



EXTENDING HARVESTING PERIOD OF LITCHI (*Litchi chinensis* Sonn.) THROUGH CHEMICALS APPLICATION

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ABSTRACT: An experiment was conducted to stagger the harvesting of litchi in cultivar Rose Scented. In this regard, various kinds of treatments were imposed on 20 years old full bearing litchi tress either at flower initiation or few days before harvest of fruits. KNO_3 (4%) was sprayed at 1 cm size of panicle in the first week of February. However, other treatments viz. GA_3 (20, 40 ppm), BA (20, 40 ppm) and bagging of fruit panicles were applied two weeks before expected date of harvest, while silver thiosulphate (10 m mol) sprayed twice (on 30th April and 15th May). Shading treatments were given by covering the tree with nylon nets producing 30% and 50% shade, respectively, 30 days after fruit set. KNO_3 (4%) and cluster bagging treatments advanced the harvesting for 2 and 3 days, respectively over control. Shade nets of 30% and 50% were most effective in delaying ripening of litchi fruits and delayed the harvest date by 14 and 16 days, respectively without compromising with the fruit quality. Silver thiosulphate gave a harvest delay of 8 days, however, a few brown spots on fruit skin were observed after the spray. GA_3 20 and 40 ppm delayed the harvest date for 2 and 5 days, respectively while BA delayed the harvest date for 5-6 days. Higher fruit retention and reduced fruit cracking were obtained with shade net (50%) which was remained at par with shade net (30%) and cluster bagging. Higher fruit quality attributes were recorded with GA_3 (40 ppm) over other treatments.

Keywords: KNO_3 , GA_3 , BA, shading, litchi, quality.

Uttarakhand is one of the most popular states of the country known for its quality litchi production. The litchi industry in Uttarakhand is based on one major cultivar, the 'Rose Scented'. Its harvesting period is quite short, 7 to 10 days. The availability of fresh litchi fruits in the market may be extended for another few days by utilizing other genotypes available in the litchi. However, much scope is not there as available genotypes differ little with regard to their maturity period (Ray and Sharma, 9). Two pronged strategy may be employed to solve the problem i.e., either advancing the date of harvest or delaying the date of harvest.

Still, there is no commercial method to be used for either advancing or delaying the harvesting time of litchi and thus extending the harvesting and marketing season. The motive of this study was to test methods for extending harvesting period of litchi. An alternative approach to induce early flowering and fruiting by using KNO_3 has been successfully used in mango (Kumar *et al.*, 6). GA_3

has been found to offer suitable means of controlling ripening process in litchi (Ray and Sharma, 9) and in other fruit crops (Dilley, 3, and Lavon *et al.*, 7). Evidence suggest that cytokinins retards sugar accumulation and pigmentation in litchi fruits (Wang *et al.*, 13). Yin *et al.*, (14) demonstrated inhibition of litchi fruit maturation and colouration following silver thiosulphate (STS) spray, indicated that ethylene is involved in the regulation of ripening events. Bagging of fruits including litchi can improve ripening and reduce physical damage (Tyas *et al.*, 11 and Wang *et al.*, 13). Shading has been found to delay the fruit ripening in cactus pear (Mantia *et al.*, 8), however, little information is available on litchi (Zipori *et al.*, 15). The objective of this study was to determine the relationship between integrated use of various treatments and litchi fruit maturity, size and quality.

MATERIALS AND METHODS

The experiment was carried out in 2007 at HRC, Patharchatta, G.B.P.U.A&T., Pantnagar on 20 year old plants of litchi cv. Rose Scented, spaced

10 10 m and maintained under uniform cultural practices. The experiment was laid out in a randomized block design with three replications. All the treatments were applied after fruit set except 4% KNO₃ (T₁), which was sprayed at 1 cm panicle stage in the month of February. First and second sprays of 10 m mol silver thiosulphate (T₂) were carried out on 30th April and 15th May respectively. GA₃ at 20 ppm (T₃) and 40 ppm (T₄) and BA (6-Benzyl adenine) at 20 ppm (T₅) and 40 ppm (T₆) were sprayed only once, on 15th May *i.e.* 2 week before from expected date of normal harvest. Teepol (2 ml/l) was added to the solution as wetting agent. Cluster bagging (T₇) with perforated and transparent polyethylene was also carried out 2 week before harvesting on 15th May. Shading treatments were gives on 1st May *i.e.* 30 days after fruit set. Trees were shaded by erecting over head shade nets producing 30% (T₈) and 50% (T₉) shade. Shade nets were removed one week before harvesting so that fruit colour of trees could be improved. There were total 10 treatments including control (T₁₀). All treatments were applied to separate trees.

Randomly 10 panicles were selected in each tree for recording data on fruit cracking and other fruit quality attributes. The fruits were considered to be ripe when they developed a bright pinkish-red blush with flattened tubercles (Gaur and Bajpai, 5). TSS was determined by using ERMA hand refractometer and acidity, regarded as citric acid, by titration of the juice with 0.1 N NaOH using phenolphthalein as the indicator. For estimating ascorbic acid, the fresh juice to which 4% metaphosphoric acid as stabilizing reagent had been added was titrated against 2:6 dichloro-indo-phenol dye solution. Reducing sugars were determined by titrating the juice with fehling's solutions A and B (standardized) using methylene blue as indicator. For determining total sugars, the juice was subjected to acid hydrolysis and total sugars were estimated by the method described for reducing sugars.

