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SHORT COMMUNICATION

EFFECT OF PACLOBUTRAZOL ON FLOWERING IN "CHINA" LITCHI (*LITCHI CHINENSIS* SONN.)

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In a field trial on litchi trees cv. china, paclobutrazol was applied in the rhizhosphere @ 1.0, 1.5, 2.0, 2.5, 3.0, 3.5 and 4.0 g a.i./m radius of tree canopy. The chemical was applied once in November 2000, approximately 3 months ahead of panicle emergence to induce flowering. The treatment significantly restricted vegetative flushes before panicle emergence and increased percentage of terminal branches which could in turn produce flowering shoots. Amongst various doses 3.0 g a.i./m radius of a tree canopy was found to be most effective. The response was poor in the fruiting season of 2001 as the trees continued to be vigorously vegetative with limited floral panicles in spite of the treatment. The fruit yield was almost negligible this year. However, the effect of the chemical was carried over to the next flowering season as there was marked difference in the yield between the treated and untreated trees. A yield gain of 52 per cent was recorded in the second year due to the treatment.

***Key words*: Flowering, irregular bearing, litchi, paclobutrazol, vegetative flushing, yield.**

The litchi cv. China is one of the important commercial cultivars in Bihar. Although, it bears large size and good quality fruits but, year to year fluctuation in yield is very high. In fact, the variety exhibits a strong irregular bearing tendency (Ray *et al.* 1985). The main reason for this bearing habit is excessive vegetative growth about one or two months before panicle emergence or at blooming. Vegetative flushing prior to usual period of floral initiation results in poor or no initiation of the flowering panicles. The trees under this situation divert the photosynthates to alternative sink like actively growing vegetative shoots.

Growth regulating compounds like paclobutrazole, dikegulac, morphactin and mepiquat chloride have been recognised as potential tools to control excessive vegetative growth of trees and encourage flowering and fruiting in fruit crops. Menzel and Simpson (1990) and Lal *et al.* (2000) have used, paclobutrazol to check excessive vegetative growth and favour fruiting in litchi. Earlier Williams (1984) reported more consistent annual cropping with paclobutrazol application than untreated trees. Thus, the purpose of the experiment reported here was to appraise paclobutrazol as a potential growth retardant which facilitate getting regular fruit yield from the "China" litchi trees.

The experiment was conducted at Horticultural Research Station, Birauly from year 2000-2002. Paclobutrazol ($C_{15}H_{20}ClN_3O$) @ 1.0, 1.5, 2, 2.5, 3.0, 3.5 and 4.0 g a.i./m radius of the tree ground cover was applied by trunk soil line pour (TSLP) method in rhizosphere of 12 year old "China" litchi trees in first week of November, 2000 i.e. approximately 3 months before panicle emergence. The trees were irrigated to run-off immediately after application. The observations were taken on emergence of vegetative and flowering shoots, length of flowering shoots and yield for two consecutive years in 2001 and 2002. Vegetative flush and flowering data were expressed as percentage of the terminal branches on a tree recorded as average visual estimates

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by 3 observers working independently. For measuring panicle length, 5 panicles from all the four directions from each tree were randomly selected and measured. The treatments were arranged in a randomised block design with three replications. Each treatment in a replication had two trees.

The data on emergence of vegetative flush and flowering panicle (Table 1) revealed that paclobutrazol treatment restricted vegetative flush before panicle emergence and significantly increased the emergence of flowering panicle in comparison to the control trees in both the years. But the per cent of terminal shoot turned into flowering panicle was much less in the year 2001 than in "on" year of 2002. Application of paclobutrazol @ 3.0 g/m radius of canopy spread was the most effective dose to induce more number of flowering panicles in both the years. In the year 2001 only 17.21 per cent terminal branches could bear flowering panicles while this percentage rose to 94.2 per cent in 2002. The control trees had significantly lower number of terminal branches producing panicle in both the years. However, the chemical has little impact on fruiting during "off" year or lean fruiting season of 2001. More than 50 per cent of terminal branches produced vegetative flushes during this year even after the treatment. The number of flowering panicles produced in 2001 was very less but the panicles that emerged could bear fruits in usual manner. Since the number of panicle was small enough, the fruit yield varied from 1.60 to 4.52 kg/tree in that year (Table 1). Such a low yield from a 12 year old tree was imperceptible and thus considered to be negligible.

Table 1. Effect of paclobutrazol treatment on flowering and yield of litchi cv China.

