Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

ANSInet
an open access publisher
http://ansinet.com

Asian Journal of Plant Sciences
Volume 1 Number 2: 112-113, 2002

Comparative Studies on Pre-emergence Herbicides Application on the Growth and Yield of Cotton (*Gossypium hirsutum* L.)

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Abstract: The field experiment was conducted to assess the pre-emergence herbicide application on the growth and yield of cotton. Treatments for weed control were herbicides including, Dual Gold 960 EC 2000 ml ha^{-1}, Dual Gold 960 EC 2500 ml ha^{-1}, Stomp 330 EC 1.25 Lit ha^{-1}, Stomp 330 EC 1.50 Lit ha^{-1}, Stomp 455 C. S 0.66 Lit ha^{-1}, Stomp 455 C.S 1.00 Lit ha^{-1} and control (untreated). Three weed species i.e., broad leaved (locally called Waho, and Naro), grasses (locally called (Sawri, Chabber, Mandhano) and sedges (locally called Kabah) were found in the cotton field. Weed density reduced by 174 percent over untreated control significantly with the application of Stomp 455 C.S 0.66 Lit ha^{-1} as pre-emergence weed control. The greater reduction of weed species resulted taller plants, more fruiting branches, seed cotton weight, and ginning out-turn percentage. Therefore it is concluded that Stomp 455 C.S 0.66 Lit ha^{-1} is an effective pre-emergence weed control treatment for achieving maximum cotton yield and ginning out-turn.

Key words: Cotton, weeds, herbicides, growth, yield, ginning outturn

Introduction

Cotton (*Gossypium hirsutum* L.), belongs to genus *Gossypium* order *Mallow* and family Malvaceae. According to the latest classification, genus *Gossypium* has been classified into thirty nine (39) species. There are only four domesticated species of cotton. *Gossypium arboreum* and *Gossypium herbaceum* both are native in the old world, which are grown mostly in Indo and Pakistan. The lint is used for the production of textile and stuffing material. Cotton is regarded as the most important cash crop of Pakistan. The role of cotton in our national economy can not be over emphasized. It produces raw material not only to ginning factories and rapidly expending textile industry, but also to the oil mills, which provides edible oil and oil cake for milk animals as feed. As described above cotton is rightly designated as king of fibre crops and ranks among one of the leading fibers of the world. Cotton the silver fibre held for the unique quality of its fibre viz; Strength, durability, ease of dyeing, color retaining properties and suitability for the manufacture of textile fabrics. The fibre is obtaining from the thick growth of wooly seed hair. The longer fibre known as lint is used for making house hold fabrics and the shorter fibers called linters are used for making pad and sterile absorbent surgical cotton.

Cotton is the most in dispensable cash crop of Sindh and plays a vital role in building up a sound economic and agrarian structure of the province. Cotton production in Pakistan is centered in the great Indus Basin, which is about 900 miles in length. The cotton producing areas in Sindh Province are considered as the Northern and Southern zones. The Northern zones account for three fourth of the acreage and production of upland and desi cotton. It is comprised of seven districts but, only three have major importance for cotton production. Multan is the most important district, other production districts are Bahawalpur and Sargodha. In the Southern Sindh Hyderabad, Nawabshah, Tharparker and Khairpur are found major cotton producing districts. In Sindh cotton crop was grown on an area of 0.63 million hectares and production of cotton was 2.2 million bales with an average yield 594 kgs ha^{-1} (Anonymous, 2000). In order to achieve higher production, timely sowing or appropriate time of cultivation, judicious irrigation, balanced and optimum use of fertilizers, appropriate plant protection measures, use of good quality seed of recommended varieties, and yield improving factors. Another important factor is the eradication of weeds. Presence of weeds adversely affects the growth of crop as they compete for sunlight, space, soil moisture, carbon dioxide, and mineral nutrients with the crop plants. Cotton crop is subjected to greater weed competition due to sufficient space between rows. There was significant decrease in the yield of seed cotton, ranging from 12.03 to 14.01 percent, when the weeds competed with the crop for full season or after the crop was two weeks old, when the weed competition perpetuated after the crop was 4 weeks old, the decrease in the yield was 8.96 percent (Saeed *et al.*, 1980). Reduction in the yield of cotton can ranges from 12.53 to 41.29 percent due to the presence of weeds in cotton crop, it was also observed that yield was increased from 14.53 to 70.34 percent when weeds were effectively controlled (Jalis and Shah, 1982). Keeping in view the losses caused by weeds to the cotton crop; and for increasing the yield of seed cotton, This experiment was conducted to evaluate the comparative performance of different pre-emergence herbicides application on the growth and yield of cotton under agro-ecological conditions of Tandojam.

