Int.J.Curr.Microbiol.App.Sci (2019) *8*(3): 836-843

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 8 Number 03 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.803.100

Effect of NAA and Zinc Sulphate on Fruiting, Yield of Litchi [*Litchi chinensis*, (Gaertn.) Sonn.] cv. Calcuttia

Ankit Singh Chauhan[1], Kuldeep Kumar[2], Pradip Kumar Saini[3], Vikram Singh[1*] and J.P. Singh[1]

[1]Department of Horticulture, [2]Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.), India
[3]Department of Crop Physiology, Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.), India

**Corresponding author*

Keywords

NAA, Zinc sulphate, Fruiting, Yield and Litchi

Article Info

Accepted:
07 February 2019
Available Online:
10 March 2019

A B S T R A C T

The experimentation was laid out on the "Effect of NAA and Zinc sulphate on fruiting, yield of litchi [*Litchi chinensis* (Gaertn.) Sonn.] cv. Calcuttia" during 2015-2016 in Factorial Randomized Block Design with 3 replications & fifteen treatments, involving NAA, Zn and control. Observations were recorded on plant basis. The observations were recorded on the characters viz. Number of inflorescence per tree, Fruit set, Fruit drop, Fruit retention, Fruit cracking, Fruit yield. Calcuttia So, it is advised to litchi growers to spraying of 0.8% zinc sulphate and 30ppm NAA for obtaining maximum quality and yield.

Introduction

The litchi (*Litchi chinensis* (Gaertn) Sonn).is the most important subtropical evergreen tree belonging to the family Sapindaceae sub family Nepheleae? Litchi fruits are famous for its excellent quality characteristics, pleasant flavor and attractive red colour. Litchi is liked very much as a table fruit all over the world. Botanically the mature fruit of litchi is a nut and edible portion is the juicy aril. Litchi is also named as "Summer Sweet" as well as "Queen of fruits". It is also known as litchi (Thailand), letsias (Philipines), laici (South China), the original spelling (Litchi) appears to have originated to North China. The most important litchi producing country is China. Taiwan, Thailand, India etc. Out of the total production of litchi in the world, India is the second largest producer next to China. In India, more than 70% of crop is produced in Bihar (Muzaffarpur, East Champaran, Samastipur Vaisaliand Bhagalpur etc.), 15% in West Bangal (Murshidabad, 24–Paraganas)

and 6 % in Uttar Pradesh the principal litchi growing districts of U.P. are Saharanpur, Muzaffara nagar and Gorakhpur. In India litchi is mainly harvested during mid/last week of May and continues till the end of June. Yield per mature tree varies from 80 to 150 Kg depending upon the cultivar, location and year, while the maximum yields up to 675 Kg/tree have been recorded in China. The overall national yields figure of litchi was 9.8 million tonnes in 2008 – 09. More than ¾ of the litchi produce in India from Bihar state. Bihar ranks first with over 70% share in production with about 2600 ha area under litchi cultivation. In India litchi growing other states are U.P. West Bengal, Punjab, Himanchal Pradesh, Assam and Tripura. Sun-burning and cracking of developing fruits is a universal problem in litchi cultivation. Split fruits are generally worthless and thus, results in a great loss to the grower. High temperature low humidity and low soil moisture conditions during fruit development promote this disorder (Kanwar and Nijjar. 1975). Plant bio-regulators play significant in many physiological phenomenon.

There has been wide spread application of plant bio-regulators in service of fruit industry. They are used in vegetative propagation, artificial induction of seedlessness, increasing fruit set, prevention of pre-harvest fruit drop, regulation of flowering, fruit size, thinning of flowers and fruits etc. Various types of plant bio-regulators like NAA, 2-4D, 2, 4, 5-T, GA and TIBA are used for improving the flowering, fruit set, size, yield and quality of fruits. Zinc activated many enzymes in plant metabolism. Price *et al.*, 1972 has given list of several dehydrogenase enzymes which are sensitive to zinc deficiency. Some of these include dehydrogenase, glutamic hydrogenaseand malic hydrogenase. Zinc is also an essential component of Proteinases and Peptidases enzymes system. The RNA and Ribosome contents in the cell are greatly reduced under zinc deficiency condition. Zinc is used to induce early flowering, improving size, growth and quality of fruits. The beneficial effect of zinc have been reported (Hundal and Arora, 1996; Singh *et al.*, 1989; Barun and Kumar, 2003) in pineapple (Rani and Brahmachari. 2001) and in ber (Singh *et al.*, 2002).

