Indian Journal of Agricultural Sciences **79** (12): 1010–2, December 2009

Effect of paclobutrazol application and planting systems on growth and production of peach (*Prunus persica*)*

N D NEGI[1] and N SHARMA[2]

Dr Y S Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh 173 230

Received: 11 May 2009; Accepted: 23 September 2009

Key words: Foliar, Paclobutrazol, Single hedgerow, Square, Trunk paste, Trunk soil line pour

The peach (*Prunus persica* Batsch) is commercially being grown under low planting densities in India. Plantings under such systems are less productive and give low returns/unit area. In Himachal Pradesh too, traditional system of peach production has not changed and thus productivity remained as low as just over 1 metric tonne/ha in comparison to 145 metric tonnes/ha elsewhere, under intensive cultivation. With the advent of knowledge about the tree architecture and physiology of tree size control, the temperate tree fruit crops are now being planted at closer spacing with smaller sized trees in developed countries. Such trees under high density plantings have potential for early cropping with higher yields and more economic returns/unit area. Moreover, with the increasing pressure on land and reduction in average land holding, there has been a great scope to change over to more efficient system of planting and canopy management. In absence of dwarfing rootstocks, peaches when grown under high density planting systems on seedling rootstocks have shown a tendency for excessive vegetative growth. However, plant growth regulators can be used in such orchards to keep the trees within a limited space. Paclobutrazol is a potential growth retardant and has potential to reduce the vegetative growth of trees planted at closer spacing by inhibiting gibberellic acid biosynthesis and can also improve fruit quality. Therefore, this study was carried out to evaluate the effect of paclobutrazol applied through various methods to 'July Elberta' peach trees, planted under different systems of intensive cultivation.

The study was carried out in the experimental orchard of the Department of Fruit Science, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan, during 2004–05, on 14-year-old trees of 'July Elberta' peach raised on wild peach rootstocks and established under four planting systems, viz square at 2 m×2 m, cluster at 2.25 m×1 m, paired row at 2 m×1 m and single hedgerow at 2 m×1 m spacings. In the absence of a dwarfing rootstock for peach in India, wild peach rootstock was used in the present study. The selected trees were given different treatments of paclobutrazol as foliar spray at 500, 1 000 and 2 000 ppm at full bloom, as trunk soil line pour at 1.0 and 2.0 g ai/tree and as trunk paste at 0.5 and 1.0 g ai/tree before bud break in 2004. The treatments were replicated thrice and the experiment was laid on randomized block design. The treatments were given in 2004 and in 2005 their after effect was studied. The data on annual shoot growth and internode length of 10 randomly selected current season's shoot, on each experimental tree was taken at the end of growing season. The total above ground volume of each experimental tree was calculated from height and spread measurements made at the beginning and end of each growing season, as per the formulae (Westwood 1978). The increase in tree volume during the growing season was expressed in percentage. The weight of pruning wood of each tree was recorded at the time of pruning in winter and expressed as kg/tree. The area of 10 fully-grown leaves randomly selected from all over the periphery of each tree was measured with the help of LI-COR 3100 leaf area meter and expressed in cm^2. At the time of harvest, fruits from each tree were weighed on a top pan balance and the production was expressed in kg/tree and its productivity was computed as metric tonne/ha.

It was clearly noticed that different treatments of paclobutrazol decreased average shoot growth, internodes length, tree volume and weight of pruning wood significantly as compared to control. It was however observed that the treatment of PP_{333} at 2 000 ppm applied as foliar spray was most effective in controlling the shoot growth, internodes length and tree volume during the year of application (2004),

*Short note

Based on part of PhD thesis of the first author submitted to YSPUHF, Solan during 2007

[1]Scientist Incharge (e mail: nanak_negi@yahoo.co.in), Mountain Agricultural Research and Extension Centre, Sangla, Kinnaur, Himachal Pradesh 172 106

[2]Professor, Fruit Science (e mail: narender_sol@indiatimes.com; nsharma.sol@gmail.com)

Table 1 Effect of paclobutrazol and planting systems on fruit yield (kg/tree) in 'July Elberta peach'

