



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(8): 1473-1476
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www.thepharmajournal.com
Received: 20-06-2022
Accepted: 28-07-2022

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Influence of foliar spray of Biostimulants and growth substances on vegetative growth of Kagzi lime (*Citrus aurantifolia* Swingle.) Seedlings

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Abstract

The present investigation entitled “Influence of foliar spray of biostimulants and growth substances on vegetative growth of Kagzi lime (*Citrus aurantifolia* Swingle.) seedlings” was carried out at Regional Horticultural Research Station, ACHF, NAU, Navsari during 2019-20. The experiment was laid out in Completely Randomized Design with three repetitions and nine treatments viz. T₁ (19:19:19 @ 1%), T₂ (KNO₃ @ 1%), T₃ (Urea @ 1%), T₄ (BA @ 50 ppm), T₅ (GA₃ @ 100 ppm), T₆ (Novel+ @ 1%), T₇ (*Panchgavya* @ 3%), T₈ (Cow urine @ 3%), T₉ (Control). The foliar application of GA₃ @ 100 ppm (T₅) significantly influenced seedling growth as compared to other treatments which registered the maximum increment in number of leaves, increment in seedling height and increment in number of shoot at 10, 40 and 70 days after 2nd foliar spray. However, this treatment was statistically at par with *panchgavya* @ 3% with respect to the increment in number of leaves at 10 and 70 days after 2nd foliar spray and increment in seedling height at 40 and 70 days after 2nd foliar spray. The highest leaf area (4.37 cm²) fresh weight (18.16 g) and dry weight (11.40 g) of shoot and survival percentage (92.20%) was also recorded in same treatment at 70 days after 2nd foliar spray. The fresh weight of shoot (16.74 g) and survival (86.67%) were found at par with treatment *panchgavya* @ 3% (T₇) at 70 days after 2nd foliar spray. So, on the basis of the results obtained under the study it can be concluded that the foliar application of GA₃ @ 100 ppm found better for enhancing seedling growth of Kagzi lime seedlings which was applied as a foliar spray at 25 and 50 days after transplanting.

Keywords: Biostimulants, growth substances, Kagzi lime

Introduction

Citrus is one of the most important fruit crop of tropical and subtropical regions. India ranks sixth in production of citrus fruits in the world. It has different species like *Citrus aurantifolia* – Kagzi lime, *Citrus maxima* – pomelo, *Citrus medica* – citron, *Citrus reticulata* – mandarin orange, etc. Important species of citrus group is *Citrus aurantifolia*. It is also known as Kagzi lime or maxican lime or pati lime. Kagzi lime is propagated commercially through seeds. It can be propagated by budding, layering and cutting owing to high intensity of polyembryony and least chance of occurrence of viral disease. Seed propagation is the cheapest and easiest method. The time required for grow suitable grafting size of Kagzi lime seedling may be as long as one year. Therefore, shortening this time is considered very important and that can be achieved by enhancing the seedling growth. Foliar spray of biostimulants and growth substances are known to enhance the growth of seedlings of various fruit crops. Foliar fertilization has been used as a means of supplying supplemental doses of major and minor nutrients, plant hormones, stimulants and other beneficial substances. The plant nutrients which are absorbed through roots can also be absorbed with equal efficacy through foliage (Del, 1971) [1]. The overall objective of present study was to examine the effects of foliar spray of biostimulants and growth substances on vegetative growth of Kagzi lime seedlings.

Materials and Methods

The present investigation was carried out at Regional Horticultural Research Station, ACHF, NAU, Navsari during the year 2019-20. The experiment was laid out in Completely Randomized Design with three repetitions and nine treatments viz. T₁ (19:19:19 @ 1%), T₂ (KNO₃ @ 1%), T₃ (Urea @ 1%), T₄ (BA @ 50 ppm), T₅ (GA₃ @ 100 ppm), T₆ (Novel+ @ 1%), T₇ (*Panchgavya* @ 3%), T₈ (Cow urine @ 3%), T₉ (Control). Two months old seedlings of Kagzi lime were selected. Foliar spray was done with sprayer at 25 and 50 days after transplanting.

For selection of planting material two months old, healthy, disease free Vigourously growing and uniform seedlings were selected and transplanted in polythene bags arranged in polyhouse as per experimental design. Seedlings were routinely irrigated whenever it is needed. Foliar spray was done with sprayer at 25 (27th December, 2019) and 50 (21st January, 2020) days after transplanting. The experimental data were subjected to the statistical analysis by using variance technique as described by Panse and Sukhatme (1967).

