ISSN: 0974 - 0376

The Ecoscan : Special issue, Vol. VII: 493-496: 2015
AN INTERNATIONAL QUARTERLY JOURNAL OF ENVIRONMENTAL SCIENCES
www.theecoscan.in

INDUCTION OF FLOWERING BY USE OF CHEMICALS AND CINCTURING IN 'SHAHI' LITCHI

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KEYWORDS

Flower induction
Ethephon
Cincturing
KNO_3
Fruit Quality
Litchi

Proceedings of National Conference on Harmony with Nature in Context of Bioresources and Environmental Health
(HORMONY - 2015)
November 23 - 25, 2015, Aurangabad,
organized by
Department of Zoology,
Dr. Babasaheb Ambedkar Marathwada University
Aurangabad (Maharashtra) 431 004
in association with
National Environmentalists Association, India
www.neaindia.org

The Ecoscan
AN INTERNATIONAL QUARTERLY JOURNAL OF ENVIRONMENTAL SCIENCES

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ABSTRACT

An experiment was conducted to induce the flowering in litchi through chemical sprays in young litchi orchard consecutively for 2 years at ICAR-NRC on Litchi, Muzaffarpur (Bihar) with six treatments viz., Ethephon 400 ppm (T_1), KNO_3 1% (T_2), TIBA 1000 ppm (T_3), SADH 400 ppm (T_4), Cincturing of branches 3 mm wide with 3 mm depth (T_5) & Control (T_6). Results indicated that panicle emergence was early by 8-12 days in Ethephon 400 ppm and delayed by 8-10 days in KNO_3 1% application than control. Cincturing of branches recorded highest 60.50% of shoot converted into flowering panicle as compared to 37.50% conversion in control. Ethephon 400 ppm advanced the fruit maturity by 7 days followed by KNO_3 1% (4 days) than normal date of fruit harvesting (22nd May). Foliar application of KNO_3 1% recorded higher fruit weight (20.26 g), fruit length (3.49 cm), fruit breadth (3.00 cm), pulp content (67.68%), TSS (19.74 °Brix), ascorbic acid (49.28 mg), TSS/acid ratio (35.88) and lowest acidity (0.55%).

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INTRODUCTION

Litchi (*Litchi chinensis* Sonn.) is one of the high demanding and fascinating fruit liked by the people due to its unique flavor and taken as table fruit. It is evergreen subtropical fruit considered as cash crop particularly in the eastern and northern states of India with native to southern province of China particularly Kwanngtong and Fukein state.It is highly specific to climatic and soil requirement and probably due to which its cultivation is restricted to the few countries in the world(Kumar *et al.*, 2014a). Fruit yield of litchi in different production area is irregular and frequently below the potential bearing capacity of the trees. Apart from erratic and irregular bearing in juvenile phase of orchard it suffers from several problems besides insect pest among them fruit borer, mite and leaf defoliators are major causing economic losses to the grower (Kumar *et al.*, 2014b). This phenomenon is happens in litchi due to failure to bloom, because of the continuous vegetative growth of the tree which is attributed to an insufficient degree of dormancy to initiate flower bud formation. Dormancy in litchi is apparently influenced by dry weather or recurring period of relatively cold weather. As the litchi tree require low temperature to induce flowering and subsequently fruiting (Menzel and Simpson, 1995).

The use of growth regulators particularly Paclobutrazol and Ethephon have proved its efficacy in modifying growth, development, flowering, fruit setting and yield in several tropical and subtropical fruit crops (Yadav, 2012). Response of various growth regulators and chemicals on regulation of flowering and fruiting have been studied by various workers in many fruit crops viz, litchi (Zhang *et al.*, 2002), mango (Miranda, 2001), peach (Maiko and Musat, 1977, Ebel *et al.* 1999), apricot (Moghadam and Mokhtarian, 2006). Potassium nitrate has been used throughout the tropics to induce flowering and fruit retention in mango (Chen, 1983, and Kulkarni, 2004). The information on use of various growth regulators and chemicals in litchi for flower induction under sub tropics region of eastern India is lacking.Keeping the above facts in view, an experiment was conducted to study the response of different chemicals on flower induction**,** fruit yield and quality in litchi in subtropics of Bihar in order to get regular flowering and fruiting.