A number of scientists and research workers have worked on litchi there were great influences seen with spraying of NAA and Zinc on growth fruiting and yield characters in theirs investigations. But in this regards, further needs of more investigations are required for enhancing of yield and quality of this prominent crop litchi.

Materials and Methods

Fourty five years old well established orchard of litchi located at Horticulture Garden, Department of Horticulture, Chandra Sekhar Azad University of Agriculture and Technology, Kanpur 208002 (India) during 2015-2016 in Factorial Randomized Block Design with 3 replications & fifteen treatments involving NAA, Zn and control. viz. N_0 Water spray, N_1 20ppm NAA, N_2 30ppm NAA and Zn_o Water spray Zn_1 Zinc sulphate 0.2%, Zn_2 Zinc sulphate 0.4%, Zn_3 Zinc sulphate 0.6%, Zn_4 Zinc sulphate 0.8%. Observations were recorded on plant basis. The observations were recorded on the characters viz. Number of inflorescence per tree, Fruit set, Fruit drop, Fruit retention, Fruit cracking, Fruit yield. Geographically the district Kanpur City of Uttar Pradesh falls under subtropical climatic zone and is situated between the latitude 25.26º and 26.28º North and longitude 79.31º and 80.34º East at an elevation of 127.12 meter above mean sea level. It lies in the alluvial belt of genetic plains, located in the Central part of Uttar Pradesh.

Results and Discussion

Number of inflorescence per tree

It is obvious from the Table-1 that the number of inflorescence per tree was significantly affected by nutritional treatments. The maximum number of inflorescence per tree were observed 380.80 in NAA at 30 ppm followed by NAA 20ppm recording 376 inflorescences which was significantly at par when compared with NAA 30ppm. The minimum 369.66 inflorescences were recorded under control. When zinc sulphate was sprayed on the tree it also influenced greatly to number of inflorescences per tree. The maximum inflorescences (387.00) was observed under 0.8% Zn concentration followed by 378 with 0.6% concentration of zinc. The minimum number of inflorescences was recorded under control (374). Zn (0.2%) and 0.4% exhibited 372.66 and 376.66 inflorescences respectively in this regards. The interactive treatments of NAA and Zn were found to be non significant; maximum number of inflorescences (403) were recorded under interactive treatment N_2Zn_4 followed by N_1Zn_4 and N_2Zn_3 demonstrated 380.00 and 379.00 inflorescences par tree respectively. Yadav, Subhash, *et al.,* (2010).

Fruits set per panicle

Data presented in Table-2 clearly indicates that effect of NAA and Zn caused significant improvement in the initial fruits set of litchi. The interaction of NAA and Zn was also found to be significant. The maximum number of fruit set per inflorescence was obtained when 30ppm of NAA was sprayed recording 222.40 fruit set followed by 20ppm NAA concentration showed 219.40 fruit set. The minimum number of fruits per panicle was recorded under control 214.40. Zn treatments showed significant enhancement to fruit set. Maximum number of fruit set was observed under 0.8% Zn concentration reveling 233.66 fruit set followed by 223.66 fruit set under 0.6% Zn concentration. The minimum fruit set 202.66 was showed under control treatments Z_1 (0.2%) and Zn_2 (0.4%) exhibited significant variation when compared with control showing 214.33 and 219.33 fruit set respectively. Interactive effect of NAA with Zn treatments was found to be significant and a great variation was appeared when compared with interactive treatment N_0 Zn_0 (Control). The maximum fruit set was noted with interactive treatments N_2 Zn_4 followed by N_1 Zn_4 showing 238.00 and 232.00 fruit set respectively. The minimum fruit set was observed with interactive treatment N_0 Zn_0 (Control) exhibiting 190.00 fruit set. Chandel, J.S. (1995). Kumar Mnoj *et al.,* (2016). Sharma, S.B. *et al.,* (1986)

