Biological Forum – An International Journal **14(4): 271-275(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of GA_3, Zinc Sulphate and Borax on Fruit Drop, Fruit Cracking Length of Fruit, Fruit Diameter, Weight of Fruits and Weight of Pulp, of Litchi Cultivar Dehradun

Ajey Pratap Singh, Viveka Nand*, Dipankar Singh Badal, Pradeep Kumar and Anand Singh Rawat
Research Scholar, Department of Fruit Science (Horticulture),
C.S. Azad University of Agri. & Technology, Kanpur (Uttar Pradesh), India.

(Corresponding author: Viveka Nand)*
(Received 07 August 2022, Accepted 29 September, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The present investigation entitled "Effect of GA_3, zinc sulphate and borax on fruit drop and fruit cracking of litchi (*Litchi chinensis* Sonn.) *cv.* Dehradun" was carried out at garden, Department of Horticulture, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur during the year 2019. During studied seven uniform plants of litchi *cv.* Dehradun formed the experimental material, four uniform branches in growth and vigour were selected on each tree. The following observations were recorded randomly selected samples of ten fruits from each treatments and three replications. The different treatments used were control (water spray), GA_3 25 ppm, GA_3 50 ppm, $ZnSO_4$ 0.2%, $ZnSO_4$ 0.4% and Borax 0.2%, Borax 0.4%. The experiment was planned in a Completely Randomized Design with four replications. The minimum fruit drop percentage was obtained under spray of GA_3 25 ppm followed by Borax 0.4%. The foliar application of Borax 0.4% exhibited reduction in cracking of litchi fruits (9.45%) as compared with control (16.15%) followed by Borax 0.2%.

Keywords: Litchi, quality, fruit cracking, Boron, Zinc and Gibberellic acid.

INTRODUCTION

Litchi (*Litchi chinensis* Sonn.) is a subtropical evergreen fruit tree of family Sapindaceae having chromosome number 2n=30. It is one of the most relished fruits by virtue of its color and distinct taste. It is native to South China and South- Eastern Asia, and has been widely cultivated for its prized fruit even before 1766 B.C. (Mitra, 2004). The litchi fruit consists of about 60 percent juice, 8 per cent rag, 19 per cent seed and 13 per cent skin which varies depending upon cultivar and climatic conditions under which it is grown. Nutritional value of litchi per 100 g fresh weight contains 84 g water, protein 0.7 g, carbohydrates 15 g, thiamine 0.02 mg, niacin 1.1 mg, riboflavin 0.07 mg, phosphorous 32 mg, iron 0.7 mg and calcium 4 mg. But, inspite of the availability of different types of fruit in the market, the demand for fresh litchi is always very high due to its unique taste, flavour and colour (Hossain *et al*., 2014). Because of explicit climatic prerequisites, the successful cultivation of litchi is limited to very few nations of the world. India and China account for 91 per cent of the world's litchi production. India is the second-biggest producer of litchi next to China. Besides China and India, other significant litchi growing nations are West Indies, Brazil, Honduras, Hawaii, Madagascar, Southern Japan, Spain, Mexico, North-Eastern Australia, Southern United States, Israel, Thailand, New Zealand, Mauritius, Taiwan, Burma, Bangladesh, and Nepal. India is the second-largest producer with 94000 hectares of area under litchi cultivation, where its yearly production is 7.10 lakh tonnes and productivity is 6.1 tonnes per hectare (NHB, 2018). In India wide spread deficiency of micronutrients specially zinc, boron in horticultural crops has been reported. There are report from different part of the country on the occurrence of deficiency of these micro elements especially zinc, boron and it appears that the problem is very much wide spread all over India particularly in north India, where litchi varieties can be seen exhibiting cracking due to one or the other nutritional disorder. Boron is another micro nutrient whose deficiency affects many crops. It is concerned with flowering and fruiting processes, pollen germination, cell division and metabolism of carbohydrates. It affects water relation in plants and is involved with the translocation of sugar in plants. Boron is necessary element in the maintenance of

conducting tissues and it regulates other elements as well (Dixit *et al.*, 2013).