MATERIALS AND METHODS

A field experiment was conducted during 2013 and 2014 consecutively for 2 years at the research farm of ICAR-NRC on Litchi, Mushahari, Muzaffarpur (Bihar) located at 210 m altitude from msl. The litchi cv. Shahi was planted in the year 2005 at a spacing of 8.25 m x 8.25 m accommodating 144 plants per ha. Standard cultural practices were followed to grow the litchi crops as described by Kumar *et al.*, 2012. The experimental field was sandy loam in texture, alkaline in reaction with low to medium in fertility status. The experiment was laid out in randomized block design (RBD) comprising of six treatments viz., Ethephon 400 ppm (T_1) , KNO_3 1% (T_2), TIBA 1000 ppm (T_3), SADH 400 ppm (T_4), Cincturing of branches 3 mm wide with 3 mm depth (T_5)& Control (T_6) and replicated thrice.Four spraying of each chemical were applied at monthly interval during 2nd week of September, October, November and December in 2013-2014. The observation on per cent

shoot flower was recorded on the basis of shoot flowered divided by total shoots tagged and multiplied by 100. Sex ratio was calculated by number of female flower divided by number of male flowers per panicle counted from randomly selected flowering shoot of each direction. Fruit maturity (harvest date) was determined on the basis of fruit colour developed a bright pinkish red blush with flattened tubercles (Gaur and Bajpai, 1977) and pulp TSS (18 °Brix). Fruit length and diameter were measured from ten randomly selected fruit during study with digital vernier caliper. The weight of the fruits was calculated on the basis of 10 representative fruits and the mean was expressed in gram. The total soluble solids (TSS) content was determined with Erma Hand Refractometer (0-32° Brix) with necessary temperature correction. The titratable acidity and ascorbic acid content of juice were estimated as per AOAC (2000). TSS/acid ratio was calculated by dividing the TSS value with acidity. The data were subjected to statistical analysis as per the method of Gomez and Gomez (1984). Least significant of difference at 5% level was used for finding the significance of differences if any, among the treatment means.

RESULTS AND DISCUSSION

Data presented in Table 1 indicate that various treatments had pronounced effect on panicle emergence, percentage of flowering shoot, sex ratio and fruit maturity. Panicle emergence was early by 8-12 days in treatment ethephon 400 ppm (T_1) followed by 3-4 days in SADH 400 ppm (T_4) than normal time of panicle emergence (05-10 February) observed in control (T_6) and TIBA 1000ppm (T_3). Whereas, KNO_3 1% (T_2) and cincturing of branches (T_5) showed delayed panicle emergence by 3-4 days and 8-10 days,respectively than normal. The early flowering may be attributed to suppression of vegetative growth of the shoot which resulted into the fast maturation of twigs.Delay in panicle emergence under KNO_3 1% and cincturing of branchesmight be due to changes in carbohydrate and mineral metabolism. Delay in flowering in KNO_3 treated plants might be due to its effect in supplementing the nitrogen to the leaves. The highest percentage of shoot showing flowering panicle was observed in T_5 (60.50%) followed by Ethephon 400 ppm (56.75) and lowest in control (37.50%). Growth promoting substance such as Ethephon when used as a foliar spray has been reported to be beneficial for floral initiation and inflorescence development in longan (Qiu *et al.,* 2000). Sex ratio of female to male flower ranged from 0.55 in T_4 to 0.78 in T_1. Advancement in fruit maturity was noticed due to various treatments. Data revealed that Ethephon 400 ppm advanced the fruit maturity by 7 days followed by KNO_3 1% (4 days) than normal date of fruit harvesting (22nd May)

Table 1: Effect of various chemicals and cincturing on flower induction, sex ratio and fruit maturity in litchi cv. Shahi

Treatments	Panicle emergence (days)	Shoot flowering panicle (%)	Sex ratio	Fruit maturity
Ethephon 400 ppm (T_1)	8-12 early	56.75	0.78	15th May
KNO_3 1% (T_2)	3-4 delay	50.50	0.75	18th May
TIBA 1000 ppm (T_3)	Normal	53.75	0.72	20th May
SADH 400 ppm (T_4),	3-4 early	48.00	0.55	19th May
Cincturing of branches(T_5)	8-10 delay	60.50	0.62	21st May
Control (T_6)	Normal (5-10 Feb.)	37.50	0.61	22nd May
CD at 5%	-	9.38	0.08	-

Table 2: Effect of various chemicals and cincturing on physical parameters of litchi fruit cv. Shahi

