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Effect of NAA and micronutrients on yield and quality of litchi cv. Muzaffarpur under the Arunachal Pradesh foothill

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ABSTRACT

Synthetic NAA with different concentrations along with micronutrients (zinc and boron) were investigated on ten years old trees of litchi cv. Muzaffarpur to study their effect on yield and quality parameters of litchi during 2020-21. Results revealed that T_8 (NAA @ 25 ppm + 0.5% Borax + 0.5% Zinc sulphate) showed the maximum improvement in yield and quality of fruits, yield plant^{-1} (24.00 kg), ascorbic acid (25.70 mg 100g^{-1}), maximum TSS (18.75°Brix), total sugar (15.70%), reducing sugar (10.05%) with minimum titratable acidity (0.24%). The highest fruit diameter (2.54 cm), fruit volume (18.40 cm^3), fruit weight (20.60 g), aril weight (13.24 g) and juice content (9.20 ml) was found in treatment T_7 (NAA @ 20 ppm + 0.5% Borax + 0.5% Zinc sulphate)which was at par with T_8. Hence, the application of foliar spray with NAA @ 25 ppm + 0.5% Borax + 0.5% zinc sulphate thrice, at post emergence of new flushes, at flowering and after fruit setting has significantly increased the productivity and quality in litchi.

***Keywords*:** Litchi, micronutrients, NAA, quality, yield

Litchi is an important sub-tropical fruit that belongs to the family Sapindaceae, which has originated in south eastern China and is scattered mostly in tropical and sub-tropical regions. Botanically, litchi is nut type fruit with translucent pulp and a single seed which is popularized for its excellent quality, characteristic pleasant flavor, juicy texture, attractive colour and nutritional value. Fresh pulp has a musky flavor and when dried, it is acidic and very sweet. Its ripe fruit contains significant sources of sugars, vitamins and minerals. It can also be processed into various value added products (Singh and Kaur, 2016).The total output of litchi is produced more mainly in the litchi growing belts of Bihar, West Bengal, Uttar Pradesh, Jharkhand and Assam. Litchi has also grown to a smaller extends in states like Tripura, Orissa, Punjab, Himachal Pradesh and Nilgiri hills in the south (Kaur, 2017). Its cultivation is now being expanded in the foothills of North East states such as Manipur and Arunachal Pradesh. It fruits are considerably rich in sugar and the total sugar content varies from 6.46 to 18 % with an average of 11.85 %.The range of acidity in the fruit varies from 0.20 to 0.64 % in which malic acid is the predominant acid followed by citric, succinic, levulinic, phosphoric, glutaric, malonic and lactic acids (Singh and Singh, 1954). Muzaffarpur is one of the important cultivar of Uttar Pradesh, North Bihar, Jharkhand and Uttaranchal and it is known as "Shahi" in some areas. Fruits have medium to large size, globules-heart or obtuse in shape with red tubercles at ripening. This litchi variety is popular for having outstanding aroma and quality aril. The inflorescence in litchi is an abundantly branched panicle usually appearing terminally from the previous season growth with three different types of flowers *viz.*male type, functionally female and functionally male flowers (Anon, 2011). Production of litchi in different litchi growing regions faced the problem of low economic potential due to low fruit set, fruit drop disorder, fruit cracking disorders and inferior fruit quality. Plant growth regulators have huge scope and potential in litchi to increase flowering, fruit setting, increasing fruit maturity, ripening and improving fruit quality. Through many research it is observed that the synthetic auxin *viz*. NAA checks fruit drop and increases the fruit retention percentage of the fruits in litchi (Sultana *et al.*, 2016). Besides, micronutrients play an important character in enhancing the growth, flowering, yield and quality of litchi even though these elements are required in little quantities. Performing the metabolic activities of plants and synthesis of tryptophan which is a precursor of IAA required zinc and also Zn is related with water uptake and water retention in plant bodies (Noggle and Fritz, 1989). Besides, boron is considered important for hormone metabolism, photosynthetic

Short Communication

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activities, pollen tube germination and fertilization and its deficiency results in the production of lower number of flowers and is mostly sterile, also fruits are deformed (Yawalkar *et al.,* 1992).Taking into account the above consideration, the present experiment was started to evaluate the effect of NAA and micronutrients (zinc and boron) on yield and quality of litchi cv. Muzaffarpur under foothills condition of Arunachal Pradesh.

