

## Influence of Paclobutrazol on Yield Components and Seed Quality in Lentil (*Lens culinaris* Medic.)

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### Abstract

Foliar spraying of field grown lentil plants with paclobutrazol (PBZ-5, 10 and 20 µg/ml) significantly suppressed plant height but increased the number of primary and secondary branches with a consequent enhancement in seed yield through increased number of pods per plant. PBZ enhanced total dry matter of plants, partitioning coefficient and harvest index. The leaves in PBZ treated plants were dark green and showed higher total chlorophyll content. The levels of total soluble sugars, amino acids and proteins were also higher in seeds harvested from PBZ treated plants.

**Key words :** Lentil, *Lens culinaris*, Paclobutrazol, Yield, Seed quality.

Lentil yield is a function of the number of pods per plant and average seed weight. However, the maximum yield in this crop is constrained by abscission of large number of reproductive structures (flowers and developing pods), low partitioning co-efficient and poor harvest index. Competition for nutrients and their insufficient availability to the developing embryos, poor sink size and hormonal imbalance do influence flower formation, flower and pod drop, yield and seed quality in legumes (1—3). Different plant growth regulators, when applied exogenously, are reported to advantageously modify growth and yield of lentil (4—7). Paclobutrazol is one of the most important plant growth retardants and is shown to induce several physiological alterations that generally lead to optimized yield formation in crop plants (8—10). In this communication we report the effects of paclobutrazol on growth, yield components and seed quality in lentil.

### Methods

Lentil (*Lens culinaris* cv LL-147) plants were raised in the experimental area of the department in small plots in a randomized block design in three replications following recommendations described in the package of practices for crops, Punjab Agricultural University. The plants were foliarly sprayed at the time of anthesis with paclobutrazol (PP333)/[2RS, 3RS]-1-(4-chlorophenyl)-4,4-dimethyl-2-yl-1H-1,2,4-

traizol-1-yl)-pentan-3-ol] solutions at 5, 10 and 20 µg/ml concentrations containing 0.05% (vol / vol) Triton X-100 as surfactant. Another spray treatment was given after a week. Plants sprayed with water containing surfactant served as control. At maturity, attained in about 155 days after sowing (DAS), the data on various growth and yield parameters were recorded from ten randomly selected plants from central rows of each plot. Chlorophyll content of leaves was determined at 110, 120 and 130 DAS stages by the method of Anderson and Boardman (11). Seeds collected at final harvest from control and treated

**Table 1.** Effect of paclobutrazol (PBZ) on growth and yield attributes of *Lens culinaris*.

Plant character	Treatments			
	Control	PBZ (5µg/ml)	PBZ (10µg/ml)	CD (at 5%)
Plant height (cm)	41.50	37.60	32.80	3.3
Number of branches				
Primary	7.00	8.90	10.20	1.75
Secondary	13.00	16.00	21.00	3.89
Number of pods/plant	119.00	166.00	229.00	3.75
Seed yield/plant	2.72	3.87	5.10	1.35
1000-seed weight(g)	18.89	19.00	19.12	2.00
Total dry matter (g/plant)	7.90	10.60	14.30	1.89
Partitioning coefficient (%)	46.00	48.00	49.00	
Harvest index	0.34	0.36	0.36	

**Table 2.** Effect of paclobutrazol (10 µg/ml) on leaf chlorophyll (chl) content (mg/g FW) during different stages of development of *Lens culinaris*.

Days after sowing	Control				Treatment			
	Total chl	Chl <i>a</i>	Chl <i>b</i>	Chl <i>a/b</i> ratio	Total chl	Chl <i>a</i>	Chl <i>b</i>	Chl <i>a/b</i> ratio
110	1.92	1.38	0.54	2.50	2.76	1.88	0.85	2.2
125	2.12	1.43	0.69	2.00	2.99	1.97	1.02	1.8
130	1.72	1.14	0.58	1.97	2.58	1.68	0.98	1.70

plants were analyzed for total soluble sugars (12) and starch (13), amino acids (14), and soluble proteins (15).

### Results and Discussion

Table 1 shows that PBZ treatments reduced plant height but enhanced the number of primary and secondary branches significantly over control. The inhibition in plant height with paclobutrazol is consistent with the reported mode of action of this chemical as a suppressor of GA biosynthesis (16). Increased branching resulted in significant enhancement in number of pods with a consequent increase in seed yield per plant (Table 1). With 5 and 10 µg/ml PBZ treatments the increase in seed yield per plant was about 42 and 87%, respectively, over controls. Thousand seed weight also showed marginal increase over control. In lentil, seed yield is positively correlated with number of branches and pods per plant, total dry matter and 1000-seed weight (6,17). The improvement in the characteristics related to seed yield by PBZ seems to be due to the influence of this chemical on cell division and metabolic activities in the shoot apical meristem that stimulate increased bud initiation, leading to increased branching and development of greater sink capacity. Further, PBZ is reported to break apical dominance and induce enhanced branching in oilseed brassica (9,10).

PBZ also enhanced total plant dry matter and its accumulation in the pods (Table 1). Though there was no appreciable change in harvest index, the partitioning coefficient showed improvement to some extent. The enhancement in total dry matter production and its apparent partitioning towards pods suggests that PBZ has altered source : sink relationship. Further, dry matter production is the main function of photosynthesis and PBZ appears to have enhanced

photosynthetic efficiency of plants. The leaves in PBZ-treated plants were dark green, and had higher total chlorophyll but decreased chl *a/b* ratio during different stages of development (Table 2). These changes in chlorophyll properties are indicative of increased photosynthetic and metabolic activities (18, 19).

Seed yield is strongly influenced by availability of assimilates during fruit development. The enhancement in dry weights of pods and seed yield with PBZ treatments indicates that this chemical has stimulated the efficiency of developing sink (fruit) to utilize more photoassimilates. Improvement in partitioning coefficient supports this contention. Increase in seed yield in lentil has been reported with the use of several plant growth regulators such as mixtalol, phenolic compounds, triacontanol and NAA (4–7). Analysis of mature seeds indicated that PBZ treatments enhanced the levels of total soluble sugars, amino acids and proteins but decreased that of starch (Table 3). PBZ is reported to stimulate carbohydrate metabolism in plants (20). In the present investigation PBZ at 10 µg/ml concentration was more effective than at 5µg/ml in bringing about morpho-physiological and biochemical changes and improving yield components in lentil.

**Table 3.** Effect of paclobutrazol (10µg/ml) on accumulation of rescues (mg/g) in nature seeds of *Lens culinaris*. C-Control, T-Treated.

Seed rescues	Control		Treated		CD (at 5%)
	Control	Treated	Control	Treated	
Total soluble sugars	1.72	1.87	1.87	1.87	0.25
Starch	9.60	7.39	7.39	7.39	1.85
Total free amino acids	1.52	1.79	1.79	1.79	0.39
Total alkalisoluble proteins	24.75	30.75	30.75	30.75	4.25

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