

# EFFICACY OF PENDIMETHALINE HERBICIDE AGAINST *Trianthema monogyna* (HORSE PURSLANE) WEED IN COTTON CROP SOWN ON RIDGES

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## ABSTRACT

A field study was carried out during the kharif 2003 to evaluate the efficacy of pendimethaline (Stomp 330-E) on *Trianthema monogyna* (horse purslane) growth and its control in cotton crop sown on ridges. Three levels of pendimethaline i.e. 2.5, 3.12 and 3.75 L ha<sup>-1</sup> were applied in comparison to control treatment (weedy check) as a pre-emergence. The data obtained during the investigations showed differential response. Maximum reduction in weeds density m<sup>-2</sup> was obtained with the application of pendimethaline @ 3.12 L ha<sup>-1</sup> leading to increased growth and yield of cotton as a result of reduced competition with weed plants. The maximum seed cotton yield of 1305 kg ha<sup>-1</sup> was obtained by the application of Stomp 33E @3.12 L ha<sup>-1</sup>. These findings indicate that we suspect *T. monogyna* resistance to Stomp 330 E (pendimethaline) owing to its repeated use in cotton. We can however, have an adequate control of the referred weed with an increased rate of the same herbicide i.e. 3.12 L ha<sup>-1</sup> as a pre-emergence application instead of recommended dose of 2.5 L ha<sup>-1</sup>. It is further stated that it is the time to switch over to other biochemical groups to manage *T. monogyna* in the area.

**Key Words:** Cotton, *Gossypium hirsutum*, *Trianthema monogyna*, weed infestation, pendimethaline, Stomp 330E

## INTRODUCTION

Cotton (*Gossypium hirsutum* L) is an important cash crop of Pakistan. It is one of the major sources of foreign exchange earning and provides employment to thousands of labourers in rural as well as urban areas. It provides raw material in the form of fiber and cotton seed for the textile and vegetable ghee industry respectively. Weeds reduce yield and quality of the crop, harbor insects and disease organisms, impair human health, destroy irrigation system and reduce land value. Weeds compete with the crop for light, nutrients, water and carbon dioxide (Anderson, 1983). The losses caused by weeds through depletion of nutrients and moisture are a direct burden on grower's pocket as he invests huge expenditure on fertilizers and irrigation water. Weed infestation especially *Trianthema monogyna* because of its succulent nature is a major problem in Southern Punjab in obtaining higher per acre seed cotton yield. Schwerzel and Thomas (1971) stated that weeds utilize three to four times more nitrogen, potassium and magnesium than a weed free crop. Further more, they observed increased moisture loss from the soil than the cotton plants, as the weed plants are more adaptive even under harsh and

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adverse conditions. It has been reported that weeds can reduce the seed cotton yield up to 20-55% and adversely affect the quality of the produce.

Pendimethaline (Stomp-330 E) is considered an effective control against *Trianthema monogyna* (horsepurslane vern. itsit) for the last many years as a pre-emergence application @ 2.5 L ha<sup>-1</sup>. Cheema *et al.* (1988) revealed, that pre-emergence application of pendimethaline @ 1.32 a.i. kg ha<sup>-1</sup> was most effective in controlling both broadleaf and grass weeds but was less effective against *Cyperus rotundus* L. The complaints have been received in the Adaptive Research Farm, Dera Ghazi Khan, by the cotton growers about the herbicide resistance or reduced control of pendimathline. This indicates that *T. monogyna* plant species has developed inherited ability to survive and reproduce following the exposure to a recommended dose of pendimethaline. Therefore, a study was designed to evaluate the efficacy of pendimethaline against *T. monogyna* on farmer's field under the agro-climatic conditions of Dera Ghazi Khan zone, falling in the Cotton Belt of Pakistan.

