HortFlora Research Spectrum, 2(1): 77-80 (Jan.-March 2013) ISSN : 2250-2823

EFFECT OF MICRONUTRIENTS AND PLANT GROWTH REGULATORS ON FRUITING OF LITCHI

Amit Dixit*, S.S. Shaw and Virendra Pal[1]

Department of Horticulture, College of Agriculture, Indira Gandhi Krishi Vishwavidayalaya, Raipur

[1]Krishi Vigyan Kendra, Bagpat (S.V.P. Univ. of Agri. & Tech., Meerut)

**E-mail: amitdixit1872@yahoo.com*

ABSTRACT: The present investigation was conducted in the litchi orchard of the Farm Area of R.M.D., College of Ambikapur in the year 2007 to 2009 to assess the effect of micronutrients and growth regulators on fruiting in Litchi cv. Ambika Litchi -1. The application of borax 0.4 per cent resulted in maximum fruit set (41.20%), fruit retention (22.60%), size of fruit (4.10 cm × 3.10 cm), number of fruits per tree (4625), weight of individual fruit (21.05 g) and fruit yield (92.85 kg/tree). GA_3 10 ppm also was found effective treatment to increase fruit set, fruit retention and size of fruit. GA_3 20 ppm produce maximum number of fruit/tree and yield. Interaction between borax 0.4 per cent and GA_3 20 ppm exhibited in maximum retention of fruit and fruit yield. Maximum fruit cracking of 13 per cent was observed in borax 0.4 per cent.

Horticultural products in general and fruits in particular are premier commodities of export. Amongst fruit crops, litchi (*Litchi chinensis* Sonn.) occupies prime place of importance. So far as export of agricultural products is concerned by virtue of its delicious taste, excellent flavour, pleasant fragrance, attractive appearance and high nutritional values, it has popularity in many parts of the world opening up new vistas for accelerated export opportunity. However, to stay in global market which is turning more competitive day by day, it is of paramount important to maintain high standard in the qualities of fruits produced. Besides imparting fascinating appearance to them and providing longer shelf life. From economic point of view, it is equally important to get a good harvest, besides having improvement in quality aspect.

Zinc plays a vital role in the metabolic activities of plant. The principle functions of zinc in plant are as a metal activator of enzymes like dehydrogenase (pyridine nucleotide, glucose-6 phosphodiesterase, carbonic anhydrase etc.). It is involved in the synthesis of tryptophane, a precursor of IAA, it is associated with water uptake and water retention in plant bodies (Noggle and Fritz, 4). Boron, on the other hand is considered to be necessary for hormone metabolism, photosynthetic activities, cellular differentiation and water absorption in plant parts. It is also involved in reproduction, germination of pollen tube and fertilization. In case of boron deficiency, flowers are produced least and more sterile, fruits are deformed and render themselves commercially useless (Yawalkar *et al.,* 8)

The effect of micronutrients in augmenting litchi yield and quality is a foregone conclusion, but the beneficial effect of micronutrients in combination with plant growth regulators was yet to be fully explored. This paves and path for the current experimentation.

MATERIALS AND METHODS

The experiment was conducted in Horticultural farm of Raj Mohini Devi College of Agriculture and Research Station, Ambikapur during 2007 to 09. The climate of the region is subtropical with an annual rainfall of 1300-1400 mm. The soil of the experiment plot was medium loam of average fertility and well drained. Two micronutrients ($ZnSO_4$ and borax) and two plant growth regulators (2, 4-D and GA_3) each at their two lower and higher levels $ZnSO_4$ at 0.4 per cent (M_1) and 0.8 per cent (M_2); Borax at 0.2 per cent (M_3) and 0.4 per cent (M_4) and 2,4-D at 10 ppm (P_1) and 20 ppm (P_2) and GA_3 also at 10 ppm (P_3) and 20 ppm (P_4) spray were tested in Randomized Block Design (Factorial) replicated thrice. One control

Received : 15.12.2012 *Accepted : 13.1.2013*

plot was also there in each replication for making effective comparison. Macronutrients were sprayed on new growth flushes before initiation of inflorescence, whereas, PGRs were sprayed after completion of fruit setting. The litchi variety used for experimentation was Ambika Litchi-1. The litchi trees were 7.62 m apart in both direction *i.e.,* between the rows and within rows having an average height of 7.1 m. The fertility status as envisaged through the status of available N (294.8 kg), P_2O_5 (23.8 kg) and K_2O (203.5 kg) was in the medium range having soil reaction in the acidic range pH 6.5.