Results and Discussion

Increment in number of leaves

The foliar spray consisting of GA₃ @ 100 ppm (T₅) resulted in maximum increment in number of leaves (6.92, 8.87 and 9.20, respectively) at 10, 40 and 70 days after 2nd foliar spray which was statistically at par with treatment (T₇) *Panchgavya* @ 3% (6.49, 8.40 and 8.87, respectively). The minimum increment in number of leaves (3.42, 5.07 and 5.13, respectively) was found in control (T₉) at 10, 40 and 70 days after 2nd foliar spray. This treatment was statistically at par with T₁, T₂, and T₈ at 40 and 70 days after 2nd foliar spray. The data regarding increment in number of leaves are presented in table 1.

Maximum increase in number of leaves in foliar spray of GA₃ might be due to maximum height of seedlings under this

treatment. This also helps in invigoration of physiological process of plant stimulatory effect of chemicals to form new leaves at faster rate. Such type of findings also reported by Jadhav (2003) [4] and Gurav (2004) [2] in Rangpur lime and Kadam and Singh (2010) [6] in Kagzi lime and Rangpur lime.

Increment in seedling height

There was significant difference of seedling height at all stage of growth. The data regarding increment in seedling height are presented in table 2. Maximum increment in seedling height (8.21 cm, 8.63 cm and 8.85 cm) was recorded in treatment GA₃ @ 100 ppm (T₅) at 10, 40 and 70 days after 2nd foliar spray. This treatment was at par with treatment (T₇) *Panchgavya* @ 3% (8.18 cm and 8.30 cm, respectively) at 40 and 70 days after 2nd foliar spray. The minimum increment in seedling height (3.89 cm, 4.37 cm and 5.01 cm, respectively) was noted in control (T₉) which was at par with T₁ at 10, 40 and 70 days after 2nd foliar spray.

More plant height in GA₃ might have occurred due to cell division (Stowe and Yamaki, 1957) [12] and cell elongation (Shanmugavelu, 1970) [10], which in turn would have increased the internodal length. These results are in conformity with Hoda *et al.* (2010) [3] in Voikamer lemon and Sour Orange rootstock and Kadam and Singh (2010) [6] in Kagzi lime seedling

Table 1: Effect of foliar spray of biostimulants and growth substances on increment in number of leaves of Kagzi lime seedlings

Treatments	Increment in number of leaves (days after 2 nd foliar spray)		
	10	40	70
T ₁ : 19:19:19 @ 1%	4.60	5.40	5.47
T ₂ : KNO ₃ @ 1%	5.16	5.47	5.53
T ₃ : Urea @ 1%	5.23	6.00	6.13
T ₄ : BA @ 50 ppm	5.18	6.80	7.00
T ₅ : GA ₃ @ 100 ppm	6.92	8.87	9.20
T ₆ : Novel ⁺ @ 1%	4.40	6.00	6.67
T ₇ : <i>Panchgavya</i> @ 3%	6.49	8.40	8.87
T ₈ : Cow urine @ 3%	4.16	5.53	5.53
T ₉ : Control	3.42	5.07	5.13
S. Em±	0.15	0.16	0.20
C.D. at 5%	0.44	0.46	0.60
C.V.%	5.09	4.21	5.27

Table 2: Effect of foliar spray of biostimulants and growth substances on increment in seedling height of Kagzi lime seedlings

Treatments	Increment in seedling height (cm) (days after 2 nd foliar spray)		
	10	40	70
T ₁ : 19:19:19 @ 1%	4.72	4.83	5.24
T ₂ : KNO ₃ @ 1%	5.08	5.38	5.86
T ₃ : Urea @ 1%	5.86	6.05	6.35
T ₄ : BA @ 50 ppm	6.18	7.09	7.19
T ₅ : GA ₃ @ 100 ppm	8.21	8.63	8.85
T ₆ : Novel ⁺ @ 1%	6.87	7.20	7.63
T ₇ : <i>Panchgavya</i> @ 3%	7.13	8.18	8.30
T ₈ : Cow urine @ 3%	5.04	5.40	6.06
T ₉ : Control	3.89	4.37	5.01
S. Em±	0.14	0.19	0.19
C.D. at 5%	0.42	0.55	0.57
C.V.%	4.21	5.06	4.98

Increment in number of shoots

The data regarding increment in number of shoots are presented in table 3. Different foliar spray treatment significantly affect increment in number of shoots. The foliar spray consisting of GA₃ @ 100 ppm (T₅) resulted in highest increment in number of shoots (1.20, 1.40 and 1.87, respectively) at 10, 40 and 70 days after 2nd foliar spray. An increment in number of shoots was minimum (0.20, 0.20 and 0.47, respectively) in control at all growth stages under observations.