## MATERIALS AND METHODS

The investigations pertaining to the effect of pendimethaline to control *T. monogyna* in cotton sown on ridges was undertaken during the year 2003. The study was carried out on farmer's field in Basti Cheena, Tehsil Jampur district Rajanpur, Punjab Pakistan during kharif 2003. The experiment was laid out in Randomized Complete Block Design (RCBD) having three replications. Three levels of pendimethaline viz. 2.5, 3.12 and 3.75 L ha<sup>-1</sup> were applied as pre-emergence just after sowing the cotton crop. The net plot size was 27×11 m<sup>2</sup> and the cotton variety CIM-473 was used as a test crop. After seed bed preparation, ridges were made by tractor driven ridger. Seed was sown during the 1<sup>st</sup> week of May, 2003 on ridges by maintaining 22.5 cm plant to plant distance and ridges were kept 60 cm apart from each other. A recommended dose (120-60-60 NPK kg ha<sup>-1</sup>) of fertilizer was applied. Whole the phosphorus and potassium in the form of DAP and potassium sulphate were applied at the time of sowing while nitrogen in the form of urea was applied in 3 equal splits doses i.e. at the time of sowing, during 1<sup>st</sup> and 2<sup>nd</sup> irrigation stages. First irrigation was applied 30 days after emerging and subsequent irrigations were given at an interval of about two weeks depending upon the weather conditions. The crop received seven normal irrigations in each year during the crop growth period. Herbicide applications were applied with knapsack hand sprayer having flat fan nozzle. The following schedule was followed to protect the crop from insects pests as per requirement of the crop.

To control jassid and spotted bollworm 1<sup>st</sup> spray of imidacloprid @ 0.625 kg ha<sup>-1</sup> (confidor SL 100) + Cyhelothrin @ 1 L ha<sup>-1</sup> (Karate 2.5 E.C.) was applied. After two weeks of 1<sup>st</sup> spray, the 2<sup>nd</sup> spray of fanvalrate (Sumiciden 20E.C.) + bifenthrin (Talstar 10 E.C.) @ 0.825 + 0.625 L ha<sup>-1</sup> was applied to control spotted bollworm + pink bollworm. The 3<sup>rd</sup> spray after 25 days of 2<sup>nd</sup> spray of buprofozin @ 1.5 kg ha<sup>-1</sup> (100 E.C.) to control white fly. To control the insects like army bollworm, 4<sup>th</sup> spray of thiodicarb @ 1.20 kg ha<sup>-1</sup> (Larvin 80 D.F.) was applied after 10 days of 3<sup>rd</sup> spray. The last and final spray (5<sup>th</sup>) of profenofos (Curacron 500 E.C.) was applied after a week of 4<sup>th</sup> spray @ 2.5 L ha<sup>-1</sup> to control army bollworms and their eggs.

All other agronomic practices were kept normal and uniform for all the treatments. Data regarding number of weeds m<sup>-2</sup> after weedicide spray, plant height at maturity, number of bolls/plant, boll weight and the seed cotton yield were recorded.

The data collected were analyzed statistically by using Fisher's analysis of variance technique and Duncan's new multiple range test to compare the treatment means (Steel and Torrie, 1980). The meteorological data (rainfall and temperature) and physico-chemical characteristics of the soil recorded are given in Figure-1 and Table-1 respectively.

Fig-1. Mean monthly rainfall and temperature during crop growth period at experimental sites during the year 2003.

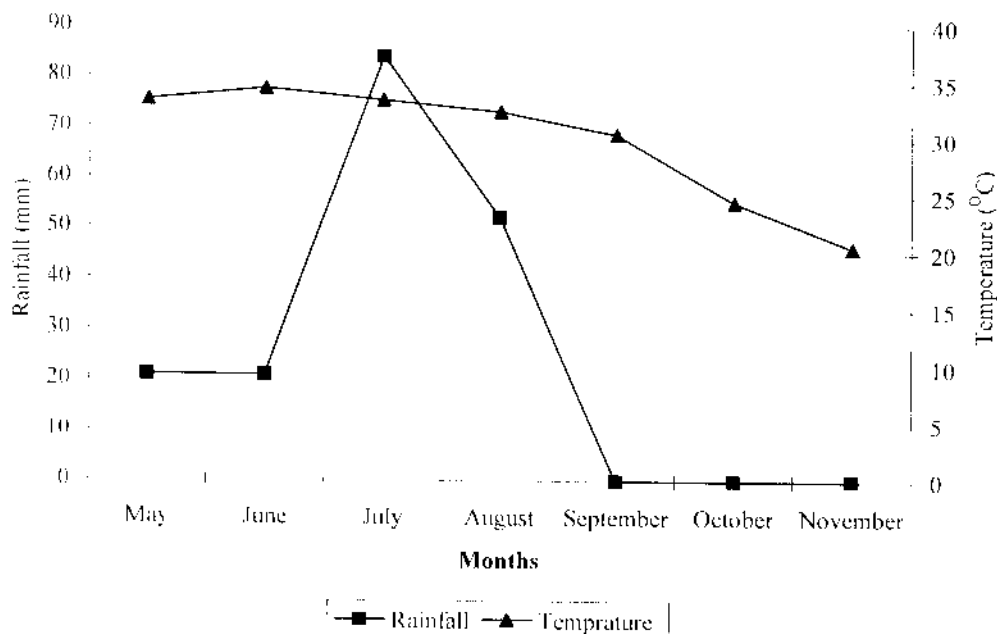


Table-1. Physico-chemical characteristics of the experimental site.

