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Studies on Phytotoxicity of Carbaryl on Pigeonpea (*Cajanus cajan* (L.) Millsp.) and its Impact on Grain Yield

V. J. Patel*, C. B. Patel, R. C. Jhala, A. B. Rai and A. H. Shah

Department of Entomology, N. M. College of Agriculture, Gujarat Agricultural University, Navsari Campus, Navsari-396 450

ABSTRACT

Studies on phytotoxicity of carbaryl on pigeonpea were made in field conditions at Agricultural Research Farm, Gujarat Agricultural University, Navsari during 1984 kharif season. Results revealed that carbaryl both in spray and dust formulations exhibited phytotoxic symptoms on foliage. Phytotoxic symptoms started developing from first week after treatment and were fairly evident after 2nd week of the treatment. However, there was recovery in affected leaves as recorded after 4th week's of treatment. Although higher doses *viz.*, Carbaryl 0.43%, 0.22% and 0.1% of Carbaryl 50 WP and 10% dust formulation of carbaryl have caused phytotoxicity on leaves but recorded higher yield may be due to protection given by the pesticide against pest complex infesting pods.

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INTRODUCTION

Among pulses, pigeonpea (*Cajanus cajan* (L.) Millsp.) occupies a very important place in the Indian food pattern, being next to chickpea in the area and production. It suffers great losses due to many insect pests particularly *Melanagromyza obtusa* Mall., *Heliothis armigera* Hb., *Exelastis atomosa* W. and *Clavigralla gibbosa* Spin. during later growth stage of the plant in the area. A number of insecticides have been tested against pest complex of pigeonpea and carbaryl has been found promising (Chelliah *et al.*, 1978; Rajendran *et al.*, 1979 and Sundararaju *et al.*, 1986). But, there have been some reports of its phytotoxicity on this crop (Chari and Patel, 1971; Thakur *et al.*, 1986 and Kabaria *et al.*, 1988). Considering this, the present work was undertaken to confirm the phytotoxicity of carbaryl dust and wettable powder having all possible range from lower to higher dosage and its effect on yield potential of the crop as compared to untreated control.

MATERIALS AND METHODS

Field experiment was conducted at Agricultural Research Farm, Gujarat Agril. University, Navsari during 1984 in *kharif* season to test the phytotoxic effect of carbaryl wettable powder (from lower to higher doses) and dust on pigeonpea crop with five replications and seven treatments including control (water spray) as per detail given in Table 1. All the treatments were applied at 50% flowering stage. One line having 25 tur plants was considered for one treatment. In case of carbaryl 10% dust @ 50 gram per plant was given with the help of musline cloth to ensure full coverage. For the purpose of investigation, five plants were randomly selected from each treated line considering one plant as one replication. Three branches

* Present address : Assistant Research Scientist (Entomology), GAU, Gandevi.

from each of previously marked five plants were randomly selected and stagged with luggage lable. The observations on the number of leaves having phytotoxic effect were made only on three tagged branches per plant at 2nd and 4th weeks after treatments. The mean percentage of affected leaves per plant were worked out based on total number of leaves including healthy and affected leaves per three branches per plant. The data on per cent leaves having phytotoxic effect were subjected to statistical analysis using completely randomized design after transformation. At maturing, the yield per plant was also taken into account and analysed statistically using same design.

RESULTS AND DISCUSSION

The data on mean percentage of leaves having phytotoxic effect due to different treatments and the respective grain yield are presented in Table 1. Results revealed that carbaryl both in spray and dust formulations exhibited phytotoxic effect on foliage. The phytotoxic injury symptoms started developing one week after an application of the treatments. It consisted of burning, yellowing and bronzing of leaves and finally the affected leaves defoliated. The branches were seen more spreaded in the treatments where phytotoxic effect was recorded. After two weeks of treatments, the phytotoxic symptoms on foliage were fairly evident and it increased with increasing concentration. It was highest in the treatment of carbaryl 0.43% (81.39%) and differed significantly with rest of the treatments. The treatment of carbaryl 0.01% recorded the lowest percentage of phytotoxic effect(2.38%) and was at par with control. The treatments of carbaryl 0.22%

TABLE 1

Phytotoxicity of carbaryl on pigeonpea and its effect on grain yield.