The maximum increment in number of shoots were recorded in GA₃ might be due to fact that the synthesis of amino acids in plants was accelerated, which is indirectly exhibited by enhanced growth of citrus plants and their parts. (Meshram *et al.*, 2015) [8]. These results are in conformity with Hoda *et al.* (2010) [3] in Voikamer lemon and Sour Orange rootstock and Kadam and Singh (2010) [6] in Kagzi lime seedling.

Table 3: Effect of foliar spray of biostimulants and growth substances on increment in number of shoots of Kagzi lime seedlings

Treatments	Increment in number of shoots (days after 2 nd foliar spray)		
	10	40	70
T ₁ : 19:19:19 @ 1%	0.40	0.53	1.07
T ₂ : KNO ₃ @ 1%	0.60	0.60	1.20
T ₃ : Urea @ 1%	0.60	1.07	1.33
T ₄ : BA @ 50 ppm	1.00	1.20	1.27
T ₅ : GA ₃ @ 100 ppm	1.20	1.40	1.87
T ₆ : Novel ⁺ @ 1%	0.80	1.00	1.40
T ₇ : <i>Panchgavya</i> @ 3%	0.93	1.13	1.47
T ₈ : Cow urine @ 3%	0.40	0.60	1.00
T ₉ : Control	0.20	0.20	0.47
S. Em±	0.02	0.04	0.05
C.D. at 5%	0.07	0.11	0.16
C.V.%	5.65	7.76	7.67

Leaf area (cm²)

The data pertaining to leaf area as affected by foliar spray of different biostimulants and growth substances are presented in table 4. The leaf area was significantly altered by different foliar spray treatments. The foliar spray consisting of GA₃ @ 100 ppm (T₅) was found better for maximum leaf area (4.37 cm²) at 70 days after 2nd foliar spray followed by *panchgavya* @ 3% (3.98 cm²). The minimum leaf area (3.75 cm²) was observed in control (T₉) and it was at par with all the treatments except T₅.

The increase in leaf area in treatment of GA₃ is might be due to synthesis of protein in plants get accelerated, which was indirectly exhibited by increased in size of different plant parts (Meshram *et al.*, 2015) [8]. These results are in conformity with Rahemi and Baninasab (2000) in pistachio growth of seedling.

Fresh weight and dry weight of shoot

The fresh weight and dry weight of shoot was significantly

affected by foliar spray of different biostimulants and growth substances at 70 days after 2nd foliar spray. The data regarding to fresh weight and dry weight of shoot are presented in table 4. The foliar spray consisting of GA₃ @ 100 ppm (T₅) resulted in higher fresh weight (18.16 g) and dry weight (11.40 g) of shoot. The lowest value of fresh weight (13.11 g) and dry weight (7.17 g) of shoot was observed in control (T₉).

The fresh weight and dry weight of shoot increased in GA₃ is might be due to the effect of mobilization of water and nutrients transported at higher rate which might have promoted more production of photosynthetic product and translocated them to various plant parts which have resulted in better growth of the seedlings and hence, more fresh and dry weight (Jaiswal *et al.* 2018) [5]. The result of present study was supported by the findings reported by various research workers *viz.*, Jadhav (2003) [4] and Gurav (2004) [2] in Rangpur lime, Sharma *et al.*, (1999) [11] and Kadam and Singh (2010) [6] in Kagzi lime and Rangpur lime.