RESULTS AND DISCUSSION

The micronutrients in general were effective in increasing fruit setting significantly in compression to control (Table 1). Except 0.8% $ZnSO_4$ (M_2) and 20 ppm 2,4-D (P_2), all the concentrations of $ZnSO_4$ and borax significantly increased fruit setting in litchi. Amongst the micronutrients, Borax 0.4% (M_4) exhibited the highest fruit setting (41.2%), but had statistical parity with 0.4% $ZnSO_4$ (M_1) and 0.2% borax (M_3). All the four treatments pertaining to PGR application showed statistical equality amongst themselves in increasing fruit setting in litchi. The results are in consonance with Mishra *et al.* (3). Fruit retention also increased due to micronutrients and PGR and fruit cracking reduced significantly as compared to control. Amongst the micronutrients, borax 0.4% was the most effective in increasing fruit retention and reducing fruit cracking. Amongst the PGRs, GA_3 20 ppm had significantly the least fruit cracking. Fruit retention was also the maximum in 20 ppm GA_3, but it was statistically alike to those under 10 ppm 2,4-D and 10 ppm, GA_3. It was only 20 ppm 2,4-D which exhibited lower fruit retention. According to the main effect of micronutrients and plant growth regulators 0.4% borax (M_4) had significantly the maximum fruit retention percentage. However, as per M x P interaction (Table 2), the 0.4% borax (M_4) was significantly superior to all other micronutrient and their varying strengths only when 20 ppm GA_3 was in comparison under all other situations of PGR application it had statistical parity with 0.4% $ZnSO_4$ and 0.2% borax, if 10 ppm 2,4-D was applied. Like wise it was at par with 0.4% $ZnSO_4$ and 0.2% borax, if 10 ppm 2,4-D sprayed. Similarly, when 10 ppm GA_3 was applied, 0.4% borax was comparable with 0.2% borax and 0.4% $ZnSO_4$.

Length and diameter of fruit were the maximum under 0.4% borax application. However, diameter of fruit under 0.4% $ZnSO_4$ was also comparable. The beneficial effect of micronutrients and PGRs can be explained on the basis of their role in plant physiology and plant metabolism. The mechanism of action of zinc may be through auxin stimulation. Zinc is involved in synthesis of tryptophan, a precursor of NAA. A number of workers have been reported that heavy drop at early stage was due to the formation of abscission layer. The cell at or near the abscission zone gets reduced and either disintegrates or dissolves resulting separation of fruit from the stock. The formation of abscission layer is associated with presence of weak auxin gradients in fruit. The increase in fruit set and fruit retention due to borax application may be ascribed to its beneficial effect on reproduction, germination of pollen tube and fertilization process. 2, 4-D itself functions as an auxin former in its lower concentration. Thus, all these chemicals ultimately help in cell division, cell elongation, cell enlargement and in reduction of abscission layer (Salisbury and Ross, 6). Comparatively less effectiveness of higher concentration of zinc may be attributed to it scorching effect on the juvenile inflorescence. Similarly, subdued impact of higher concentration of 2, 4-D (20 ppm) may be due to showing up of inherent herbicidal effect of the chemical for which it is primarily known (Yawalkar *et al.,* 8). Uptake of water and solutes are governed by the presence of zinc and other micronutrients. In case of enhanced water uptake, solutes accumulated in the fruits and minimize the pressure on the skin resulting in less cracking. Auxin simulation both due to 2,4-D and GA_3 might be the reason for the accumulation of building block at

Table 1: Effect of micronutrients and PGRs on fruit set, fruit retention, cracking and size of litchi fruit.

Treatments	Fruit set (%)	Fruit retention (%)	Cracking of fruit (%)	Length of fruit (cm)	Diameter of fruit (cm)
M_1-$ZnSO_4$ (0.4%)	40.80	20.40	14.10	3.80	2.90
M_2-$ZnSO_4$ (0.8%)	38.10	18.30	13.80	3.70	2.80
M_3-Borax (0.2%)	40.10	20.80	13.20	3.60	2.85
M_4-Borax (0.4%)	41.20	22.60	13.00	4.10	3.10
C.D. (P=0.05)	1.3	.610	0.36	0.08	0.076
P_1 2, 4-D (10 ppm)	41.38	20.10	13.90	3.90	2.80
P_2 2,4-D (20 ppm)	40.10	19.10	13.10	3.60	2.65
P_3 GA_3 (10 ppm)	41.10	21.10	12.90	3.65	2.85
P_4 GA_4 (20 ppm)	40.80	21.40	12.10	3.60	3.00
C.D. (P=0.05)	0.682	0.320	0.067	0.078	0.084

Table 2: Fruit retention percentage as influenced by micronutrients PGRs interaction.

Plant Growth Regulators	2,4-D 10 ppm (P_1)	2,4-D 20 ppm (P_2)	GA_3 10 ppm (P_3)	GA_3 20 ppm (P_4)	Mean
M_1-$ZnSO_4$ (0.4%)	23.10	22.23	22.85	23.85	23.22
M_2-$ZnSO_4$ (0.8%)	21.20	20.10	21.85	20.10	20.81
M_3-Borax (0.2%)	22.85	21.25	22.65	22.10	22.81
M_4-Borax (0.4%)	23.15	21.85	22.65	23.20	22.71
Mean	22.57	21.35	22.5	22.31	

C.D. (P=0.05) M × P 1.25

Table 3: Effect of micronutrients and PGRs on yield parameters litchi.

