Original Research Article

Response of growth and yield of garlic cv. PG-18 against various plant growth regulators and mulching along with its consortium (please mention "along with its consortium" instead of "and its consortium")

ABSTRACT

An investigation was carried out to examine the effect of plant growth regulators and mulching along with their combinations on growth and yield attributes of garlic at Agriculture Farm, School of Agricultural Sciences & Technology, RIMT University, MandiGobindgarh, Punjab, India during 2019-20by using cultivar PG-18. The study comprised plant growth regulators (GA_3 25 ppm, IAA 40 ppm and NAA 60 ppm) and mulches (Black polythene mulch and Rice straw mulch) along with a control. The experiment was replicated thrice and subjected to statistical analysis by using RBD at 5% of CD. The results revealed that growth parameters i.e. plant height (56.83 cm), number of leaves/pant (8.00) and stem diameter (7.87 mm) were reported utmost with the application of BPM+GA_3 @ 25 ppm while longest leaf length (38.59 cm) and diameter of pseudo stem (4.73 cm) were measured with BPM+NAA @ 60 ppm and SM+NAA @ 60 ppm, respectively.However, maximum number of cloves/bulb (19.33),diameter of cloves (2.93 mm), clove weight (1.73 g), diameter of bulb (4.04 cm), fresh weight (29.96 g),dry weight (10.53 g),yield/plot (480.30 g) and yield/ha (70.21 q) were resulted by BPM+IAA @ 40 ppm.

Keywords:*Garlic, growth, PG-18, plant growth regulators,mulching and yield.*

INTRODUCTION

Garlic (*Allium sativum* L.) belongs to the family Alliaceae and is one of the main Allium vegetable crops known worldwide with respect to its production and economic value. India is the second largest producer of garlic in the world. In India, crop is grown in the states of Maharashtra, Himachal Pardesh, Gujarat, Andhra Pardesh, Karnataka, Punjab and Rajasthan. Garlic is consumed throughout the year by Indian people in one or other preparations [32]. It is one of the oldest cultivated vegetable and the second most widely produced Allium next to onion[13]. The primary centre of origin of garlic is Central Asia. Garlic has wide area of adaptation and cultivation throughout the world.The fresh peeled garlic cloves contain 62.8% moisture, 29% carbohydrate and 6.3% protein [21].

Plant Growth Regulators are also one of the easiest and cheapest sources to enhance the production of onion to some extent [7]. It has also been reported that foliar application of PGRs stimulates the formation of lateral buds and increases the number of cloves per bulb. The plant bio-regulators comprise of both retardants and promoters when it is used in appropriate concentration, much influence on the plant architecture in a typical form [35].Various plant growth regulators are responsible for stimulating cell division, cell elongation, auxin metabolism altering and cell wall plasticity. They are also known to enhance the source-sink relationship and stimulate the translocation of photo assimilates, thereby increasing the productivity [30]. GA_3 play a vital role to vigorous growth that promoted the total plant length of onion by 35% of the control and also increased the number of leaves, fresh and dry weight significantly [19]. Thus, the GA_3 have the promoter effect on the growth and development of bulb crops, as well as the total yield [1]. IAA plays a major role on regulating plant growth; it

controls vascular tissue development, cell elongation, and apical dominance in all the vegetable crops [41]. NAA has been reported to induce physiological efficiencies including photosynthetic ability of plants which resulted in better growth and yield of several crops [40].

Mulch provides many advantages for the user, such as higher yield, better moisture retention, reduce fertilizer leaching, decrease soil compaction, reduce weed infestation, thus offering environment friendly control of weeds [12]. One of the main objectives of using mulch is to increase soil temperature in root and bulb zone. The favourable root zone temperature promotes the uptake of water and mineral nutrients, which in turn promotes better growth of plants and biological activity in the soil. As the garlic is reproduced exclusively by vegetative means, so plant characters such as clove weight size used for propagation also affect the quality of the produce, significantly [27]. So, there is a great need to standardize the size of garlic cloves used for propagation, in order to get cost effective results in garlic production. So keeping above facts in mind the current experiment was carried out.