Fruit drop

The scenario of data in Table-3 and analysis of variance displayed in Appendix-3 clearly revealed that different concentration of NAA, zinc sulphate and their interaction showed significant effect in reducing fruit drop. The effect of Zn spraying on fruit drop of litchi was observed and the minimum fruit drop was recorded under 0.6% concentration of zinc sprays exhibiting 74.67% followed by 0.4% Zn revealing 74.73% fruit drop. When compared between Zn 0.4% and Zn 0.6% was made it was found significantly at par. Highest concentration of Zn i.e. 0.8% recorded 74.75% fruit drop which did not differ significantly with 0.6% and 0.4% concentrations of Zn. The control (Zn_0) revealed maximum fruit drop (79.60) in this regard. Fruit drop was prominently and significantly affected by NAA sprays. The minimum 75.21% fruit drop was noted under 30 ppm concentration followed by 20 ppm concentration (75.48%) which did not vary significantly with 30 ppm concentration. The maximum fruit drop was obtained with control (N_0) recording 76.68%

drop. Interactive effect between NAA and Zn showed positively and significant variation. The minimum fruit drop was recorded under Zn_2N_2 interactive combination revealed 73.54% drop followed by interactive treatments Zn_4N_2 and Zn_4N_0 exhibiting 74.36 and 74.45% fruit drop respectively. The control (N_0Zn_0) influenced maximum fruit drop (84.21%) followed by interactive treatment N_2Zn_0 recording 78.09% drop. Rani *et al.,* (2002) Hasan *et al* (1993).

Fruit retention

It is clearly evident from the data presented in Table-4 that NAA, Zinc sulphate and their combination significantly increased the fruit retention percentage as compared to their control. The maximum fruit retention was demonstrated with Zn_4 (0.8%) showing 7.36% followed by Zn_3 (0.6%) and Zn_2 (0.4%) recording 6.88% and 6.46% respectively. The minimum 5.28% fruit retention was observed under control (Zn_0). The fruit retention percentage between Zn_3 and Zn_2 did not differ significantly when compared with one another. Under different NAA treatment, maximum retention 6.42% was recorded with 30ppm of NAA when compared to untreated plants 6.26% The 20 ppm concentration of NAA treatment showed 6.32% fruit retension of litchi fruits. The retention percentage of treatment NAA 30ppm and NAA 20ppm did not differ significantly in this regard. The treatment combination of NAA at 30ppm and zinc sulphate at 0.8% retained maximum fruit (7.44%) followed by N_1Zn_4 (7.43%) as compared to control (5.16%). Remaining other interactive treatments also influenced significantly fruit retention at harvest when compared to control (N_0Zn_0).

Fruit cracking (%)

The final data recorded were subjected to statistical analysis. The data are summarized in Table.5 and analysis of variance is presented in Appendix-5 According to data it was clearly indicated that zinc sulphate and NAA showed significant variation, whereas, interactive treatments of NAA and zinc sulphate positively enhanced variation of fruit cracking but did not differ significantly. Effect of NAA significantly varied fruit cracking and minimum fruit cracking was observed 8.56% due to spraying of 30ppm NAA concentration followed by 20ppm concentration (8.87%). The maximum cracking in litchi fruits, were recorded under control (N_0) showing 9.76% cracking. Zinc sulphate also caused progressive variation in fruit cracking of litchi fruits. The minimum fruit cracking was noted under minimum concentration (0.8%) of zinc exhibiting 5.76% followed by its moderate concentrations 0.6% and 0.4% presenting 7.70 and 8.99% respectively. Interaction effect of NAA and Zn also influence positively but did not exhibit significant variation. Interactive treatment N_2Zn_4 recorded minimum 4.87% cracking which was closely followed by N_1Zn_4 and N_0Zn_4 revealing 5.54% and 6.86% fruit cracking respectively and control (N_0Zn_0) demonstrated maximum (12.78%) fruit cracking. Qureshi *et al.,* (2011) Jana *et al.,* (2010) Sarkar *et al.,* (1984) Awasthi *et al.,* (1975), Banik *et al.,* (1997).

