (1999) [1]. Since potassium can be mobilized to the younger leaves, these symptoms appear initially on the more mature leaves towards the base of the plant. The leaves may also curl and crinkle. The stems of potassium deficient plants may be slender and weak with abnormally short intermodal regions. In potassium deficient corn, the roots may have an increased susceptibility, together with effect on the stem resulting in an increased tendency of the plant to be easily bent to the ground (lodging). In order to enhance the efficiency of fruit production under rainfed conditions, extensive efforts are afoot in Marathwada region, to develop an appropriate technology with an aim at minimizing evapotranspirational loss under drought condition. Use of chemicals, especially the antitranspirants ones is known to reduce moisture stress through reduction of transpiration loss in leaves. In recent years, some chemicals *viz.,* potassium nitrate, potassium chloride and Kaolin have been used on experimental basis for reducing transpiration loss in certain plant species. These chemicals are reported to reduce the rate of transpiration by either inducing partial stomatal closure or reflecting back the solar radiation and create an additional resistance in path of water diffusion from leaf to atmosphere (Fuehring, 1973) [5]

In view of the practical implication of the problem of moisture stress, scarcity of water and improve the yield of Sweet orange. The present research investigation entitled effect of different chemicals on growth and yield of Sweet orange (*Citrus sinensis* L. *Osbeck*) var. Nucellar will be undertaken with following objectives to study the effect of different chemicals on growth and yield of Sweet orange (*Citrus sinensis* L. Osbeck) Var. Nucellar.

Materials and Methods

An experiment was conducted at experimental farm Sweet Orange Research Station, Badnapur, Jalna (M.H) during mrig bahar in seasons of 2019-2020. The present study was laid out in randomized block design (RBD) with seven treatments and three replication *viz.,* T_1 - Potassium Chloride 1.5%**,** T_2 - Potassium Chloride 2%**,** T_3 - Potassium Nitrate 1.5%**,** T_4 - Potassium Nitrate 2%**,** T_5 - Kaolin 4%**,** T_6 - Kaolin 8% and T_7 – Control.

There were three spray schedules *i.e.* last week of April, May and August. Spraying was done early in the morning. Each tree was sprayed heavily by taking care to wet the complete tree. Nine years old uniformly grown trees spaced at 6 m x 6 m were selected for present study.

The observations of yield parameters *viz.,* Number of fruits per tree, Fruit weight and Fruit yield are taken by harvesting fruits at once and number of fruits per plant was recorded and average weight are taken on electronic balance.

Result and Discussion

The data presented in Table - 1 indicated that, significantly maximum increase of (0.67 m) in plant height was recorded in T_6 - Kaolin 8%, however, T_7 control showed minimum increase in height (0.37 m). The increase in plant height in treatment foliar application of Kaolin 8% was due to reduction in water loss through transpiration, increased in reflection of solar radiation, leaf area and soil moisture conditions. Water shortage, reduces increased in plant height in the control treatment (without spraying with antitranspirants).

The data depicted in Table - 1 shown that, significantly maximum increase of (4.15 m) in plant spread (N-S-, E-W) was recorded in T_6 - Kaolin 8%, while, T_7 control showed minimum increase in height (3.63 m).

The effect of different chemicals on tree canopy (m^3) presented in Table 1 was shown significant results, the data revealed that, maximum tree canopy (13.72m^3) was recorded in treatment T_6 i.e. spraying with Kaolin 8% and while, T_7 showed minimum tree canopy (8.53 m^3). The effect of Kaolin 8% spray on tree canopy which might be due to reduction in transpirational losses of water due to reflection of part of solar radiation incident on leaf surface, thus making the soil moisture available for better growth over longer period. (Skewes, 2013; Kerns, D. and G. Wright, 2000) [17, 9].

The per cent fruit set represented in Table 1 revealed that, significantly maximum per cent fruit set (13.67) were observed in treatment T_6 i.e. Kaolin 4% however, the minimum in treatment T_7 (11.87) *i.e.* Control. The increase in flowering and fruiting characters might be due to better growth and development of plant which produced higher yield components, which ultimately resulted in early flowering as well as higher fruit set. Similar results were recorded by Sudha *et al.* (2012) [18], Singh *et al.* (2005) [16] in mango.