MATERIALS AND METHODS

A field experiment was conducted using garlic cv. PG-18" was conducted at Agriculture Farm, School of Agricultural Sciences & Technology, RIMT University, MandiGobindgarh, Punjab, during 2019-20. In this investigationthree plant growth regulators i.e. GA_3 @ 25 ppm, IAA @ 40 ppm and NAA @ 60 ppm along with straw mulch (SM)and black polythene mulch (BPM) were taken. Total 12 treatments i.e. GA_3@ 25 ppm, IAA @ 40 ppm, NAA @ 60 ppm, straw mulch, black polythene mulch, SM+GA_3@ 25 ppm, SM+IAA @ 40 ppm, SM+NAA @ 60 ppm, BPM+GA_3@ 25 ppm, BPM+IAA @ 40 ppm and BPM+NAA @ 60 ppm along with control were used for this experiment.The experiment was laid out in a factorial randomized block design with three replications. Observations on various growth and yield characters were recorded. Results thus obtained, were subjected to statistical analysis by using OPSTAST.

RESULTS AND DISCUSSION

The results obtained on growth parameters are depicted in table 1. The combine application of plant growth regulators and mulches exerted significant effect on growth of the garlic plants.The tallest plant (56.83 cm) was recorded with the application of BPM+GA_3@ 25 ppm followed by NAA @ 60 ppm (56.63 cm) and BPM (56.42 cm). While, shortest plants (46.60 cm) were noticed under control. It is revealed that the increase in the growth of garlic plants due to application of pre sowing treatment may be attributed to improvement of water absorption by the seedling and a positive influence on cell division and cell elongation[38].This result correlated with the study past worker[20] and they noticed that the application of mulching in well tilth condition was found to be the most effective and may be used in cultivation of garlic.The present findings were the corroborated with the previous findings [18].The application of BPM+GA_3@ 25 ppm resulted more umber of leaves/plant (8.00)followed by GA_3@ 25 ppm (7.83) and BPM (7.44). Whereas, control was found for lesser umber of leaves/plant (5.44).some of past worker stated that growth regulators enhanced activity of antioxidant enzymes such as ascorbate peroxidase, glutathione reductase, catalase and peroxidise which increases the number of leaves by protecting plants from a variety of stresses[8].It has reported that higher number of leaves per plant as produced by mulch treatment was possibly due to supply of optimum moisture to the growing plants [19].According to some worker, the black polyethylene having positive effect on soil temperature and the differences can be related to this characteristic [25].The longest leaf length (38.59 cm) was recorded with the application of BPM+NAA @ 60 ppmfollowed by BPM (37.84 cm) and NAA @ 60 ppm (26.48 cm). Although, shortest leaf length (19.60 cm) wasmeasured under control.This is noticed that NAA and GA_3 at

150 ppm increases the vegetative growth of onion. Earlier worker reported the positive effect of plant growth regulators on vegetative growth, yield and quality of garlic cv. G-282 under i.e. maximum length of leaf, plant height, leaf length and plant weight with the treatment of NAA @ 325 ppm followed by NAA @ 275 ppm under Iraq condition[10].The longest leaf length (5.72 cm) as produced by rice straw mulch was possibly due to higher vegetative growth as an effect of optimum moisture supply to the growing plants.Mulches conserved more soil moistures enhancing vegetative growth contributing characters [11]. This finding were in agreement with the results of former worker[5].Treatment BPM+GA_3 @ 25 ppm recorded with greater stem diameter (7.87cm)followed by NAA @ 60 ppm (7.87 cm) and BPM (7.80 cm). On the other hand, control resulted with shortest stem diameter (4.20 cm).Some scientist also reported that increase in the stem diameter was recorded under 20 ppm of NAA [9]. It has been proved that plant growth regulators and mulching is most effective in improving almost all the growth characters of onion.The current findings were corroborated with earlier results[23].The cause of increment in stem diameter by the accumulation of dry matter inside the plant stem which is due to the application of mulch [16].Treatment SM+NAA @ 60 ppm reported for more diameter of pseudo stem (4.73 mm) followed by NAA @ 60 ppm (4.68 mm) and BPM (4.62 mm). Whereas,lesser diameter of pseudo stem (3.50mm) was resulted by control.The present findings were in the line with the results of earlier worker[4, 23 and 12].