Gibberellin has mainly used for manipulating many physiological events and are commercially used to improve the quality of fruits in crops like grapes, citrus, apples, litchi etc. In grape it has manipulated three physiological events *i.e.* rachis cell elongation, flower thinning and berry enlargement. The effect of delayed fruit senescence by GA_3 and also been exploited in the citrus and more recent results suggest that GA_3 may promote flowering in apple (Munish *et al.*, 2003). Fruit cracking is universal problem of a number of fruits such as litchi, citrus, grapes, date palm, pomegranate, cherry and losses due to this malady are some times as high as 75 %. Alternate spells of humid conditions and dry heat in summer months are mainly responsible for cracking and dropping of the fruits in litchi (Yadav *et al.*, 2011). The cracked fruits rot quickly and are not worth marketing. The splitting and cracking of fruits also takes place during its fruiting season when extremely dry and desiccating winds blow the problem of cracking is considered to be the main stumbling block in expansion of litchi cultivation. Besides cracking considerable losses also occur due to sunburn. Temperature higher than 38°C in combination with relative humidity lower than 60% was very favourable for cracking of litchi and causes 10-25% crop loss (Mitra *et al.*, 2014). It is also reported that growth substances like Gibberellic acid, NAA and CPPU have great influence on litchi. Hota *et al.* (2017 a, b, c, d, e and f).

MATERIALS AND METHODS

The present experiment was conducted to study the effect of GA_3, Zinc sulphate and Borax on fruit drop, fruit cracking and quality of litchi fruit. The climatic condition under which the present investigations were carried out and the details of techniques adopted, materials used and methods employed are described below. The present experiment was conducted to study the effect of GA_3, Zinc sulphate and Borax on fruit drop, fruit cracking and quality of litchi fruit.

Experimental details. The well-established healthy and uniform trees of litchi cultivar Dehradun were selected for the purpose of the experimentation. The trees were about 15 years old but properly maintained. During the course of the investigation the whole of the orchard was kept under clean and uniform cultivation. The plant growth regulator and mineral nutrients were sprayed on the tree. The detailed technical programme of the study is given below –

Experimental material. Seven uniform plants of litchi *cv.* Dehradun formed the experimental material, four uniform branches in growth and vigor were selected on each tree.

Preparation of solution. The solution of GA_3 (25ppm) was prepared by dissolving 25 mg GA_3 in small quantity of alcohol. The volume was made up to 1000ml by adding distilled water. Similarly 50 ppm GA_3 solution was also prepared.

The solution of $ZnSO_4$ (0.2%) was prepared by dissolving 20g $ZnSO_4$ in 10 liters of distilled water. Similarly the solution of $ZnSO_4$ 0.4% was prepared by dissolving 40g $ZnSO_4$ in 10 liters of distilled water.

The solution of Borax (0.2%) was prepared by dissolving 20g borax in 10 liters of distilled water. Similarly, the solution of borax 0.4% was prepared by dissolving 40g borax in 10 liters of distilled water.

Schedule of foliar spray. The spray was done at the pea stage *i.e.*, on 28.03.2019 with a sprayer having very fine nozzle. Care was taken to give uniform spray all over the branch.

Techniques adopted for recording observation

fruit drop (%). To study the fruit drop the number of the fruit per panicle was counted at the time of spray of chemicals and number of fruits retained at the time of harvesting and percent fruit drop was calculated with the help of following formula.

$$\text{Fruit drop (\%)} = \frac{\text{Number of fruits at initial stage} - \text{Number of fruits at the time of harvesting}}{\text{Number of fruits at initial stage}} \times 100$$

Fruit cracking. Number of fruits cracked was noted and per cent fruit cracking was worked out.

RESULT AND DISCUSSION

The present investigation entitled "Effect of GA_3, Zinc sulphate and Borax on fruit drop and fruit cracking of litchi (*Litchi chinensis* Sonn.) *cv.* Dehradun" was carried out during the year 2019. The data were statistically analyzed and are presented in tabular form as detailed below.