The average total number of flowers per branch represented in Table 1 revealed that, significantly maximum number of flowers per branch (2726.15) were observed in treatment T4 i.e. Potassium Nitrate 2.0% (KNO_3) while, the was minimum in treatment T_7 (1855.22) i.e. Control. KNO_3 is one of the chemical inducing substances that shown some potential for inducing flowering in mango and enhance fruit production (Barba 1974) [2]. Lauchil *et al.* (2006) [11] explained that KNO_3 might be involved in the inductive process where active components of KNO_3 might transfer shoots from the vegetative phase to the reproductive phase, then grow into panicles and finally bear flowers. The results are in agreement with Nulit *et al.* (2014) [13], Sudha *et al.* (2012) [18], Nahar *et al.* (2010) [12].

The data depicted in Table 1. it is revealed that, the percent fruit drop was significantly differed the minimum percent fruit drop was recorded in T_6 (61.50%) trees, which received kaolin 8. Whereas the maximum percent fruit drop was registered in T_7 (67.39) in Control. Numerically more fruits were obtained with potassium treatments, which may be due to continuous supply of food to the developing fruits and this leads to decreased fruit drop.

The data depicted in Fig. 1 on fruit diameter revealed that various treatments had significant effect on fruit diameter. It apparent from the table that, significantly maximum fruit diameter (9.36cm) was recorded in T_4 trees which received Potassium Nitrate 2.0% (KNO_3) while, Significantly minimum fruit diameter registered with control T_7 (7.08 cm), due to Potassium plays unique role in osmotic regulation and opening and closing of stomata. It improves the colour, flavour and size of fruits as elucidated by Bangerth *et al.*, (1999) [1] in apple.

The Fruit volume represented in Fig. 1 revealed that,

significantly maximum volume of fruit was noticed in the treatment T_4 (295.15ml) received Potassium Nitrate 2.0% (KNO_3). Whereas the minimum fruit volume (223.00 ml) was recorded in the treatment T_7 (Control). The increase in length and diameter of sweet orange fruits may be due to the fact that mineral nutrients appear to have indirect role in hastening the process of cell division and cell elongation due to which the size of fruit might have improved. Potassium being a major nutrient is essential for reduction of nitrate in plants. It is essentially required for the production of best quality fruits. It is also involved in the opening and closing of stomata and such finding have also been reported by Dar and Abraham (2004) [3] in guava; Gill and Bal (2009) [6] in ber.

The Data presented in Fig. 1 regarding fruit weight as influenced by treatments on sweet orange revealed that the treatments differed significantly, maximum fruit weight (319.67g) recorded in treatment T_4 (Potassium Nitrate 2.0%) at par with treatment T_3 (306.72g). While minimum average fruit weight (219.00g) was recorded in the treatment T_7 (Control). The more pronounced effect of KNO_3 as compared to other chemicals may be due to the additional supply of nitrogen which may further increase the efficiency of metabolic processes of plant and thus increases the growth of the plant and consequently increases the fruit weight. Similar results were recorded by (Erner *et al.*, 1993) [4] in citrus.

The graphically presented in Fig.1. From the data it was noticed that all the parameter was found to differed significantly that, the average numbers of fruits per plant varied from 220.05 - 343.04 due to application of different treatments. The maximum average number of fruits per plant (343.04) was produce by the treatment of Kaolin 8%. (T_6), while the minimum average number of fruits recorded in treatment T_7 (220.05). The average number of fruits per plant was significantly influenced by various treatments and spray schedules in (Table 1). However, numerically more fruits were obtained with various potassium treatments, which may be due to continuous supply of food to the developing fruits and this leads to decreased fruit drop and similar results in kinnow mandarin were reported by Sangwan *et al.*, (2008) [15].