Table 2 is containing the findings on yield parameter.The application of BPM+IAA @ 40 ppm resulted more umber of colves/bulb (19.33) followed by (18.55) and IAA @ 40 ppm (16.83). Whereas, control was found for lesser umber of cloves/bulb (10.20).Some of the worker stated that growth regulators enhanced activity of antioxidant enzymes such as ascorbate peroxidase, glutathione reductase, catalase and peroxidise which increases the number of leaves by protecting plants from a variety of stresses [8]. The reported is showing that higher number of leaves per plant as produced by mulch treatment was possibly due to supply of optimum moisture to the growing plants [19]. According to [25] black polyethylene having positive effect on soil temperature and the differences can be related to this characteristic.[3and 9] reposted same findings.Large sized clove stored comparatively large amount of nutrients that helps to the development of plant immediate after emergence of seedlings [29].Due to plant used under mulch along with some growth chemicals, the best from the resulted ecological niche under weed free environment resulted in enhanced availability of all the resources to the optimal level and it could transfer more photosynthetic materials to the reproductive organs and it could increase the bulb yield with producing more number of cloves/bulb with higher weight [26].Treatment BPM+IAA @ 40 ppm recorded for more diameter of pseudo stem (2.93mm) followed by BPM (2.85 mm) and IAA @ 40 ppm (2.36 mm). Whereas, lesser diameter of pseudo stem (1.50 mm) was resulted by control.It is noticed that generally, during the maturity, plant biomass increased considerably, however it seems that GA_3 supply leads to a vigorous plant growth and yield [6]. Higher yield i.e. diameter of cloves attributes positive effect towards rice straw mulch on moisture retention, temperature regulation and weed suppression which positively contributes towards the clove attributes [20].This might be attributed due to increasing soil organic matter (grass mulch) and water efficiency by minimizing excess evaporation, regulation of temperature in causing early bulb maturity while not using mulch allowed plant to have access for adverse conditions like scarcity on water and temperature[22 and 15].Maximum clove weight (1.73 g)was weightedwith the application of BPM+IAA @ 40 ppm which was followed by BPM (1.60 g) and IAA @ 40 ppm (1.33 g). While, control recorded with lesser clove weight (0.65g).[24] reported that increased vegetative and bulb growth observed in large sized clove due to more reserve food materials that might had helped in increasing the overall yield of garlic. The result of earlier worker is showing that GA_3 stimulates both cell division and cell elongation which is responsible for increments of the cells [14].Mulch controls the weeds by smothering seedlings, prevent day light which helps foster germination from reaching which is responsible of overall accumulation of mass of cells

that leads to increasing of weight [2,33 and 23].The present findings were accordance with the results of [26].Treatment BPM+IAA @ 40 ppm recorded with greater diameter of bulb (4.06 cm) followed by BPM (3.98 cm) and NAA @ 60 ppm (3.65 cm). Though, control resulted with lower diameter of bulb (2.83 cm) [17 and 6].Black polythene mulch was also reported as statistically significant with straw mulch.The obtained findings were accordance with the line of previous results [19].This might be attributed due to increasing soil organic matter (grass mulch) and water efficiency by minimizing excess evaporation, regulation of temperature in causing early bulb maturity while not using mulch allowed plant to have access for adverse conditions like scarcity on water and temperature [12, 22and 15].Maximum fresh weight of bulb (29.96 g)was weighted with the application of BPM+IAA @ 40 ppm which was followed by BPM (29.29 g) and IAA @ 40 ppm (28.84 g). While, control recorded with lowest fresh weight of bulb (20.55 g). Past workersrevealed that enhancement in the fresh weight of bulb is might be due to the integrated effect of smallest clove size and ability of growth regulators to reduce the transpirational losses during the storage [32]. These results are in line with the findings previous scientist [31and 36].Treatment BPM+IAA @ 40 ppm recorded with highest dry weight of bulb (10.53 g) followed by BPM (10.27 g) and NAA @ 60 ppm (9.19 g). Though, control resulted with lowest dry weight of bulb of bulb (6.56 g).Similar response was also recorded byotherworkers [34].The application of black polythene mulch was also reported statistically significant with straw mulch. Same results were observed significant variation was reported due to influence of mulching on the dry weight of garlic bulbs [28 and 37].Maximum yield/plot (480.30 g)was weighted with the application of BPM+IAA @ 40 ppm which was followed by BPM (466.37 g) and IAA @ 40 ppm (461.11 g). While, control recorded with minimum yield/plot (350.80 g)[36].The results obtained under black polythene mulch was statistically significant with straw mulch. The present findings were corroborated with the findings of former worker[25 and 26].Treatment BPM+IAA @ 40 ppm resulted maximum yield/ha (70.21q)followed by BPM (68.16q) and IAA @ 40 ppm (67.40 q). Although, minimum yield/ha (55.97 q) was resulted by control.According to findings of other workersit may be stated that the maximum bulb weight, higher yield per plot and per hectare was recorded from water hyacinth because mulch plays a vital role in moisture conservation that will ultimately enhance over all yield of plant[39 and 42].