RESULTS AND DISCUSSION

In general, all the treatments except T₁ (4% KNO₃%) and T₇ (Cluster bagging) delayed ripening and thus extended the harvesting period in litchi cv. Rose Scented. However, treatments T₁ and T₇ advanced the harvest period by 2-3 days as compared to control (Wang *et al.*, 13). Shade nets (30% and 50%) *i.e.* T₈ and T₉ were the most effective treatments with regard to delay in harvest time, and delayed the date of harvesting by 14 and 16 days, respectively with significant reduction in fruit cracking and fruit weight was significantly higher over control (Table 1). Fruit quality in terms of TSS, acidity, ascorbic acid and total sugars were significantly higher over control. Zipori *et al.* (15) effectively delayed fruit ripening by 7 to 10 days with the help of plastic nets producing 30% and 50% shade without impairing fruit quality. Cladode shading resulted in a consistent delay of fruit ripening when the shade period exceeded 15 day. This might be due to the fact that exposure of fruits to solar radiations affects fruit sink activity (Erez and Flore, 4) and shading the fruit environment reduces fruit development processes (Byers *et al.*, 2). Application of silver thiosulphate (STS) at 10 m mol delayed harvesting by 8 days without any appreciable alteration in fruit weight and other chemical quality attributes. However, brown spots on fruits skin were appeared which might be due to higher concentration of silver ions; therefore, its lower concentration may be tried for better result. Phyto-toxicity has also been also reported by Beyer (1). Wang *et al.* (13) demonstrated possible role of ethylene in chlorophyll degradation in litchi, action of which might have been inhibited by silver thiosulphate (Yin *et al.*, 14). Spray of GA₃ at 40 ppm delayed harvesting by 5 days as compared to control with reduced fruit cracking, as well as acidity and with improved fruit and aril weight, TSS, ascorbic acid and total sugars. Increase in fruit and aril weight with enhanced fruit quality attributes and harvest delay in litchi with exogenous application of GA₃ has been reported earlier by Thakur *et al.* (10) in litchi.

Table 1: Effect of chemical treatments on harvest advancement/delay and fruit quality of litchi cv. Rose Scented.

Treatment	Days taken to maturity	Harvest**		Fruit cracking (%)	Fruit weight (g)	Pulp weight (g)	TSS (°Brix)	Acidity (%)	Ascorbic acid (mg/100 g)	Total sugar (%)
		Advancement	Delay (day)							
T ₁ (4% KNO ₃)	58.33	2.33	-	10.77	22.20	16.20	20.52	0.52	27.99	13.43
T ₂ (STS)*	68.66	-	8.00	9.21	21.29	15.65	20.75	0.67	27.98	13.50
T ₃ (GA ₃ 20 ppm)	63.00	-	2.34	7.43	22.25	16.32	21.00	0.63	28.56	13.58
T ₄ (GA ₃ 40 ppm)	65.66	-	5.00	6.13	22.30	16.38	22.15	0.56	28.83	14.25
T ₅ (BA 20 ppm)	66.00	-	5.34	7.99	22.31	16.41	21.75	0.61	28.53	13.02
T ₆ (BA 40 ppm)	67.00	-	6.34	7.93	22.24	16.38	21.40	0.66	28.92	13.20
T ₇ (Bagging)	57.33	3.33	-	8.33	20.99	15.68	20.66	0.69	28.18	13.08
T ₈ (30% shade net)	74.66	-	14.00	5.28	21.59	16.20	20.65	0.69	28.16	13.12
T ₉ (50% shade net)	77.00	-	16.34	4.49	21.59	16.30	20.71	0.70	32.70	13.13
T ₁₀ (Control)	60.66	-	-	12.71	19.06	13.56	18.63	0.73	25.84	12.52
C.D. (P = 0.05)	1.84			3.85	1.03	0.86	1.26	0.045	4.70	0.34

*Silver thiosulphate.

** Harvest advancement/delay was counted by considering the date of harvest of control plants.

The harvest delay resulting from BA at 40 ppm was 6 day which is comparable to that gained with silver thiosulphate (STS) at 10 m mol; however, STS at this concentration had resulted in brown spotting of the fruits with less aril weight as well. Fruit quality of BA treated fruits was found to be at par with GA₃ treated fruits. Delayed maturity with 6-Benzyl adenine (BA) as observed during present investigation corroborated the earlier finding of Wang *et al.* (12). Cytokinin either inhibit or delay the colour changes in litchi fruit green to red associated with ripening though without influencing other changes markedly also supports the earlier finding of Wang *et al.* (13).

Shading as well as other treatments profoundly affect on the ripening process of litchi cv. Rose Scented. Thus, they provide an opportunity for litchi growers to stagger the date of harvest as per the market demand.

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