It was clear from the data in Fig. 1 That, average yield per tree ranged from 48.20 - 102.98 kg per tree due to various treatments of chemicals. The highest fruit yield per tree (102.98 kg) was recorded in the treatment T_4 (KNO_3), and lowest fruit yield per tree (48.20 kg) was recorded in treatment T_7 (Control). The increase in yield might be due to increase in fruit weight and improvement in plant vigor which increases the fruit reserves which serves the fruits till harvest and retaining somewhat more fruits as evident from the present investigation. Similar results were also observed by Sangwan *et al.*, (2008) [15] in Kinnow mandarin where they found maximum yield with KNO_3.

Table 1: Effect of different chemicals on growth parameters in sweet orange var. Nucellar

Treatment	Treatment Details	plant height		plant spread				Tree Canopy (m^3)	Per cent fruit set (%)	Average no. of flowers / Branch	Fruit drop (%)
				At initial stage		At final stage					
		At initial stage	At final stage	E-W	N-S	E-W	N-S				
T_1	Potassium Chloride 1.5% (KCl)	3.92	4.38	3.47	3.62	3.69	3.85	12.48	13.09	2216.57	64.74
T_2	Potassium Chloride 2.0% (KCl)	3.86	4.33	3.55	3.73	3.76	3.92	12.38	13.42	2217.64	66.63
T_3	Potassium Nitrate 1.5% (KNO_3)	4.29	4.76	3.46	3.57	3.28	3.70	11.70	12.39	2671.93	64.35
T_4	Potassium Nitrate 2.0% (KNO_3)	3.68	4.18	3.66	3.72	3.80	3.87	11.81	11.90	2726.15	64.84
T_5	Kaolin 4%	3.77	4.29	3.71	3.71	3.88	3.88	13.63	13.51	2444.11	63.23
T_6	Kaolin 8%	3.35	4.02	3.91	4.02	4.12	4.15	13.72	13.67	2597.78	61.50
T_7	Control	3.68	4.05	3.43	3.53	3.52	3.63	8.53	11.87	1855.22	67.39
SE ±		0.14	0.14	0.06	0.03	0.15	0.04	0.59	0.99	97.49	0.55
C.D. at 5%		0.43	0.43	0.18	0.10	0.46	0.12	1.75	3.05	300.40	1.70

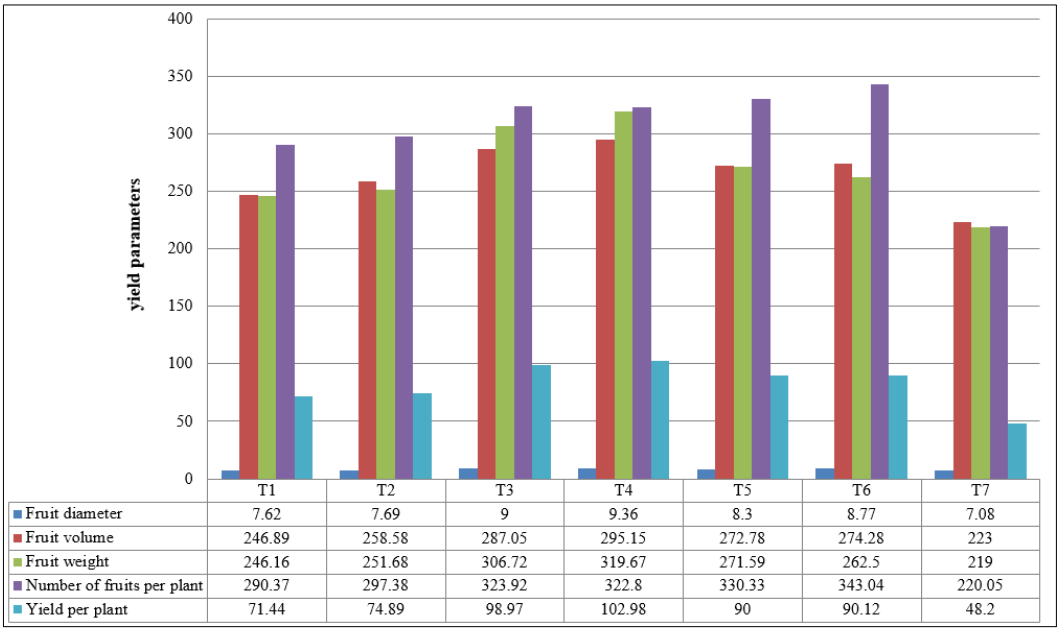

Fig 1: Effect of different chemicals on yield paramenters in sweet orange var. Nucellar

Conclusion

Regarding to the growth parameter the treatment (T_6 – Kaolin 8%) recorded maximum increase in a height of the tree spread of tree (East-West) and (North-South), tree canopy and minimum in fruit drop. While yield parameter, the treatment (T_4 - KNO_3 2%) recorded maximum in number of flowers per branch, fruit diameter, fruit volume, average fruit weight and average yield per plant.