Fruit Drop, Fruit Cracking, Length of fruit (cm). It is clear that fruit drop per cent was controlled significantly by all treatments of GA_3, $ZnSO_4$ and Borax over control. Minimum fruit drop (64.80%) was observed in treatment T_1 (GA_3 25ppm) followed by treatment T_6 Borax 0.4% (64.85%) while maximum fruit drop (74.55%) was observed in treatment T_0 (control). $ZnSO_4$ 0.4% has been found numerically better for controlling fruit drop (71.80%) than $ZnSO_4$ 0.2% (73.15%) but did not differ significantly with each other. Higher concentration of Borax (*i.e.*, 0.4%) gave significantly better control for fruit drop (64.85%) than lower concentration of Borax (*i.e.*, 0.2%), (70.80% fruit drop). Treatments T_1 and T_6 were found non-significant with each other. All the treatments were significantly better in controlling fruit drop against control except treatment T_3 ($ZnSO_4$ 0.2%). This studied supported by Bhoyar and Ramdevputra (2016) in guava, Sankar *et al.* (2013) in mango, Singh *et al.*, (1999) and Naresh Babu *et al.*, (2001) in litchi have also reported check in fruit

drop and increase in fruit retention with the use of plant growth regulators and mineral nutrients.

A perusal of data presented clearly indicates that the fruit cracking was significantly controlled by the application of plant regulator and mineral nutrients. The minimum fruit cracking (9.45%) was recorded under treatment T_6 with borax (0.4%) followed by treatment T_5 Borax (0.2%) while maximum cracking (16.15%) was observed under T_0 control. $ZnSO_4$ (0.4%) has been found better for controlling (11.25%) than $ZnSO_4$ 0.2% (12.15%). Similarly higher concentration of GA_3 (50ppm) give better control for fruit cracking (13.60%) than lower concentration of GA_3 (25ppm) is 14.90%. Treatment *viz.* T_0, T_2, T_4, T_6 were found significant with each other whereas treatment *viz.*, T_1, T_2, T_3, T_4 and T_5, T_6 were found statistically at par with each other. Higher and lower concentration of GA_3, $ZnSO_4$ and Borax did not differ with each other. This studied supported by Rathore *et al.* (2009); Banyal and Rangra (2011); Kumar *et al.* (2001); Sinha *et al.* (1999) in litchi.

It is obvious from the data summarized that length of fruit was significantly increased by plant regulator and mineral nutrients as compared to control. The maximum length of fruit (4.21cm) was found in treatment number T_6 (Borax 0.4%) followed by T_2 GA_3 50ppm (4.05cm) and T_4 $ZnSO_4$ 0.4% (3.79cm) and minimum length of fruit 3.05cm was recorded under treatment T_0 (Control). Treatment T_6, was found significantly better than rest all the treatments. Whereas treatment *viz.* T_1, T_5 were found non-significant with each other. These results are in accordance with these of Gurjar *et al.* (2015) in mango, Yadav *et al.* (2015) in peach, Venu *et al.* (2014) in acid lime.

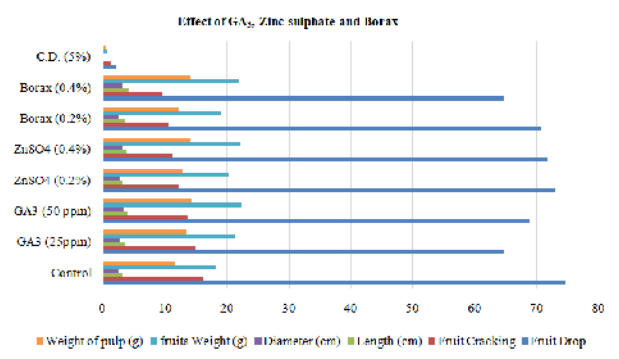
Diameter (cm), Weight of fruits (g), Weight of pulp (g). A perusal data clearly indicates that diameter of fruits was significantly affected by all the treatment of plant regulator and mineral nutrients over control. The maximum diameter of fruit (3.41cm) was recorded under GA_3 (50ppm) followed by $ZnSO_4$ 0.4%, (3.26cm) and Borax 0.4%, (3.13cm) while minimum fruit diameter (2.45cm) was observed under control. All the treatments differed significantly with each other. These results are in accordance with these of Jagtap *et al.* (2013) in acid lime, Goswami *et al.* (2012) in guava.