The present experiment was conducted during 2020-2021, on ten year old trees of litchi cv. Muzaffarpur having uniform size planted at 8 m × 8 m spacing at Fruit Research Farm, College of Horticulture and Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh. The experiment was laid out in a randomized block design (RBD) with 10 treatments and four (4) replications with one (1) plant in each replication. The details of the ten treatments were T_1 (NAA @ 10 ppm), T_2 (NAA @ 15 ppm), T_3 (NAA @ 20 ppm), T_4 (NAA @ 25 ppm), T_5 (NAA @ 10 ppm + 0.5% Borax + 0.5% Zinc sulphate), T_6 (NAA @ 15 ppm + 0.5% Borax + 0.5% Zinc sulphate), T_7 (NAA @ 20 ppm + 0.5% Borax + 0.5% Zinc sulphate), T_8 (NAA @ 25 ppm + 0.5% Borax + 0.5% Zinc sulphate), T_9 (0.5% Borax + 0.5% Zinc sulphate) and T_{10} (Control). The recommended dose of fertilizer (RDF) of litchi 1200:500:600 g NPK plant^{-1} year^{-1} was applied to all the plants under experiment in two splits doses (Anon., 2009). The first split dose of fertilizers was applied before flowering during October and the remaining half was applied after fruit setting during April. Synthetic auxin (NAA) was sprayed @ 5 litre tree^{-1} uniformly 1 week prior o micronutrient (Borax and Zinc sulphate) application (Fig. 1). Three sprays of the treatments were given in the month of November, December and April in which the first foliar spray of NAA and micronutrients was applied during November after emergence of new flushes followed by second spray during December and third spray after fruit setting during April. In each treatment plants four branches were identified randomly in the four directions of the selected tree (North, South, East and West) before the initiation of panicle formation. The observation for the number of fruits per panicle was recorded at harvest time, when the fruits were fully matured showing the maturity index of changing the colour of the peel from green to attractive red colour, flattening of tubercles and smoothness of the epicarp they were harvested, counted and the retained number of fruits per panicle at harvesting stage was recorded (Fig. 2). The quality parameters of the harvested fruits were analyzed in the laboratory with standard of AOAC (2006). The data were subjected to the statistical analysis of variance for RBD using M State software.

The effect of different concentrations of NAA and micronutrients (zinc and boron) significantly influenced the yield of litchi cv. Muzaffarpur (Table 1). The maximum yield per plant was recorded in treatment T_8 NAA @ 25 ppm + 0.5% Borax + 0.5% Zinc sulphate (24.00kg). The present investigation showed that NAA when applied in a mixture with 0.5% borax and 0.5% zinc sulphate gave remarkable effect in increasing fruit yield plant^{-1}. This may be due to the fact that Zn is required for the synthesis of tryptophan (precursor of auxin), thus aids in decreasing fruit drop. Furthermore, boron induces translocation of photosynthates from source to sink, promoting the physical attributes like fruit size and weight (Chaudhary *et al.*, 2018). A similar result was also revealed by Sahay *et al.* (2018) in litchi cv. Purbi. Further, other physical parameters of the fruit contributed to yield were also significantly increased in which optimum in fruit diameter (2.54 cm), fruit volume (18.4 cm^3), fruit weight (20.6 g), peel weight (3.77 g), aril weight (13.24 g) and juice content (9.2 ml) were found in treatment with T_7 (NAA @ 20 ppm + 0.5% borax + 0.5% zinc sulphate) and minimum values of these parameters were recorded under control. The enhancement in overall physical characters of the fruit may be due to the combine effect of NAA, borax and zinc sulphate in fruit development which plays indirectly accelerating the cell multiplication and cell extension process leading to the increasing in size and weight of fruits (Sharma and Tiwari, 2015).

Result showed a significant effect of NAA and micronutrients on quality of litchi (Table 2). The highest TSS (18.75ºBrix), total sugar (15.7%), reducing sugar (10.05%) and ascorbic acid (25.7%) with minimum titratable acidity (0.24%) were found in T_8 (NAA @ 25 ppm + 0.5% borax + 0.5% zinc sulphate). The improved in quality attributes due to NAA and micronutrients (zinc and boron) spray, may be due to their role in enhancing the leaf physiology thereby inducing faster metabolic changes of starch and pectin into soluble compounds, and also facilitating rapid translocation of sugars from leaves to the developing fruitlets. Quality parameters of the fruits were improved which may be due to the fact that application of its probably enhanced the physiology of leaves and thereby inducing faster metabolic changes of starch and pectin into soluble compounds and rapid translocation of sugars from leaves to the developing fruitlets. Significant influence of NAA and micronutrients on fruit quality was also recorded by Singh and Kaur (2016) in litchi cv. Dehradun. Similarly, the increase in ascorbic acid was due to the catalytic influence of growth regulators on biosynthesis of ascorbic acid from sugars. Tuan and Ruey (2013) has also reported on the decreasing in titratable acidity

Table 1: Yield parameters of litchi cv. Muzaffarpur for different NAA and micronutrients (Zinc and Boron) combination treatments

Treatments	Fruit length (cm)	Fruit diameter (cm)	Fruit volume (cm^3)	Fruit weight (g)	Peel weight (g)	Aril weight (g)	Juice content (ml)	Yield $plant^{-1}$(kg)
T_1	2.58	2.50	16.80	19.10	3.66	12.36	7.40	12
T_2	2.58	2.51	16.60	18.60	3.54	10.75	7.20	13
T_3	2.58	2.50	15.80	17.90	3.54	10.54	6.60	14
T_4	2.59	2.53	18.20	19.70	3.58	12.47	8.60	17
T_5	2.59	2.51	18.00	19.80	3.38	12.68	8.60	16
T_6	2.59	2.50	16.40	18.30	3.39	10.55	6.80	15
T_7	2.59	2.54	18.40	20.60	3.77	13.24	9.20	22
T_8	2.60	2.51	17.60	19.60	3.73	12.47	8.20	24
T_9	2.57	2.52	16.80	19.00	3.29	11.13	7.30	13
T_{10}(Control)	2.58	2.48	15.20	17.80	3.69	10.13	6.30	10
Mean	**2.58**	**2.51**	**16.98**	**19.04**	**3.56**	**11.63**	**7.62**	**15.6**
SEm(±)	**0.01**	**0.01**	**0.21**	**0.31**	**0.01**	**0.02**	**0.08**	**0.52**
LSD (0.05)	**NS**	**0.02**	**0.60**	**0.91**	**0.03**	**0.05**	**0.24**	**1.52**