Planting system (no. of trees/ha) Treatment	2004					2005				
	Square (2 500)**	Cluster (4 444)	Paired (3 333)	SHR* (5 000)	Mean	Square (2 500)	Cluster (4 444)	Paired (3 333)	SHR* (5 000)	Mean
T_1: PP_{333} 500ppm	5.56	4.37	5.11	4.11	4.78	5.65	4.45	5.16	4.16	4.85
T_2: PP_{333} 1 000ppm	5.80	4.60	5.39	4.33	5.09	5.78	4.51	5.35	4.23	4.97
T_3: PP_{333} 2 000ppm	5.97	4.75	5.67	4.53	5.23	5.90	4.72	5.52	4.30	5.11
T_4: PP_{333} 1.0 g ai, TSLP	5.63	4.45	5.23	4.17	4.87	6.10	4.88	5.65	4.44	5.26
T_5: PP_{333} 2.0 g ai, TSLP	5.78	4.55	5.37	4.19	4.97	6.22	5.02	5.92	4.66	5.45
T_6: PP_{333} 0.5 g ai, TP	5.46	4.32	5.10	4.07	4.73	5.50	4.36	5.37	4.10	4.84
T_7: PP_{333} 1.0 g ai, TP	5.54	4.47	5.20	4.13	4.83	5.64	4.52	5.25	4.16	4.89
T_8: Control	5.42	4.11	4.99	4.00	4.63	5.44	4.14	5.02	4.04	4.66
Mean	5.65	4.46	5.28	4.19		5.78	4.57	5.40	4.26	
CD (P=0.05)	Treatment (T): 0.23; 0.21			Planting system (S): 0.18; 0.15 T×S: 0.52; NS						

Table 2 Effect of paclobutrazol and planting systems on Yield efficiency (MT/ha) in 'July Elberta' peach

Planting system (no. of trees/ha) Treatment	2004					2005				
	Square (2 500)**	Cluster (4 444)	Paired (3 333)	SHR* (5 000)	Mean	Square (2 500)	Cluster (4 444)	Paired (3 333)	SHR* (5 000)	Mean
T_1: PP_{333} 500ppm	13.90	19.40	17.03	20.57	17.72	14.13	19.80	17.20	20.82	17.98
T_2: PP_{333} 1000ppm	14.50	20.44	17.96	21.65	18.63	14.46	20.06	17.85	20.83	18.30
T_3: PP_{333} 2000ppm	14.91	21.01	18.89	22.65	19.36	14.76	20.96	18.39	21.52	18.90
T_4: PP_{333} 1.0 g a.i., TSLP	14.07	19.77	17.43	20.85	18.03	15.25	21.70	18.83	22.18	19.49
T_5: PP_{333} 2.0 g a.i., TSLP	14.45	20.22	17.89	20.95	18.37	15.54	22.32	19.73	23.30	20.22
T_6: PP_{333} 0.5 g a.i., TP	13.66	19.18	16.99	20.37	17.55	13.80	19.39	17.92	20.52	17.90
T_7: PP_{333} 1.0 g a.i., TP	13.86	19.88	17.33	20.65	17.93	14.11	20.10	17.49	20.82	18.13
T_8: Control	13.55	18.26	16.65	20.02	17.12	13.61	18.43	16.73	20.22	17.38
Mean	14.11	19.77	17.52	20.96		14.45	20.34	15.75	21.27	
CD (P=0.05)	Treatment (T): 0.35; 0.26			Planting system (S): 0.24; 0.18 T×S: 1.86;0.52						