Sr. No.	*Treatment*	*Average percentage of phytotoxic leaves after indicated period of treatment*		*Yield per plant (gram)*
		After II week	*After IV week*	
1.	Carbaryl 10% dust	32.29 bc (28.53)	24.98 bc (17.84)	42.8 ab
2.	Carbaryl 50 WP @ 0.01%	08.87 d (02.38)	03.76 d (00.43)	31.a bcd
3.	Carbaryl 50 WP 0.05%	24.71 c (17.48)	11.03 cd (03.66)	29.8 cd
4.	Carbaryl 50 WP 0.1%	31.58 bc (27.43)	21.36 bc (13.27)	50.6 a
5.	Carbaryl 50 WP 0.22%	40.59 b (42.33)	31.50 ab (27.30)	32.6 bc
6.	Carbaryl 50 WP 0.43%	64.42 a (81.39)	42.60 a (45.82)	38.6 ab
7.	Control (water spray)	07.52 d (01.70)	04.47 d (00.61)	18.2 d
	S. Em. ±	04.69	05.05	03.90
	C. D. (P= -0.05)	13.56	14.59	13.42
	C. V. %	52.57	37.62	25.00

Note : 1. Figures in parentheses are arcsin retransformed values

2. Figures with same letter(s) are not significantly different at 5% level of significance.

W.P. was at par with the treatments of carbaryl 0.1% W.P. and carbaryl 10% dust. However, carbaryl 10% dust was at par with the treatments of carbaryl 0.08% W.P. After 4 weeks of the treatment, the percentage of phytotoxic leaves decreased in all the treatments as compared to that of two weeks after treatments indicating the recovery in phytotoxic effect. However, the treatments of carbaryl 0.43% recorded highest per cent of phytotoxic leaves (42.82%) and was at par with carbaryl 0.22% (27.30%), while it differed significantly with rest of the treatments. The treatment of carrbaryl 0.01% recorded lowest percentage of phytotoxic leaves (0.43%) and was at par with the treatments of carbaryl 0.05% and control.

Inspite of an apparent phytotoxic effect, yield remained unaffected and different treatments of carbaryl recorded increase in yield as compared to control. The higher yield in various treatments seems mainly due to their better effectiveness in controlling different pests damaging pods. During the study, the crops were observed to suffer from a considerable attack of insect pests mainly *Malanagromiza obtusa, Heliothis armigera, Exalastis atomosa* and *Clavigralla gibbosa* during the reproductive stage of the crop. The treatment of carbaryl 0.1% recorded highest yield (50.6 gm./plant) and was at par with carbaryl 10% dust and carbaryl 0.43%, while it was significantly superior over rest of the treatments. The lowest yield (18.29 gm/plant) in untreated control treatment may be attributed to the pests infesting pods as they were not protected. However, it was at par with carbaryl 0.1% and carbaryl 0.05%.

Thus, it can be concluded that though various higher doses *viz.*, 0.43%, 0.22% and 0.1% of carbaryl 50 WP as well as 10% dust formulation of carbaryl have led to the phytotoxic effect on foliage but recorded higher yield by protecting the pest complex infesting pods. Similarly, Thakur *et al.*, (1986) found carbaryl both in spray (0.2% and 0.4%) as well as dust exhibiting phytotoxic effect on foliage of pigeonpea and reported that the slight to moderate phytotoxic effect did not have a profound effect on the yield potential of the crop. Carbaryl dust formulation has been reported highly phytotoxic to the pigeonpea plant resulting into yellowing and bronzing of leaves and finally the plant defoliated (Chari & Patel, 1971; Kabaria *et al.*, 1988).

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