Conclusion

On the basis of above findings it may be concluded that all the growth parameters like plant height, number of leaves/plant and stem diameter were recorded with the application of BPM+GA_3 25 @ ppm while BPM+NAA @ 60 ppm excreted positive effect on leaf length and diameter of pseudo stem was significantly affected by SM+NAA @ 60 ppm. All the yield and yield attributing parameters was positively enhanced with the application ofBPM+IAA @ 40 ppm. While, all of

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REFERENCES

1. Amal M, Hegazi M. Effect of Acetylsalicylic Acid, Indole-3- Bytric Acid and Gibberellic Acid on plant growth and yield of pea (*Pisumsativum* L.). *Aus. J. of Basic and App. Sc.*2009;3(4):3514-23.
2. Amoroso G, Frangi P, Piatti R, Fini A, Ferrini F. Effect of mulching on plant and weed growth, substrate water content and temperature in container-grown giant arborvitae. *Hort. Tech.* 2010;20(6):957-62.

3. Bideshkil A, Arvin MJ. Interactive effects of methyl jasmonate and indole-3 butyric acid on growth and bio chemical parameters, bulb and allicin yield of garlic (*Allium sativum*L.) under drought stress in Iran.*Agriculture.* 2013;3(2):349-60.
4. Chattopadhyay NF, Lalrinpuii F, Thapa U. Influence of plant growth regulators on growth and yield of garlic. *J. Crop and Weed.* 2015;11(2):67-71.
5. Chung DH. Effect of polyethylene film mulching, sulphur application and different levels of nitrogen and potassium on growth, flower stalk elongation, bulbing and leaf tip yellowing of garlic (*Allium sativum* L.) cv. Enising. *Kor. Soc. of Hort. Sc.* 2011;28:1-8.
6. Daykin A, Scott IM, Francis D, Causton DR. Effects of gibberellin on the cellular dynamics of dwarf pea internode development. *Planta.* 2007;2(3):526-35.
7. Devi J, Singh R, Walia I. Effect of foliar application of GA_3 and NAA on onion. *Plant Archives.* 2018;18(2):1209-14.
8. Fletcher A, Gilley N, Davies T. Triazoles as plant growth regulators and stress protectants. *Hort. Review.* 2010;24:55-138.
9. Geetharani P, Manivannan MI, Ponnuswamy AS. Seed production of onion as influenced by the application of growth regulators and nutrients. *The Asian J. of Hor.* 2008;3(2):301-03.
10. Govind S, Maji R, Kumwat A, Pal S, Kumar S, Sahai. Improvement of growth, yield and quality of garlic. *The Bioscan.* 2015;10(1):23-27.
11. Gupta RA, Antala DK, Bhuva JV, Tomar G. Effect of mulching on onion production. Agri. Eng. Today. 2013;37(2):36-41.
12. Haque MS, Islam R, Karim MA, Khan HA. Effects of Natural and Synthetic Mulches on Garlic. *Asian J. of Plant Sc.* 2003;2:83-89.
13. Hassan AH. Improving growth and productivity of two garlic cultivars (*Allium sativum*L.) grown under sandy soil conditions. *Middle East J. Ag. Res.* 2015;4(2):332-46.
14. Hisamatsu T, Koshioka M, Kubota S, King RW. Effect of gibberellins and GA biosynthesis inhibitors on growth and flowering of stock (*Matthiolaincana*L.). *J. of Japanese Society Hort. Sc.* 2008;67:537-43.
15. Hossain AKM, Islam MJ, Khanam F, Majumber UK, Rahman MM, SaifurRahman M. Effect of mulching and fertilization on growth and yield of garlic at Dinajpur in Bangladesh. *Asian Journal of Sciences,* 2007;6(1):98-101.
16. Hossain MI, Ahmed SU, Alam KS, Rahman SL. The impact of mulches and manures on growth and yield of garlic. *Bangladesh J. of Ag. Res.* 2008;23:115-20.
17. Hye A, Haque M, Karim M. Influence of growth regulators and their time of application on yield of onion. *Pakistan J. of Biol. Sc.* 2002;5(10):1021-23.
18. Islam MA, Reza MH, Kamal S, Wazed MA, Islam KM. Effect of planting date and gibberellic acid on the growth and yield of garlic. *The Agriculturists.* 2008;6(1&2):132-39.
19. Islam MJ, Hossain AKK, Khanam F, Majumder UK. Effect of mulching and fertilization on growth and yield of garlic at Dinajpur in Bangladesh. *Asian J. of Plant Sc.* 2007;6(1):98-101.