#### Soil Characteristics

Organic matter

Available phosphorus

Soil PH

Moisture contents in 0-6" depth at sowing time

Moisture contents in 6-12" depth at sowing time

Soil Texture

#### Extent

0.28%

2.70 mg kg<sup>-1</sup>

7.8

1.30 %

8.5 %

Sandy loam (clay 20, silt 38, Fine sand 38 and coarse sand 4%).

## RESULTS AND DISCUSSIONS

### Weed density per m<sup>2</sup>

It is evident from the data in Fig-2 that *T. monogyna* density m<sup>-2</sup> was reduced significantly, when pendimethaline was applied @ of 3.12 L ha<sup>-1</sup> which is closely followed by 3.75 L ha<sup>-1</sup> and is statistically at par with each other. This indicated that the application of pendimethaline @ of 3.12 L ha<sup>-1</sup> gave good control of *T. monogyna* and is more economical and justifiable in view of health hazards while the application of

pendimethaline @ of 2.5 and 3.75 L ha<sup>-1</sup> is under and over dose leading to instigate the risk of herbicide resistance and economically heavy burden on farmer's pocket. Maximum No. of weeds m<sup>-2</sup> i.e.42 were recorded in weedy check plots. These results are in line with Cheema *et al.* (1988) who reported that optimum level of weedicide should be applied rather than reduced rate to avoid resistance development.

#### **Crop population m<sup>-2</sup>**

The results indicate that there were highly significant difference among treatment means regarding plant population /unit area. Maximum plant population 2.51 plants m<sup>-2</sup> each was recorded in plots sprayed with 3.12 L ha<sup>-1</sup> and 3.75 L ha<sup>-1</sup>, which were statistically significant from the plant population (1.78) achieved in plots where pendimethaline was applied @ 2.5 L ha<sup>-1</sup> which is at par with the control treatment. These results are in accordance with the results of Zaki *et al.* (1988), who also recorded non-significant difference of plant population among various treatments. The population achieved in various treatments is not directly affected by the weedicide application, but is more related to soil and climatic conditions. The climatic conditions prevailed during the season were more harsh and severe (Fig-1). As a result, the plant population achieved remained lesser than normal one, which subsequently affected the seed cotton yield and its yield components markedly.

#### **Plant height (cm)**

Statistically significant results were achieved regarding plant height during the year of studies (Table-2). It is evident from the results that with the increase in pendimethaline dose per acre, there was substantial decrease in plant height. Maximum plant height of 94 cm was achieved in treatment where pendimethaline was applied @ 2.5 L ha<sup>-1</sup> as compared to 90 cm where weedicide was applied @ of 3.75 L ha<sup>-1</sup> however, in control treatment; 86 cm plant height was obtained. From the results it is very clear that the increased rate of herbicide application has also discouraged the growth of main crop as well in addition to weed plants. In weedy check plots, cotton plants also attained less height as a result of competition of resources that exists among weed and cotton plants. These results are in accordance with those of Zaki *et al.* (1988) who recorded that the plant height decreased with the increase of competition for resources.

#### **No of bolls plant<sup>-1</sup>**

Statistically non-significant results were received regarding number of bolls per plant during the year of study i.e. kharif 2003 (Table-2). Maximum numbers of bolls per plant (21) were recorded in control followed by 19 bolls per plant in plots where pendimethaline was sprayed @ 2.5 L ha<sup>-1</sup> and minimum number of bolls/plant (16) were noted in plots where pendimethaline was sprayed @ 3.75 L ha<sup>-1</sup>. These results indicate that herbicide application has inverse relation with the number of bolls/plant and might have caused the flower shedding, leading to less number of bolls per plant.