The tree sprayed with important antitranspirant like potassium chloride, potassium nitrate and kaolin with various concentrations observed more fresh leaves than the control treatment. In treatment control, found more wilting of leaves compare than other treatments.

It can be concluded from overall results of present study that, the treatment (T_4) application of potassium nitrate (KNO_3) 2.0% found to be beneficial as compare to other treatment.

References

1. Bangerth F. Second discussion meeting on bitter pit in apple, Acta Hort. 1999;45:53-52.
2. Barba RC. Induction of flowering of mango by chemical spray. Proceedings of Crop Science. 1974;5:54-160.
3. Dar ZM, Abraham G. Ameliorating effects of Ca(NO3)2 on growth of NaCl stressed guava (*Psidium guajava* L.) seedlings, Annals of Forestry. 2004;12(1):6164.
4. Erner Y, Kaplan B, Artzi B, Hamu M. Increasing fruit size using auxins and potassium. Acta Hort. 1993;329:112-116.
5. Fuehring HD. Effects of antitranspirants on yield of grain sorghum under limited irrigation. Agro. J 1973;65(3):348-351.
6. Gill PPS, Bal JS. Effect of growth regulator and nutrients spray on control of fruit drop, fruit size and quality of ber under sub-montanezone of Punjab, J of Hort. Sci. 2009;4(2):161-163.
7. Holtzhansen LC, Duplessis JA. Skin splitting of citrus fruits. Hort. Abstracts. 1970;41:7562.
8. Hsiao TC. Plant responses to water stress. Annual Review of Plant Phy. 1973;24:519-570.
9. Kerns D, Wright G. Protective and Yield enhancement qualities of yield of Kaolin on lemon, 2000.
10. Kriedemann PE, Bars HD. Water deficit and plant growth. Academic press New York, 1981, 419-469.
11. Lauchil U, Pierre M, Normand F. Season effect of leaf nitrogen partitioning and photosynthesis water use efficiency in mango. Journal of Plant Physiology. 2006;163(1):48-57.
12. Nahar N, Choudhary MSH, Rahim MA. Effect of KClO3, KNO3 and urea on the flowering and fruiting of mango and longan. Journal of Agro Environment. 2010;4(1):31-34.
13. Nulit R, Afiqah AN, Hawa ZEJ, Kusnan M. Improving the yield of 'Chok Anan' mango with potassium nitrate foliar sprays. International Journal of Fruit Science. 2014;14:416-423.
14. Salisbury FB, Ross CW. Plant Physiology Woodsworth Publishing Company, Belmont, California, 1992, PP. 583-589.
15. Sangwan AK, Rattanpal HS, Arora NK, Dalal RS. Effect of foliar application of potassium on fruit yield and quality of Kinnow mandarin. Environment and Ecology. 2008;26(4C):2315-2318.
16. Singh NP, Mahli CS, Sharma RC. Effect of foliar feeding of N, P and K on vegetative and fruiting characters of mango cv. Dusehri. International Conference on Mango and Date Palm: Culture and Export. 2005, pp. 27-31.
17. Skewes M. Citrus drought survival and recovery trial. 2013, HAL project no. CT08014.
18. Sudha R, Balamohan TN, Soorianathasundaram K. Effect of foliar spray of nitrogenous chemicals on flowering, fruit set and yield in mango (*Mangifera indica* L.) cv. Alphonso. Journal of Horticultural Science. 2012;7(2):190-193.
19. Syed HM, Ghatge PU, Machewad G, Pawar S. Studies on preparation of squash from sweet orange. 2012;1:311 doi:10.4172/Scientific reports. 311