20. Jamil M, Munir M, Qasim M, Baloch J, Rekman K. Effect of different types of mulches and their duration on the growth and yield of garlic (*Allium sativum* L.). *Int. J. of Ag. and Biol.*2005;7(4): 588-91.
21. Jatav K. Effect of fertilizer levels and organic manures on growth, yield and quality of garlic (*Allium sativum* L.) cv. G-323, M.Sc. Thesis, Jawaharlal Nehru KrishiVishwaVidyalya, Jabalpur. 2013.
22. Karaye AK, Yakubu AI. Influence of intra-row spacing and mulching on weed growth and bulb yield of garlic (*Allium sativum*).*African J. of Biotech.* 2006;5(3):260-64.
23. Karim MR, Mondal MF, Rashid MH. Effects of NPK and mulching on growth and yield of garlic. *Bangladesh J. ofAg. Sc. and Tech.* 2011;8(1&2):119-24.
24. Khanam D, Mohammad F. Effect of structurally different plant growth regulators on the concentration, yield and constituents of peppermint essential oil. *J. of Herbs Spices and Med. Plants.* 2016;23(1):1-10.
25. Lamont WJ. Plastic mulches for the production of vegetable crops. *Hort. Tech.* 2005;3:35-39.
26. Mallik S, Sharangi AB, Datta N. Herbicidal options in managing weeds towards growth and yield dynamics of single clove garlic. *Int. J. of Ag. Sc.* 2017;9(1):3627-30.
27. Memane PG, Tomar RS, Kakade DK, Kulkarni GU, Chovatia RS. Effect of clove weight and plant growth regulators on growth and yield of garlic. *Asian J. of Hort.*2008;3(1):82-86.
28. Pandey S, Tewari GS, Singh J, Rajpurohit D, Kumar G. Efficacy of mulches on soil modification, growth, production and quality of strawberry. *Indian J. of Soil and Nut.* 2016;7:813-20.
29. Rahim MA, Siddique MA, Iiossain MM Effect of time of planting mother bulb size and plant density on the yield of garlic. *Bangladesh J. of Agrl. Res.* 2008;9(2):112-18.
30. Rahman M, Haque M, Karim M. Effects of gibberellic acid (GA_3) on breaking dormancy in garlic.*Int. J. of Ag. & Biol.* 2006;2(3):1560-70.
31. Randhawa KS, Mohan S, Kooner KS. Studies on the storage of onion as affected by different chemicals. *Punjab Veg. Grower.* 2017;22:15-17.
32. Shafi MM. Onion storage in Pakistan. *J. of Agrl. Res.* 2018;16(2):188-94.
33. Shiferaw DG, Dechassa NR, Woldetsadik K, Tabor G, and Sharma JJ. Growth and nutrients content and uptake of garlic as influenced by different types of fertilizers and soils. *African J. of Ag. Res.* 2013;8(5):387-98.
34. Shukla N, Mondal S. Effect of GA_3 and NM on yield and yield attributes of onion cv. N-53. *Ag. Sc. Digest.*2005;25(4):260-262.
35. Singh H, Maji S, Kumar S. Influence of plant bio-regulators on growth and yield of garlic (*Allium sativum* L.). *Int. J. of Agrl. Sc.*2014;10(2):546-49.
36. Singh JV, Chetan S, Singh C. Studies on the storage of onion (*Allium cepa* L.) as affected by different concentrations of maleic hydrazide. *Indian J. of Agrl. Res.* 2016;32(2):81-87.
37. Soliman R. Virus disease in garlic and the production of virus-free plants. *The J. of Hort. Sc. and Biotech.* 2015;4:311-15.
38. Tiwari AN, Lal S. Effect of plant growth regulators on the growth and development of onion (*Allium Cepa* L.). *Bangladesh Hort.* 2003;3(2):11-16.