Yield (Kg) per plant

It is also clear from the data that when zinc sulphate was sprayed on the plants, significantly higher yield per plant (144.10kg) was reported with 0.8% zinc sulphate closely followed but significant by zinc sulphate at 0.6% (137.55kg) treated plants. However, the minimum yield (111.89kg) per plant were recorded under control (Zn_0). The perusal of data regarding the average yield per plant (Kg), given in Table-6 clearly revealed that fruit yield per plant was significantly increased by different levels of NAA and zinc sulphate. As regard NAA concentration, maximum yield per plant (131.21 kg) was observed with maximum concentration of

NAA i.e. 30ppm. 20ppm concentration of NAA revealed 129. 42 kg yield per plant, it was significantly greater with control (N_0) but did not differ significantly when compared with 30 ppm concentration of NAA (N_2). The minimum yield (126.81kg) per plant was exhibited with NAA control (N_0). The interactive effect of NAA and Zn were found to be non significant. The maximum yield per plant (145.69kg) was recorded in the plants treated with NAA at 30ppm and 0.8% at zinc sulphate, which was significantly higher than all other treatment under investigation.

Table.1 Effect of NAA and Zn on the number of inflorescence per tree

Treatments	Naphthalene acetic Acid			
	0ppm (N_0)	20ppm (N_1)	30ppm (N_2)	Mean
Zn (0%)	362.00	373.00	374.00	369.66
Zn_1 (0.2%)	373.00	374.00	372.00	372.66
Zn_2 (0.4%)	375.00	377.00	376.00	376.00
Zn_3 (0.6%)	378.00	377.90	379.00	378.00
Zn_4 (0.8%)	378.00	380.00	403.00	387.00
Mean	373.20	376.00	380.80	

Table.2 Effect of NAA and Zn on fruit set (number/ panicle)

Treatments	Naphthalene acetic Acid			
	0ppm (N_0)	20ppm (N_1)	30ppm (N_2)	Mean
Zn (0%)	190.00	208.00	210.00	202.66
Zn_1 (0.2%)	212.00	215.00	216.00	214.33
Zn_2 (0.4%)	217.00	218.00	223.00	219.33
Zn_3 (0.6%)	222.00	224.00	225.00	223.66
Zn_4 (0.8%)	231.00	232.00	238.00	233.66
Mean	214.40	219.40	222.40	

Table.3 Effect of NAA and Zn on the fruit drop (%) at harvest

Treatments	Naphthalene acetic Acid			
	0ppm (N_0)	20ppm (N_1)	30ppm (N_2)	Mean
Zn (0%)	160.00 (84.21%)	160.00 (76.92%)	164.00 (78.09%)	161.33 (79.60%)
Zn_1 (0.2%)	161.00 (75.94%)	162.00 (75.34%)	163.00 (75.46%)	162.00 (75.70%)
Zn_2 (0.4%)	163.00 (75.11%)	164.00 (75.22%)	164.00 (73.54%)	163.66 (74.73%)
Zn_3 (0.6%)	166.00 (74.77%)	167.00 (74.54%)	168.00 (74.66%)	167.00 (74.67%)
Zn_4 (0.8%)	172.00 (74.45%)	175.00 (75.43%)	177.00 (74.36%)	174.66 (74.75%)
Mean	164.40 (76.68%)	165.60 (75.48%)	167.26 (75.21%)	

Table.4 Effect of NAA and Zn on fruit retention at harvest

Treatments	Naphthalene acetic acid			
	0ppm (N_0)	20ppm (N_1)	30ppm (N_2)	Mean
Zn (0%)	10.25 (5.16%)	10.75 (5.23%)	10.66 (5.47%)	10.55 (5.28%)
Zn_1 (0.2%)	11.60 (5.58%)	12.00 (5.67%)	12.25 (5.76%)	11.95 (5.67%)
Zn_2 (0.4%)	12.50 (6.46%)	14.10 (6.39%)	14.26 (6.53%)	13.62 (6.46%)
Zn_3 (0.6%)	14.50 (6.89%)	15.50 (6.88%)	15.90 (6.88%)	15.30 (6.88%)
Zn_4 (0.8%)	16.75 (7.21%)	17.70 (7.43%)	15.39 (7.44%)	16.61 (7.36%)
Mean	13.12 (6.26%)	14.01 (6.32%)	13.69 (6.42%)	