*SHR, Single hedgerow; TSLP, trunk soil line pour; TP, trunk paste

** Number of tree/ha

whereas in the following year (2005), the residual effect in controlling the tree growth was strongest when PP_{333} was applied at 2.0 g ai/tree as trunk soil line pour. As paclobutrazol inhibits gibbrellin's biosynthesis (Fletcher *et al.* 2000), its effect on the reduction of shoot internodes elongation is understandable. In this study, the reduction of tree volume and pruning wood weight was in proportion to the decrease in the growth of annual shoot of the different treated trees. The decrease in the annual shoot growth due to shorter internodes following the application of paclobutrazol might have contained the tree size. All the paclobutrazol treatments except its foliar application at 500 ppm reduced the leaf area significantly in comparison to control. However the reduction in leaf area was more with the application of PP_{333} at 2000 ppm as foliar spray, in 2004 and the residual effect in controlling the leaf area was more with its application at 2.0 g ai/tree as trunk soil line pour (TSLP). The rapidity and persistency of the PP_{333} treatments' effects depend upon the method of application and concentration of the chemical being used, as its soil application at higher rates had greater carry over effect during the following year than trunk paste and foliar applications, which can be attributed to the slower rate of degradation of chemical in the soil. Vegetative growth in terms of internode length and per cent increase in tree volume and pruning wood weight was highest in trees planted in square system, with more planting distance and accommodating least number of trees/ha (2 500/ha) and lowest in trees planted in single hedgerows, with less planting distance and accommodating highest number of trees/ha (5 000/ha). The tree growth is primarily a function of greater availability of photosynthates, nutrients etc. and higher vegetative growth in the trees planted in square system can attribute to increased rates of photosynthesis and higher accumulation of nutrients in leaves. The pruning wood weight was higher under square system which may be attributable to the increased annual shoot growth in these plantations.

The production of fruits in terms of yield (kg/tree) was more on the trees under different paclobutrazol treatments

in both the years (Table 1). However, higher increase in yield was observed under the treatment of PP_{333} at 2000 ppm when applied as foliar spray, during the year of application (2004) and in the following year (2005) the increase in these production parameters was greater in those trees which were treated with PP_{333} at 2.0 g ai/tree in the previous year. The increase in fruit yield following the application of paclobutrazol has also been reported earlier by different workers (Eliwa and Ashour 2004). The maximum fruit yield (kg/tree) among the different planting systems was recorded in trees under square system, having the lowest planting density and the yield deceased linearly with the increase in planting density and thus it was recorded minimum in trees planted under single hedgerow system having the highest tree density (Table 1). The yield efficiency in terms of metric tonnes/ha was recorded highest on trees given PP_{333} at 2.0 g ai/tree as soil application (Table 2). The present results are also in congruence with the findings of Szewczuk and Licznar (2004).

SUMMARY

Paclobutrazol was applied through foliage at full bloom at 500, 1 000, 2 000 ppm, as trunk soil line pour at 1.0 and 2.0 g ai/tree and as trunk paste at 0.5 and 1.0 g ai/tree before bud break to 'July Elberta' peach (*Prunus persica* Batsch) in 2004. Trees given higher doses of paclobutrazol irrespective of mode of application showed a greater reduction in pre cent increment in tree volume and pruning wood weight (kg) as compared to control. However, average fruit yield was higher under all the paclobutrazol treatments (4.07–4.53 kg/tree and 4.84–5.45 kg/tree in 2004 and 2005, respectively) in comparison to control (4.0 kg/tree and 4.66 kg/tree in 2004 and 2005, respectively). Higher vegetative growth, pruning wood weight and yield/tree was observed under the square system of planting at 2 m × 2 m spacing, but further increasing the tree density, a reduction in fruit yield was resulted.

REFERENCES

Eliwa G I and Ashour N E. 2004. Effect of paclobutrazol sprays on shoot growth, yield and fruit quality of Meit Ghamer peach cultivar. *Assiut Journal of Agricultural Sciences* **35**(4): 141–153.

Fletcher R A, Gilley A, Sankhla Narendra and Davis T D. 2000. Triazoles as plant growth regulators and stress protectants. *Horticultural Reviews* **24**: 55–139.

Szewczuk A and Licznar M M. 2004. Growth and Yielding estimation of young peach trees Early Reheaven cultivar in relation to shape of canopy and density of trees. *Folia Universitatis Agriculturae Stetinensis Agricultura.* **96**: 207–12.

Westwood M N. 1978. Temperate Zone Pomology, 478 pp. W H Freeman Co. San Francisco.