Data presented indicated that all the treatments significantly increased the fruit weight as compared to control. The maximum fruit weight (22.43 g) was recorded under GA_3 (50ppm) followed by $ZnSO_4$ 0.4% (22.30 g) and Borax 0.4% (21.95 g). Treatments T_2, T_4, T_6 were found non-significant with each other. Significantly minimum fruit weight was recorded in control (18.27g). These results are in conformity with Chandra and Singh (2015) in aonla, Gurjar *et al.* (2015) in mango, Laila *et al.* (2014) in olive, Banyal *et al.* (2013) in litchi.

It is clear that all the treatment significantly increased the pulp weight as compared to control. Maximum pulp weight (14.29g) was recorded under GA_3 (50ppm) followed by $ZnSO_4$ 0.4% (14.21g) and Borax 0.4% (13.98g). The minimum pulp weight (11.64g) was obtained under control. Treatments T_1, T_6, T_2, T_4 stood statistically at par. These results are in concurrence with Sarkar and Ghosh (2009) in litchi, Katiyar *et al.* (2008) in litchi, Venu *et al.* (2014) in acid lime.

Table 1: Effect of GA_3, Zinc sulphate and Borax on fruit drop, fruit cracking, Length of fruit, fruit Diameter, Weight of fruits and Weight of pulp, of litchi cultivar Dehradun.

Treatment	Fruit Drop	Fruit Cracking	Length (cm)	Diameter (cm)	fruits Weight (g)	Weight of pulp (g)
Control	74.55	16.15	3.05	2.45	18.27	11.64
GA_3 (25ppm)	64.80	14.90	3.60	2.85	21.25	13.54
GA_3 (50 ppm)	68.75	13.60	4.05	3.41	22.43	14.29
$ZnSO_4$ (0.2%)	73.15	12.15	3.16	2.73	20.36	12.97
$ZnSO_4$ (0.4%)	71.80	11.25	3.79	3.26	22.30	14.21
Borax (0.2%)	70.80	10.60	3.51	2.56	19.10	12.17
Borax (0.4%)	64.85	09.45	4.21	3.13	21.95	13.98
C.D. (5%)	2.065	1.3618	0.0908	0.0744	0.5765	0.5175



CONCLUSION

On the basis of sprays of plant growth regulators and mineral nutrients *i.e.*, GA_3, $ZnSO_4$ and Borax which influenced different parameters including in this research trial. The foliar application of Borax 0.4 per cent proved most effective and optimum for fruit cracking, length of fruit of litchi fruit *cv.* Dehradun. The second effective treatment GA_3 50 ppm was identifies in present investigation for diameter of fruit, fruit weight, pulp weight.

Conflict of Interest. None.

REFERENCES

Banyal, A. K. and Rangra, A. K. (2011). Response of yield and quality attributes of litchi *cv.* Dehradun to soil and foliar application of boron. *Journal of Hill Agriculture*, *2*(1): 33–37.

Banyal, A. K., Sharma, U. and Thakur, J. (2013). Effect of different chemicals and mulch materials on fruit quality and productivity of litchi *cv.* Dehradun. *Progressive Research*, *8*(2): 254–256.

Bhoyar, M. G. and Ramdevputra, M. V. (2016). Effect of foliar spray of zinc, iron and boron on the growth, yield and sensory characters of guava (*Psidium guajava* L.) *cv.* Sardar L-49. *Journal of Applied and Natural Science*, *8*(2): 701–704.

Chandra, R. and Singh, K. K. (2015). Foliar application of zinc sulphate, magnesium sulphate and copper sulphate on the yield and quality of aonla (*Emblica officinallis* Gaerth L.) *cv.* NA-7 under Garhwal Himalayas. *Journal of Medicinal Plants Studies*, *3*(5): 42-45.