Table.5 Effect of NAA and Zn on the number of cracked fruits per panicle

Treatments	Naphthalene acetic acid			
	0ppm (N_0)	20ppm (N_1)	30ppm (N_2)	Mean
Zn (0%)	1.31 (12.78%)	1.29 (12.00%)	1.28 (12.01%)	1.29 (12.26%)
Zn_1 (0.2%)	1.28 (11.03%)	1.27 (10.58%)	1.25 (10.20%)	1.26 (10.60%)
Zn_2 (0.4%)	1.24 (9.92%)	1.22 (8.65%)	1.20 (8.41%)	1.22 (8.99%)
Zn_3 (0.6%)	1.19 (8.20%)	1.18 (7.61%)	1.16 (7.29%)	1.17 (7.70%)
Zn_4 (0.8%)	1.15 (6.86%)	0.98 (5.54%)	0.75 (4.87%)	0.96 (5.76%)
Mean	1.23 (9.76%)	1.18 (8.87%)	1.12 (8.56%)	

Table.6 Effect of NAA and Zn on fruit yield (kg) per plant

Treatments	Naphthalene acetic acid			
	0ppm (N_0)	20ppm (N_1)	30ppm (N_2)	Mean
Zn (0%)	107.82	112.50	115.35	111.89
Zn_1 (0.2%)	120.60	121.95	122.69	121.74
Zn_2 (0.4%)	126.50	131.21	133.67	130.46
Zn_3 (0.6%)	136.50	137.49	138.68	137.55
Zn_4 (0.8%)	142.63	143.98	145.69	144.10
Mean	126.81	129.42	131.21	

Treatments N_1Zn_4 and N_0Zn_4 recording. 143.98 And 142.63 kg yield respectively which were significantly at par in between and when these treatments were again compared with highest yielding interactive treatment N_2Zn_4 it was found significant at

per values. The minimum yield per plant (107.82kg) was recorded under interactive control (N_0Zn_0). Chandra Ramesh (2015), Kaur Sukhjit (2017). Yadav, Subhash *et al.*, (2010) Sarkar Animesh *et al.*,(2009) Saraswat (2006) Chandel *et al.*, (1995)

In conclusion, according to scenario of results of present investigation the effect of zinc and NAA were observed. Regarding fruit drop, combined effect of Zn_2 (0.4%) and NAA 30ppm revealed minimum fruit drop. Zinc sulphate at 0.6% and NAA at 30ppm also showed minimum drop as individually and for other parameters it was found that 0.8% zinc sulphate and 30ppm NAA individually showed more effective and combined application of NAA 30ppm and zinc sulphate at 0.8% concentration showed most effective in enhancing the number of inflorescences per plant, fruit set, fruit retention, fruit cracking, yield per plant of litchi cv. Calcuttia. So, it is adviced to litchi growers to spraying of 0.8% zinc sulphate and 30ppm NAA for obtaiing maximum quality and yield.

References

Awasthi, R.P, Tripathi, B.R. and Singh, Ajit (1975). Effect of foliar sprays of zinc on fruit drop and quality of litchi (*Litchi chinensis* Sonn.). Punjab Hort.J., Vol. 15 (3):14-16.

Banik BC, Sen SK and Bose TK. (1997). Effect of zinc, iron and boron in combination with urea on growth, flowering, fruiting and fruit quality of mango cv Fazli. Environment and ecology. Vol. 15(1):122-125.

Barun and Kumar Rajesh, (2003).Effect of NAA, Zinc sulphate and urea on growth and yield of litchi (*Litchi chinensis Sonn*) cv. Purbi. *Orissa Journal of Horticulture Vol.* 31*(1):114-118.*

Chandel, J.S. (1995). Influence of different irrigation regimes along of growth regulator and nutrient on fruiting and quality of litchi cv. Dehradun. *Ad.* Horti.Fore.,Vol. 4: 23 -27.

Chandel, S.K. and Kumar, G. (1995).Effect of irrigation frequencies and foliar spray of NAA and micro nutrient solution on yield and quality of litchi (*Litchi chinensis* Sonn.) cv. Rose Scented. *Ad* Plant Sci.,Vol.8 (2):284- 288.

Chandra Ramesh; Manju; Rawat, S.S. and Singh,K.K (2015). Effect of foliar application of various growth regulators on yield and quality of aonla (*Phyllenthus Emblica GaerthL*.) CV. Na-7. National academy of agri. Sci., 33 (3).

Hasan, M.A and Chattopadhyay, P.K. (1993). Effect of chemical in controlling fruit drop of litchi cv. Bomai. Prog. Hort., Vol.22 (1-4):18-22.