Treatments	Fruit weight (g)			Fruit length (cm)			Fruit breadth (cm)			Pulp
	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	content (%)
Ethephon 400 ppm (T_1)	18.72	17.53	18.13	3.40	3.20	3.30	2.99	2.62	2.81	61.80
KNO_3 1% (T_2)	20.61	19.90	20.26	3.57	3.41	3.49	3.13	2.87	3.00	67.68
TIBA 1000 ppm (T_3)	19.58	18.85	19.22	3.47	3.32	3.40	2.96	2.77	2.87	62.99
SADH 400 ppm (T_4)	19.40	18.55	18.98	3.43	3.37	3.40	2.87	2.86	2.87	64.30
Cincturing of branches (T_5)	17.25	17.15	17.20	2.84	3.22	3.03	2.55	2.84	2.70	63.76
Control (T_6)	18.14	15.97	17.06	3.11	3.30	3.21	2.75	2.81	2.78	62.34
CD at 5%	1.46	1.80	-	0.19	0.16	-	0.18	0.21	-	-

Table 3: Effect of various chemicals and cincturing on bio-chemical attributes of litchi fruit cv. Shahi

Treatments	TSS (°brix)			Acidity (%)			Ascorbic acid (mg/100g)			TSS/acid
	2013	2014	Pooled	2013	2014	Pooled	2013	2014	Pooled	ratio
Ethephon 400 ppm (T_1)	18.61	18.46	18.54	0.58	0.52	0.55	38.24	33.38	35.81	33.70
KNO_3 1% (T_2)	19.39	20.08	19.74	0.56	0.54	0.55	48.50	50.06	49.28	35.88
TIBA 1000 ppm (T_3)	18.55	19.20	18.88	0.62	0.49	0.56	37.24	32.52	34.88	34.01
SADH 400 ppm (T_4)	19.09	18.10	18.60	0.68	0.66	0.67	42.67	45.89	44.28	27.75
Cincturing of branches (T_5)	18.30	18.93	18.62	0.59	0.63	0.61	36.20	35.0	35.60	30.52
Control (T_6)	18.27	18.53	18.40	0.65	0.56	0.61	40.74	43.44	42.09	30.41
CD at 5%	0.73	0.82	-	0.04	0.05	-	3.28	4.12	-	-

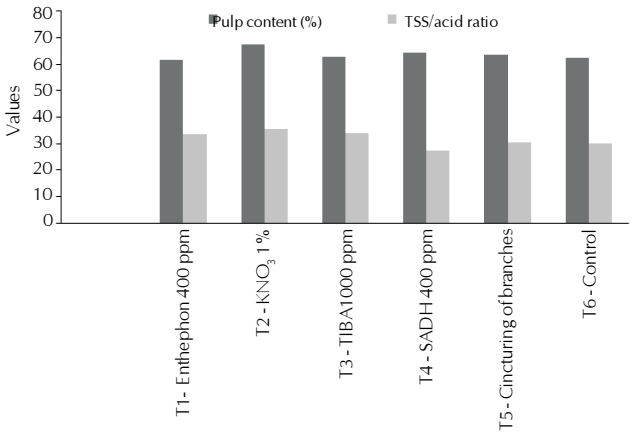

Figure 1: Effect of various chemicals and cincturing on pulp content and TSS/acid ratio in litchi fruits

observed in control. Mishra *et al*. 2012 also observed advancement in harvesting time of litchi cv. Rose Scented in foliar spray of KNO_3 4%. The early fruit ripening under ethephon treatment may be attributed to an increase in ethylene production. The treatment of plant led to marked increase rate of ethylene production in leaves, twig and apices (Abdallah *et al.,* 1986).

Physical parameters of litchi fruits were significantly influenced by the various treatments during both the years (Table 2). The pooled (2013 and 2014) data revealed that foliar application of KNO_3 1% recorded significantly higher fruit weight (20.26 g), fruit length (3.49 cm) and fruit breadth (3.00 cm)over other treatments whereas, the lowest fruit weight (17.06 g) was observed in control. Pulp content ranged from 61.80 to 67.68 % in Ethephon 400 ppm and KNO_3 1%, respectively (Figure 1).

Fruit quality in terms of TSS, acidity and ascorbic acid content were significantly influenced due to various treatments (Table 3). TSS ranged from 18.40 °Brix in control to 19.74 °Brix in KNO_3 1%. Similarly, ascorbic acid content in litchi fruit varied from 34.88 to 49.28 mg under TIBA 1000 ppm and $KNO_3$1% respectively. Whereas, acidity percent ranged between 0.55 in both KNO_3 1% and Ethephon 400 ppm to 0.67 per cent in SADH 400 ppm applied plants. The higher TSS/acid ratio (35.88) was obtained in T_2(KNO_3 1%) followed T_3 and T_1 with their corresponding values 34.01 and 33.70 (Figure 1). It is an established fact that as the TSS increased the acidity decreased. Similar results have also been reported by Godara *et al.*, 2002 in grapes and Yadav, 2012 in cape gooseberry.

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