Dixit, A., Shaw, S. S. and Pal, V. (2013). Effect of micronutrients and plant growth regulators on fruiting of litchi. *Horticulture Flora Research Spectrum*, *2*(1): 77–80.

Goswami, A. K., Shukla, H. S., Kumar, P. and Mishra, D. S. (2012). Effect of pre-harvest application of micro-nutrients on quality of guava (*Psidium guajava* L.). *Horticulture Flora Research Spectrum*, *1*(1): 60-63.

Gurjar, T. D., Patel, N. L., Panchal, B. and Chaudhari, D. (2015). Effect of foliar spray of micronutrients on flowering and fruiting of Alphonso mango (*Mangifera indica* L.). *The Bioscan*, *10*(3): 1053-1056.

Hossain, M. M., Hossain, M. S., and Islam, M. M. (2014). Fruit setting, cracking and quality of litchi as influenced by foliar spray of different nutrient solutions during fruit growth and development. *Journal of Agricultural Technology*, *10*(3): 717-731.

Hota, D., Sharma, D. P., and Bhoyar, M. G. (2017b). Analysis of vegetative growth by spraying of forchlorfenuron and N-acetyl thiazolidine 4-carboxylic acid on of apricot (*Prunus armeniaca* L.) cv. New Castle. *International Journal of Chemical Studies*, *5*(5), 2182–2185.

Hota, D., Sharma, D. P., Prasad, H., Chauhan, A., (2017f). Effect of Forchlorfenuron and N-Acetyl Thiazolidine 4-Carboxylic Acid on physico-chemical parameter of Apricot (*Prunus armeniaca* L.) cv. New Castle. *Bulletin of Environment, Pharmacology and Life Sciences*, *6*(5), 224–228.

Hota, D., Sharma, D. P., and Sharma, N. (2017a). Effect of Forchlorfenuron and N-Acetyl Thiazolidine 4-Carboxylic Acid on vegetative growth and fruit set of Apricot (*Prunus armeniaca* L.) cv. New Castle. *Journal of Pharmacognosy and Phytochemistry*, *6*(2), 279–282.

Hota, D., Sharma, D. P., Sharma, N., Mishra, G., Solanki, S. P. S., and Priyadarshi, V. (2017c). Effect of forchlorfenuron and N-Acetyl thiazolidine 4-carboxylic acid on size and yield of apricot (*Prunus armeniaca* L.) cv. New Castle. *International Journal of Current Microbiology and Applied Sciences*, *6*(9), 1852–1860.

Hota, D., Sharma, D. P., Sharma, S., and Singh, N. (2017d). Effect of forchlorfenuron and n-acetyl thiazolidine 4-carboxylic acid on physical parameter of apricot (*Prunus armeniaca* L.) cv. new castle. *Chemical Science Review and Letters*, *6*(24), 2408–2412.

Hota, D., Sharma, D. P., and Singh, N. (2017e). Effect of Forchlorfenuron and N-Acetyl Thiazolidine 4-Carboxylic Acid on Fruit Drop of Apricot (*Prunus armeniaca* L.) cv. New Castle. *International Journal of Pure & Applied Bioscience*, *5*(5), 1123–1127.

Jagtap, V. M., Patel, H. C., Nehete, D. S. and Godage, S. S. (2013). Effect of foliar application of plant growth regulators and micronutrients on yield and quality of acid lime *cv.* Kagzi (*Citrus aurantifolia* Swingle). *Asian Journal Horticulture*, *8*(1): 57-59.

Katiyar, P. N., Prakash, O., Singh, J. P. and Singh, P. C. (2008). Effect of zinc sulphate, borax and calcium nitrate on flowering, fruiting, yield and quality of Litchi *cv.* Dehradun. *Journal of Rural and Agricultural Research*, *8*(2): 49-51.