Hundal, H.S. and Arora, C.L. (1996).Preliminary micro nutrients foliar diagnostic norms of litchi (*Litchi chinensis*Sonn.). J. Soci. Soil Sci., Vol. 44 (2):294- 298.

Jana, B. R.; Das, Bikash and Nath Vishal (2010).Effect of micronutrients and growth regulators on fruit retention, cracking and fruit quality in litchi (*Litchi chinensis* Sonn.) cv. Shahi. *Horticultural Journal Vol. 23 (1):12-15.*

Kanwar, J.S. and Njjar, G.S. (1975).Litchi cultivation in the Punjab problem and prospect. *Punjab Hort. J., Vol.* 15(1-2):9-13.

Kaur Sukhjit (2017). Effect of micronutrients and plant growth regulators on fruit set, fruit Retention. yield and quality attributes in litchi cultivars Dehradun. Chemical Science Review and Letters. vol. 6 (22):982-986.

Price, C.A.; Clark, H.E. and Funkhouser, E.A. (1972).Function of micronutrients in

agriculture. Soil Sci. Soc. Amer. Madison Wisconsin.

Qureshi, S. N.; Rather, J. A. and Bhat, S. K. (2011). Effect of exogenous auxin application on fruit drop and fruit cracking in litchi (*Litchi chinensis* Sonn.) cv. Dehradun. Environment and Ecology Vol. 29 (1): 235-237.

Rani, R. and Brahmachari, V.S. (2001). Effect of foliar application of calcium, zinc boron on cracking and physico-chemical compositions of litchi. Orissa J. Hort., Vol. 29(1):50-54.

Rani, R.and Brahmachari, V. S. (2002). Effect of growth substances and girdling on fruit set, fruit drop and quality of litchi (*Litchi chinensis* Sonn.) cv. China. Horticultural Journal Vol. 15(3):18.

Saraswat, N. K.; Pandey, U. N. and Tripathi, V. K. (2006). Influence of NAA and zinc sulphate on fruit set, fruit drop, cracking, fruit size, yield and quality of litchi cv. Calcuttia. *Journal of Asian Horticulture Vol. 2 (4):255-259*.

Sarkar Animesh and Gosh, Bikash (2009). Effect of foliar application of micro nutrients on retention, yield and quality of fruit in litchi cv. Bombai *Environment and Ecology Vol. 27 (1):89-91*.

Sarkar, G.K.; Sinha, M.M. and Mishra, R.S. (1984). Effect of NAA on fruit set, fruit drop, cracking, fruit size and quality of litchi cv. Rose Scented. *Prog. Hort*., Vol. 16 (3-4):301-304.

Sharma, S.B. and Dhillion, B.S. (1986). Effect of zinc sulphate and growth regulator on fruit and seed size of litchi (*Litchi chinensis* Sonn.). J. *Res. Punjab. Agril. Univ*., Vol.*23 (2)*:*233–236.*

Singh, A.K.; Mughal, M.S. and Vachkoo, A.M. (2002).Effect of ethrel and naphthalene acetic acid on fruit quality and fruit drop of Royal Delicious apple. *Indian J. Hort., Vol. 59*(4):355-358.

Singh, A.R.; Shukla, P.K. and Singh, K. (1989).Effect of boron, zinc and NAA onThe chemical composition and metabolites of ber (*Zizyphus mauritiana* Lamk.) fruit. *Haryana J. Hort. Sci.*,Vol. 18 (1-2):23 – 28.

Yadav, Subhash; Shukla, H.S. and Ram, R. A. (2010). Studies on foliar application of NAA, GA3, boric acid and Ca(NO3)2 on fruit retention, growth, yield and quality of aonla (*Emblica officinalis* Gaertn.) cv. Banarasi. *The Hort. J*; vol. 23(2):64-66

How to cite this article:

Ankit Singh Chauhan, Kuldeep Kumar, Pradip Kumar Saini, Vikram Singh, Singh, J.P. 2019. Effect of NAA and Zinc Sulphate on Fruiting, Yield of Litchi [*Litchi chinensis*, (Gaertn.) Sonn.] cv. Calcuttia. *Int.J.Curr.Microbiol.App.Sci.* 8(03): 836-843.
doi: https://doi.org/10.20546/ijcmas.2019.803.100