Table 4: Effect of foliar spray of biostimulants and growth substances on leaf area of Kagzi lime seedlings

Treatments	Leaf area (cm ²)	Fresh weight of shoot (g)	Dry weight of shoot (g)	Survival (%)
T ₁ : 19:19:19 @ 1%	3.85	13.97	7.89	79.97
T ₂ : KNO ₃ @ 1%	3.86	13.75	7.64	75.53
T ₃ : Urea @ 1%	3.89	15.08	8.10	79.97
T ₄ : BA @ 50 ppm	3.92	15.89	8.88	82.10
T ₅ : GA ₃ @ 100 ppm	4.37	18.16	11.40	92.20
T ₆ : Novel ⁺ @ 1%	3.74	15.42	8.62	76.97
T ₇ : <i>Panchgavya</i> @ 3%	3.98	16.74	9.04	86.67
T ₈ : Cow urine @ 3%	3.82	13.64	7.48	70.00
T ₉ : Control	3.75	13.11	7.17	66.68
S. Em±	0.12	0.49	0.15	2.06
C.D. at 5%	0.35	1.45	0.44	6.14
C.V.%	5.29	5.60	3.04	4.54

Survival percentage

Foliar application of different biostimulants and growth substances significantly influenced on survival percentage at 70 days after 2nd foliar spray. The data regarding to survival percentage are presented in table 4. Maximum survival percentage (92.20%) of kagzi lime seedling was observed in treatment GA₃ @ 100 ppm, which was statistically at par with treatment *panchgavya* @ 3% (86.67%). The lowest survival of seedling (66.68%) was recorded in control (T₉) which was at par with treatment T₈.

The survival percentage was recorded higher in GA₃ @ 100 ppm treatment is might be due the GA₃ treatment help in cell

expansion and its elongation and healthy seedlings obtained with GA₃ @ 100 ppm treatment which survive more as compare to rest of the treatments. (Khatana *et al.*, 2015) [7].

Conclusions

On the basis of results obtained from present investigation, it can be concluded that the foliar application of GA₃ @ 100 ppm which was applied at 25 and 50 DATP, enhanced seedling growth parameters *viz.* increment in number of leaves, seedling height and number of shoots. Maximum leaf area, fresh and dry weight of shoot and survival percentage of Kagzi lime seedlings were obtained in the same treatment.

References

1. Del R. A review of foliar fertilization of crops in India. *Fertil. News*. 1971;16(12):77-81.
2. Gurav AJ. Seed treatment studies in Rangpur lime. *Thesis, M.Sc. (Agri.), V.N.M.A.U., Parbhani*. (unpublished), 2004.
3. Hoda M, Mohamed ABD, El -Rahman GF, El – Rehman ME. Impact of gibberellic acid enhancing treatments on shortening time to budding of citrus nursery stocks. *J. American. Sci*. 2010;6(12):410-422.
4. Jadhav YS. Seed treatment studies in Rangpur lime. *Thesis, M.Sc. (Agri.), V.N.M.A.U., Parbhani*. (unpublished), 2003.
5. Jaiswal SB, Nainwad RV, Supekar SJ, Mane SB. Effect of growth regulators and chemicals on growth of Kagzi lime (*Citrus aurantifolia* Swingle.) Seedlings. *Int. J. Curr. Microbiol. App. Sci*. 2018;6:940-944
6. Kadam AB, Singh DB. Effect of plant growth regulators and potassium nitrate on growth of seedlings of Kagzi lime. *Asian J Hort*. 2010;5:431-434.
7. Khatana KJ, Jadav RG, Nehete DS. Influence of GA₃ on germination and growth of acid lime cv. Kagzi Lime seed (*Citrus aurantifolia* Swingle) under field as well as net house conditions. *Asian J Hort*. 2015;10(1):11-16.
8. Meshram PC, Joshi PS, Bhoyar RK, Sahoo AK. Effect of different plant growth regulators on seedling growth of acid lime. *Res. Environ. Life Sci*. 2015;8(4):725-728.
9. Panse VG, Sukhatme PV. *Statistical Methods for Agricultural Workers*, Indian Council of Agricultural Research, New Delhi, India, 1985.
10. Shanmugavelu KG. Effect of gibberellic acid on seed germination and development of seedling of some tree species. *Madras Agric. J*. 1970;57(6):311-314
11. Sharma MC, Ughreja PP, Jambukia TK. Effect of some plant growth regulators, chemicals and organic waste on germination and subsequent seedling growth of kagzi lime (*Citrus aurantifolia* Swingle). *Int. Symposium on Citriculture, (Abstracts), Nagpur, 1999*, pp.51.
12. Stowe BB, Yamaki T. The history of physiological action of the gibberellins. *Ann. Rev. Plant Physico*. 1957;8:181-216.