Kumar, A., Singh, C., Ral, M. and Ranjan, R. (2001). Effect of irrigation, calcium and boron on fruit cracking in litchi *cv*. Shahi. *Orissa Journal of Horticulture*, *29*(1): 55–57.

Laila, Hagagg, F., Abd El-Migeed, M. M., Attia, M. F., Shahin, M. F. M., Merwad, M. A. and Genaidy, E. A. E. (2014). Impact of foliar application of zinc sulphat and gibbralic acid on fruit quality and quantity of Kallamata olives. *Middle-East Journal of Agriculture Research*, *3*(4): 745-750.

Mitra, S. K., Dutta Ray, S. K. and Mandal, D. (2014). Control of fruit cracking and sun-burning in litchi by irrigation and moisture conservation. *Acta Horticulturae*, *1024*: 177–181.

Mitra, S. K. (2004). Sustainable litchi (*Litchi chinensis* Sonn.) production in West Bengal. *Acta Horticulturae, 632:* 209-212.

Munish, A., Kahlon, P. S. and Mahajan, B. V. C. (2003). Effect of exogenous application of growth regulators on fruit drop, cracking and quality of litchi (*Litchi chinensis* Sonn.) *cv.* Dehradun *Agricultural Science Digest.*, *23*(1): 191–194.

Naresh, B. and Singh, A. R. (2002). Effect of micro nutrients spray on fruit cracking and fruit maturity in litchi. *Indian Agriculture*, *46*(3/4): 203–207.

National Horticulture Board (2019). Indian Horticulture Database, Gurgaon, Haryana.

Rathore, N., Mishra, N. K., Lal, R. L. and Mishra, D. S. (2009). Effect of foliar application of nutrients on yield and quality of litchi *cv.* Rose Scented. *Indian Journal of Horticulture*, *66*(4): 524–525.

Sankar, C., Saraladevi, D. and Parthiban, S. (2013). Influence of pre-harvest foliar application of micronutrients and sorbitol on pollination, fruit set, fruit drop and yield in mango (*Mangifera indica* L.) *cv.* Alphonso. *Asian Journal of Horticulture*, *8*(2): 635-640.

Sarkar, A. and Ghosh, B. (2009). Effect of application of micro nutrients on retention yield and quality of fruit in litchi *cv.* Bombai. *Environment and Ecology*, *27*(1): 89-91.

Singh, R. P., Sharma, Y. P. and Awasthi, R. P. (1999). Influence of different cultural practices on pre-mature fruit cracking of pomegranate. *Progressive Research*, *22*(1-4): 92–96.

Sinha, A. K., Singh, L. and Jain, B. P. (1999). Effect micro nutrients and growth regulators on yield and quality of litchi (*Litchi chinensis Sonn.*). *Journal of Research Birsa Agriculture University Nottingham*, *11*(1): 45–48.

Venu, A., Delvadia, D. V., Sharma, L. K., Gardwal, P. C. and Makhmale, S. (2014). Effect of micronutrient application on flowering, fruiting and yield of acid lime (*Citus aurantifolia* L.) *cv.* Kagzi lime. *International Journal of Therapy Appl*., *32*(1): 3-4.

Yadav, P., Lal, R. L. and Pandey, C. (2011). Effect of different levels of fertigation on yield, quality and leaf nutrient status of litchi (*Litchi chinensis* Sonn*.) cv.* Rose Scented. *Progressive Horticulture*, *43*(2): 276–280.

Yadav, V., Singh, P. N. and Chakraborty, B. (2015). Response of foliar fertilization of micronutrients on fruit growth and yield in low-chill peach *cv.* Sharbati. *Progressive Horticulture*, *47*(1): 43-47.

How to cite this article: Ajey Pratap Singh, Viveka Nand, Dipankar Singh Badal, Pradeep Kumar and Anand Singh Rawat (2022). Effect of GA_3, Zinc Sulphate and Borax on Fruit Drop, Fruit Cracking Length of Fruit, Fruit Diameter, Weight of Fruits and Weight of Pulp, of Litchi Cultivar Dehradun. *Biological Forum – An International Journal*, *14*(4): 271-275.