#### **Boll weight (g)**

Data presented in Table-2 clearly showed statistically significant effect of pendimethaline treatments on boll weight (g) during the course of study. Application of pendimethaline @ 3.75 and 3.12L ha<sup>-1</sup>, respectively produced bolls weight 2.59 g and 2.55 g which were statistically at par with each other while minimum boll weight (2.40 g) was achieved in control plots. These results exhibit that pendimethaline @ 3.12 L ha<sup>-1</sup> as pre-emergence remained help full in obtaining significant boll weight, which finally contributed towards increased seed cotton yield. It has been recorded that the average boll weight thus achieved during the season actually is the result of inherited potential of the variety combined with ecological conditions.

### Seed cotton yield (kg ha<sup>-1</sup>)

From the results presented in Table-2, it is very clear that highest yield of 1305 kg ha<sup>-1</sup> was recorded in plots sprayed with 3.12 L ha<sup>-1</sup> pendimethaline followed by 1244 kg ha<sup>-1</sup> of seed cotton yield in plots sprayed with 3.75 L ha<sup>-1</sup> and these are statistically at par with each other. Lowest yield was obtained in control treatment i.e. 887 kg ha<sup>-1</sup>. From the results, it is revealed that an increase of 8%, 47% and 40% was obtained by applying pendimethaline @ of 2.5, 3.12 and 3.75 L ha<sup>-1</sup>, respectively. The overall lesser yield could be the result of meteorological, soil conditions that prevailed during the year of study. The increase in seed cotton yield in plots where weedicide was applied is in accordance with the findings of Jalis and Shah (1982) and Malik *et al.* (1983). It is therefore depicted from the results that to get maximum per acre seed cotton yield, pre

Fig-2 Effect of Pendimethalin on the density of *Trianthema monogyna* in cotton crop sown on ridges.

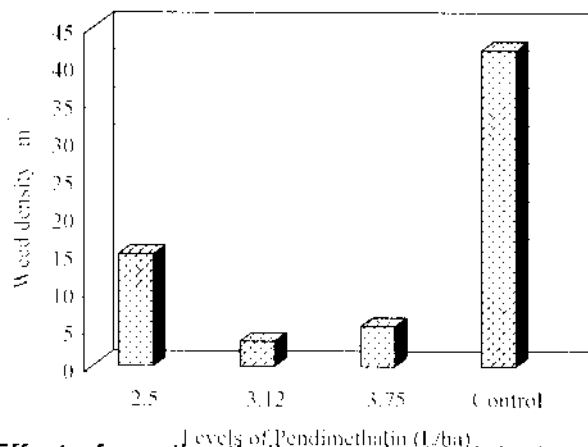


Table-2. Effect of pendimethaline on plant height (cm), plant population m<sup>-2</sup>, number of bolls per plant, boll weight (g) and seed cotton yield kg ha<sup>-1</sup>.

Plant characteristics	Pendimethaline L ha <sup>-1</sup>				LSD <sub>0.05</sub>
	2.5	3.12	3.75	Weedy check	
Plant height (cm)	94 a <sup>3</sup>	92 a	90 ab	86 b	5.40
Crop population m <sup>-2</sup>	1.78 b	2.51 a	2.51 a	1.47 b	0.351
Number of bolls plant <sup>-1</sup>	18.66	17.33	16.33	20.66	ns
Boll weight (g)	2.49 c	2.55 ab	2.59 a	2.48 c	0.063
Seed Cotton Yield (kg ha <sup>-1</sup> )	958.5 b	1304.9 a	1243.8 a	886.9 c	3.68

Any two means not sharing a letter in common in the respective column do not differ significantly by New Duncan's multiple range test at P<sub>0.05</sub>.

emergence spray of pendimethaline @ 3.12 L ha<sup>-1</sup> proved effective to control *T. monogyna* vern. itsit weed infestation leading towards 6 to 47% increase in seed cotton yield.

### CONCLUSIONS

On the basis of study conducted, it can be concluded that to get maximum per acre yield of cotton, the cotton growers in the Cotton belt (comprising D. G. Khan and Rajanpur Districts) need to increase the application rate of pendimethaline at least to 3.12 L ha<sup>-1</sup> to effectively control the *T. monogyna* infestation. However, further experimentation needs to be carried out in different agro-ecological zones of cotton belt to standardize the dose of pendimethaline as per soil and meteorological requirement of the area so as to confirm the development of resistance in *T. monogyna* weed against pendimethaline, so that it could be combated with appropriate measures.

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