39. Uddin MA. Effect of mulching and fertilizer management practices on the growth and yield of garlic. M.Sc. Thesis, Department of Horticulture, BAU, Sabore. 2007.
40. Verma AK. Effect of NAA and thiourea on growth, yield and quality of garlic (*Allium sativum* L.). *Indian J. of Arid Hort.* 2019;13(2):94-97.
41. Wang Y, Mopper S, Hasenstein H. Effect of salinity on endogenous ABA, IAA and SA in *Iris hexagona*. *J. of Chem. Ecol.,* 2001;27:327-42.
42. Yimer O. Different mulch material on growth, performance and yield of garlic: A Review. *Int. J. of the Sc. of Food and Ag.* 2020;4(1):38-42.

Table 1: Effect of plant growth regulators and mulching along with its interaction on growth of garlic.

Treatments	Plant height (cm)	Number of leaves/plant	Leaf length (cm)	Stem diameter (cm)	Diameter of pseudo stem (mm)
Control	46.60	5.44	19.60	4.20	3.50
Plant Growth Regulators					
GA_3 @ 25 ppm	55.16	7.83	24.53	5.68	4.31
IAA @ 40 ppm	53.36	6.83	22.53	4.57	4.16
NAA @ 60 ppm	56.63	7.50	26.48	7.87	4.68
SE(m)±	0.38	0.37	0.82	0.55	0.03
CD at 5%	1.23	1.12	1.80	1.17	0.12
Mulching					
SM	54.68	7.33	35.19	4.62	4.15
BPM	56.42	7.44	37.84	7.80	4.62
SE(m)±	0.31	0.3	0.04	0.54	0.03
CD at 5%	1.70	0.9	0.13	1.08	0.10
Interaction					
SM+GA_3 @ 25 ppm	55.16	6.66	35.12	4.61	4.10
SM+IAA @ 40 ppm	52.46	6.66	34.10	4.33	3.61
SM+NAA @ 60 ppm	56.43	7.66	36.37	5.91	4.73
BPM+GA_3 @ 25 ppm	56.83	8.00	37.95	7.87	4.52
BPM+IAA @ 40 ppm	54.26	7.00	37.00	3.82	4.72
BPM+NAA @ 60 ppm	55.16	7.33	38.59	4.68	4.62
SE(m)±	0.54	0.53	0.07	0.87	0.05
CD at 5%	1.62	1.06	0.23	1.50	0.17

Table 2: Effect of plant growth regulators and mulching along with its interaction on yield of garlic.

Treatments	Number of cloves/bulb	Diameter of cloves (mm)	Clove weight (g)	Diameter of bulb (cm)	Fresh weight of bulb (g)	Dry weight of bulb (g)	Yield/plot (g)	Yield/ha (q)
Control	10.20	1.50	0.65	2.83	20.55	6.56	350.80	55.97
Plant Growth Regulators								
GA_3@ 25 ppm	16.00	2.33	1.26	3.60	28.13	9.15	439.70	64.27
IAA @ 40 ppm	16.83	2.36	1.33	3.51	28.84	9.11	461.11	67.40
NAA @ 60 ppm	15.66	2.28	1.25	3.65	28.37	9.19	453.92	66.35
SE(m)±	0.32	0.04	0.04	0.05	0.22	0.15	5.04	0.71
CD at 5%	0.96	0.12	0.06	0.15	NS	0.45	15.13	2.10
Mulching								
SM	13.77	1.80	0.96	3.19	27.60	8.04	431.61	63.09
BPM	18.55	2.85	1.60	3.98	29.29	10.27	466.37	68.16
SE(m)±	0.26	0.03	0.03	0.04	0.18	0.13	6.45	1.42
CD at 5%	0.84	0.11	0.11	0.14	0.57	0.41	19.35	4.21
Interaction								
SM+GA_3@ 25 ppm	13.66	1.83	0.96	3.26	27.26	8.03	436.30	63.78
SM+IAA @ 40 ppm	14.33	1.80	0.94	2.95	27.26	7.70	432.80	63.27
SM+NAA @ 60 ppm	18.33	1.76	1.00	3.36	27.83	8.04	445.20	65.09
BPM+GA_3@ 25 ppm	18.33	2.83	1.56	3.93	29.05	10.28	464.50	67.90
BPM+IAA @ 40 ppm	19.33	2.93	1.73	4.06	29.96	10.53	480.30	70.21
BPM+NAA @ 60 ppm	18.00	2.80	1.50	3.95	28.91	10.00	460.2	67.27
SE(m)±	0.45	0.06	0.06	0.07	0.31	0.22	8.04	1.32
CD at 5%	1.35	0.19	0.19	0.25	0.94	0.66	24.13	3.94