Table 2: Quality parameters of litchi cv. Muzaffarpur for different NAA and micronutrients (Zinc and Boron) combination treatments

Treatments	Total soluble solids (°Brix)	Titratable acidity (%)	Ascorbic acid (mg $100g^{-1}$)	Total sugar (%)	Reducing sugar (%)	Non reducing sugar (%)
T_1	16.00	0.39	22.90	12.70	7.59	4.86
T_2	16.40	0.37	23.55	12.45	7.71	4.50
T_3	16.50	0.35	23.27	12.42	8.10	4.11
T_4	17.00	0.33	25.17	14.65	8.31	6.02
T_5	18.00	0.31	24.50	13.90	8.79	4.86
T_6	18.25	0.29	24.05	14.00	9.03	4.72
T_7	18.50	0.28	25.30	15.25	9.57	5.39
T_8	18.75	0.24	25.70	15.70	10.05	5.37
T_9	17.55	0.32	25.00	14.42	8.40	5.72
T_{10} (Control)	15.55	0.40	22.12	12.20	7.42	4.54
Mean	**17.25**	**0.33**	**24.16**	**13.77**	**8.50**	**5.01**
SEm(±)	**0.15**	**0.02**	**0.21**	**0.21**	**0.22**	**0.23**
LSD (0.05)	**0.45**	**0.05**	**0.62**	**0.62**	**0.64**	**0.69**

Fig. 1: Foliar spraying of NAA and micronutrients

Fig. 2: Tree at fruit maturity stage of fruit

as a result of the transformation of organic acids to sugars under treatments.The results are in the line with the findings of litchi cv. Dehradun (Singh and Kaur, 2016).

It is concluded that the foliar spray of NAA @ 25 ppm + 0.5% Borax + 0.5% Zinc sulphate thrice, at post emergence of new flushes, before flowering and after fruit setting has significantly increased yield and quality parameters in litchi under Arunachal Pradesh foothills condition.

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REFERENCES

Anonymous, 2011. Good Management Practices in Litchi. Ministry of Agriculture, Govt. of India and National Research Centre on Litchi, Mushahari, Muzaffrpur, Website: www.nrclitchi.org

AOAC 2006. In: Official Methods of Analysis of AOAC International, 18th edn (Gaithersburg, USA: Association of Official Analytical Chemists), pp. 210.

Chaudhary, M., Singh, D.P., Singh, J.P. and Mishra, K.K. 2018. Effect of foliar application of PGRs and mineral nutrients on fruiting behaviour, growth and yield of Aonla cv. NA-7. *J. Pharmacogn. Phytochem*.,**7**(4): 2714-2718.

Noggle, G.R. and Fritz, G.T. 1989. In: Introductory Plant Physiology. Prentice Hall of India Private Limited Publication, New Delhi, pp. 4.

Sahay, S., Kumari, P., Mishra, P.K., Rashmi, K., Shrivastava, P., Ahmad, M.F. and Kumar, R. 2018. Pre-harvest foliar spray of micronutrients and growth regulators on yield attributes of litchi (*Litchi chinensis*Sonn.) cv. Purbi. *Acta Hortic.*, **1211**: 141-144.

Sharma, R. and Tiwari, R. 2015. Effect of growth regulator sprays on growth, yield and quality of guava under Malwa plateau conditions. *Ann. Plant Soil Res.*, **17**(3): 287-291.

Singh, L.B. and Singh, U.P. 1954. In: The text book of The Lychee. Superintendent printing and stationary, Uttar Pradesh, India, pp. 14-22.

Singh, N. and Kaur, A. 2016. Response of quality attributes of litchi cv. Dehradun to foliar application of zinc and boron. *Int. J. Adv. Res.*, **4**(10): 339-342.

Sultana, S., Das ,G., Das, B. and Rudra, B.C. 2016. Evaluation of various plant growth regulators in flower and fruit setting of litchi. *Int. J. Green Pharm*., **10**(4): 1-3.

Tuan, N.M. and Ruey, Y.C. 2013. Effect of gibberellic acid and 2, 4-dichlorophenoxyacetic acid on fruit development and fruit quality of wax apple. *Int. J. Biol. Biomol. Agric. Food Biotechnol. Eng*., **7**(5): 299-305.

Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 1992. In: Manures and Fertilizers, 7th edition. Agri-Horticultural Publishing House, 52, Bajaj nagar, Nagpur- 440010 India, p. 20