Treatments	No. of fruits per tree	Weight of individual fruit (g)	Fruit yield (kg/tree)
M_1-$ZnSO_4$ (0.4%)	4524	20.80	90.15
M_2-$ZnSO_4$ (0.8%)	4415	18.10	80.25
M_3-Borax (0.2%)	4585	20.95	90.25
M_4 Borax (0.4%)	4625	21.05	92.85
C.D. (P=0.05)	260.15	0.76	4.65
P_1-2,4-D (10 ppm)	4605	20.70	90.15
P_2-2,4-D (20 ppm)	4325	19.10	82.25
P_3-GA_3 (10 ppm)	4485	20.85	91.25
P_4 GA_4 (20 ppm)	4685	20.75	92.18
C.D. (P=0.05)	290.25	1.275	6.25

Table 4: Interactive effect of micronutrients and PGRs on fruit yield per tree of litchi.

Micronutrients	PGRs				
	2,4-D 10 ppm (P_1)	2,4-D 20 ppm (P_2)	GA_3 10 ppm (P_3)	GA_3 20 ppm (P_4)	Mean
M_1 $ZnSO_4$ (0.4%)	90.25	85.15	88.15	92.15	88.92
M_2 $ZnSO_4$ (0.8%)	80.85	76.15	80.10	76.15	78.31
M_3 Borax (0.2%)	91.25	80.15	89.15	90.25	87.70
M_4 Borax (0.4%)	92.15	88.15	89.85	94.15	91.08
Mean	88.62	82.40	86.81	88.17	
C.D. (P=0.05)	10.32				

faster rate and better execution of source-sink relation registering higher fruit setting, retention and less cracking (Kumar *et al,* 2).

Application of borax @ 0.4% (M_4) was instrumental in formation of maximum fruits per tree, maximum weight of individual fruit which and fruit weight per tree (Table 3). However, it had statistical equality with 0.4% $ZnSO_4$ application. 0.2% borax (M_3) was also comparable in case of weight of individual fruit. 0.8% $ZnSO_4$ was the least effective. Amongst the PGRSs, 10 ppm GA_3 and 20 ppm GA_3 fared equally well so far as number of fruits per tree, weight of individual fruit and weight of fruit per tree was concerned. 20 ppm 2,4-D appeared to be the least effective. The micronutrients and PGRs as such were significantly superior to the control confirming to the reports of Mishra *et al.* (3). However, according to M P interaction, the result was more complex. If 0.4% borax or 0.4% $ZnSO_4$ were sprayed the maximum fruit yield was under 20 ppm GA_3. If 0.2% borax was sprayed, the highest fruit yield was under 10 ppm GA_3 and if 0.8% $ZnSO_4$ was sprayed, the maximum fruit yield was under 10 ppm GA_3. The results of the present investigation get support in the works of Brahmachari and Kumar (1), Kumar *et al,* (2), Raina *et al.* (5) and Sharma *et al.* (7).

REFERENCES

1. Brahmachari, V.S. and Kumar, Rajesh (1997). Effect of foliar spray of mineral nutrients on fruit set retention and cracking of litchi (*Litchi chinensis* Sonn:) fruit. *Haryana J. Hortic. Sci.,* **26** (3-4): 177-180.
2. Kumar, M., Kumar, R. and Singh, R.P. (2009). Effect of micronutrients and plant growth regulators on fruiting of litchi. *Intern. J. Agric. Sci.,* **5** (2): 521-524.
3. Mishra, D.S., Kumar, P. and Kumar, R. (2012). Effect of GA_3 and BA on fruit weight, quality and ripening of 'Rose Scented' litchi. *HortFlora Res. Spectrum,* **1** (1) : 80-82.
4. Noggle, G.R. and Fritz, G.T. (1980). *Introductory Plant Physiology,* Prentice Hall of India Pvt. Ltd. Publication, New Delhi.
5. Raina, B.L., Bhatt, S.K. and Muthoo, A.K. (2001). Effect of foliar spray of NAA and 2,4-D on yield and quality of litchi (*Litchi chinensis* Sonn.) cv. Dehradun. *Adv. in Plant Sci.,* **14** (2): 385-389.
6. Salisburry, F.D. and Ross, C. (1969). *Plant Physilogy* (ed.) 1969 Wardworth Publishing company Inc. Belmont, California.
7. Sharma, P., Sharma, R.M., Singh, A.K. and Tiku, A.K. (2005). Effect of plant bioregulators and micronutrients on tree productivity, fruit cracking and aril proportion of litchi (Litchi chinensis Sonn.) cv. Dehradun. *Haryana J. Hortic. Sci.,* **34** (3-4): 220-221.
8. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. (1992). *Manures and Fertilizers, Seventh edition*. Agri. Horticultural Publishing House, 52, Bajaj nagar, Nagpur.