Paclobutrazol a.i./m radius of tree ground cover	% of terminal branches producing vegetative flushes		% of terminal branches producing flowering panicle		Panicle length (cm)		Yield (kg/tree)	
	2001	2002	2001	2002	2001	2002	2001	2002
No treatment (control)	72.85	10.70	6.42	84.60	23.63	30.12	1.60	50.76
	(66.91)	(9.06)	(14.66)	(74.12)				
1.0 g	68.50	6.20	4.50	90.20	22.11	28.85	1.80	61.75
	(62.25)	(14.39)	(12.23)	(79.96)				
1.5 g	58.50	5.50	10.15	94.80	21.68	26.90	1.70	60.27
	(55.49)	(13.54)	(18.56)	(85.42)				
2.0 g	51.66	6.40	13.72	91.50	21.26	27.07	2.25	62.60
	(51.06)	(14.63)	(21.72)	(81.35)				
2.5 g	54.24	6.70	16.24	90.60	20.80	26.15	4.20	64.33
	((52.73)	(14.98)	(23.74)	(80.91)				
3.0 g	50.45	2.80	17.21	94.20	19.48	25.10	4.52	77.45
	(50.29)	(9.58)	(24.48)	(84.56)				
3.5 g	51.72	4.40	12.48	91.70	19.15	24.57	2.76	70.21
	(51.10)	(12.07)	(20.66)	(81.30)				
4.0 g	54.33	4.50	14.10	93.20	19.02	24.31	2.64	71.64
	(52.77)	(12.20)	(22.02)	(83.26)				
Mean	58.03	5.84	11.85	91.35	20.89	26.63	2.68	64.88
	(55.32)	(12.56)	(19.76)	(81.35)				
S.Em (±)	3.02	0.65	0.63	1.57	0.84	1.59	0.142	3.64
L.S.D. (P = 0.05)	9.16	1.97	1.91	4.76	2.56	4.83	0.432	11.04

Angular transformed value are presented in parentheses.

In the fruiting season of 2002, the treated trees produced significantly better yield than the untreated control. Application of paclobutrazol @ 3.0 g a.i./m canopy radius proved to be the best treatment. Only 2.8 per cent of terminal branches produced vegetative flush and 94.2 per cent bore flowering panicles. Ramburn (2001) recorded enhanced flowering in unproductive litchi trees with paclobutrazol application. The highest yield of 77.45 kg/ plant was recorded with this treatment as compared to 50.70 kg/tree under the control trees. Reduction in vegetative flush and increase in proportion of flower bearing shoot following paclobutrazol treatment has been reported by other workers also in litchi (Menzel and Simpson 1990, Chaitrakulsub *et al.* 1992, Rowley 1992 and Lal *et al.* 2000). Paclobutrazol is considered an inhibitor of gibberellin biosynthesis (Malik 1999) and a reduction in vegetative growth could be expected on the basis of gibberellin effects on new flushing. According to Voon *et al.* (1991) paclobutrazol could intensify flowering by blocking the conversion of kauren to kaurenoic acid, precursor of gibberellin.

Treatment with paclobutrazol significantly reduced the length of flowering shoot in both the year (Table 1). The average shoot length was shorter (20.89 cm) during the “off” year i.e. 2001 in comparison to “on” year of 2002 (26.63 cm). However, the effect of the treatment on fruiting was not evident in 2001, probably due to the shortness of time elapsed between treatment and panicle inception. The effect of the treatment on fruiting was better (more pronounced) in 2002 due to its residual effect on tree growth particularly on suppressing vegetative flushing prior to flowering. Menzel and Simpson (1990) have also reported carryover effect of the chemical on vegetative growth of bearing litchi trees. The delayed responses of the chemical up to a season may occur if there is insufficient soil moisture for uptake of collar drenches shortly after application. According to Menzel and Simpson (1990) there was no improvement in flowering when paclobutrazol merely delayed the development of a vegetative flush. Further, they observed that the benefits of paclobutrazol on flowering were greater when trees were expected to bloom moderately. Here, in our case the benefits were observed even when the trees were expected to bloom heavily in 2002. The results clearly indicated that the carryover effect of the chemical applied @ 3.0 g/m canopy was so strong that it significantly influenced the next years fruiting. Further, differences in the response of reproductive growth to paclobutrazol in other experiments may be due to differences in the rates of paclobutrazol used, or more importantly, to differences in the time of application during the growth cycle. Reduction in panicle length after paclobutrazol treatments has also been reported by Oosthinzan *et al.* (1995) and Lal *et al.* (2000) in litchi.

Although percentage of flowering panicles increased with paclobutrazol treatments, length of the panicle was shorter in comparison to those of the control trees. Average number of fruits/panicles was comparatively low and the bunch was less compact than the untreated trees. Thus the gain in yield was mainly due to increase in number of flowering panicles and not due to number of fruits/panicle. Shape of fruits became oblong from heart shape due to increased diametrical growth. The orientation of around 30 per cent fruit bunches changed to upward direction instead of their usual drooping habit. This was probably due to the shorter length and comparatively lower number of fruits per panicle following paclobutrazol application. Vegetative flush was very less in the treated trees. These trees dominated with brilliant pink furits with lesser quantity of green foliage in comparison to the control tree at the time of harvesting. However, further experiments are required to demonstrate the exact time and dose of application paclobutrazol. Information on long-term effect of repeated application on vegetative and reproductive growth is also needed.

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