Materials and Methods

The experiment was conducted in a four replicated Randomized Complete Block Design, keeping a net plot area of 12 × 7 meters. All the collected data were subjected to analysis of variance, to test the superiority of treatments mean L.S.D.(Least significant difference) test was applied, following the procedures of Gomez and Gomez (1984).

Land preparation: The experimental land was prepared by giving three dry ploughs each followed by clod crushing and leveling to eradicate the weeds and uniform distribution of irrigation water, when the land came in plowing condition land was given cultivator and leveled. A good seedbed was prepared.

Seed sowing: Homogenous delinted seeds of a commercial cotton variety NIAB-78 was drilled by single coulter hand drill in rows 75cm apart. A seed rate of 25 kg ha^{-1} was applied.

Herbicide application: After sowing of the seeds the herbicide (pre-emergence) was applied except one treatment (un-treated control).

Thinning: To maintain the required plant to plant distance of 22.5 cm the seedlings were thinned just before 1st irrigation in all the treatments.

Fertilizer application: The fertilizer was applied at the rate of 150-56 kg NP ha^{-1} in the form of Urea and Single Super Phosphate. The full dose of phosphorus with a one third of nitrogen was applied at the time of soaking dose, while rest of N was applied and top dressed at various crop developmental states e.g., flowering and boll setting.

Treatments: The treatments were pre-emergence herbicides including, Dual Gold 960 EC 2000 ml $ha.^{-1}$, Dual Gold 960 EC 2500 ml ha^{-1}, Stomp 330 EC 1.25 Lit ha^{-1}, Stomp 330 EC 1.50 Lit ha^{-1}, Stomp 455 C.S 0.66 Lit ha^{-1}, Stomp 455 C.S 1.00 Lit ha^{-1} and control (untreated).

Result and Discussion

Weed species: There were three types of weed species i.e broad leaved weeds (Waho and Naro), grasses (Sawri , Dubah , Chabbar, Mandhano, and Sedges (Kabh) were found in the un-weeded or weedy check plot (Table 1). Research conducted earlier by Malik *et al.* (1983) and Zaki *et al.* (1988) also found these species associated with cotton crop.

Weed count (m^2): Weed density recorded (Table 2) after three weeks of sowing in all the treated plots and compared with weedy check depicted that pre-emergence application of Stomp C.S at 0.66 lit ha^{-1} check weed growth significantly by 174.00 percent over untreated (check).

Effect of herbicides on crop growth and yield characters: Plant height affected significantly by the weed control treatments, weeds emergence application of Stomp C.S at 0.66 lit ha^{-1} produced taller plants than the other treatments (Table 2). However, monopodial branches per plant were not affected significantly by the applied treatments and all the weed control treatments produced similar monopodial branches. The number of sympodial

Table 1: Weed species in cotton field during growing period

Local Name	English Name	Botanical Name	Family
Broad leaved weeds			
Waho	Itsit	*Trianthema monogyna*	Aizoaceae
Naro	Field bind weed	*Convolvulus arvensis*	Convolvulaceae
Grasses weeds			
Sawri	Junglerice	*Echinochloa colonum*	Gramineae
Dubh	Deep root	*Desmotacha bipinnata*	=
Chabbar	Bermuda grass	*Cynodon dactylon*	=
Mandhano	Goose grass	*Eleusine indica*	=
Sedges weeds			
Kabah	Purple nut sedge	*Cyperus rotundus*	Cyperaceae

Table 2: weed count and crop growth and yield characters

	Treatments (Herbicides)											
Dual Gold E-2000 (ml ha^{-1})	%Dec. Over Control	Dual Gold E-2500 (ml ha^{-1})	%Dec. Over Control	Stomp 330 E.C 1.25 lit. (ha^{-1})	%Dec. Over Control	Stomp 330 E.C 1.5 lit. (ha^{-1})	%Dec. Over Control	Stomp C.S 0.66 (lit ha^{-1})	%Dec. Over Control	Stomp C.S 1.0 (lit ha^{-1})	Dec% Over Control	Un-weeded (Control)(-)
Weed count (m^2)												
57.00b	80.26	54.50b	88.53	57.25b	79.48	46.00bc	123.37	37.50cd	174.00	55.50b	85.134	102.75a
Plant height (cm)												
85.85cd	18.10	92.05bc	23.54	83.80d	16.01	98.30ab	28.40	103.05a	31.65	95.60b	25.60	70.38e
Number of monopodial branches per plant												
1.75a	42.85	1.00a	00.00	1.75a	42.85	1.80a	44.44	1.85a	45.95	1.80a	44.44	1.00a
Number of sympodial branches per plant												
14.75c	55.93	17.40b	62.64	15.25c	57.38	17.85ab	63.59	18.45ab	64.77	17.65b	63.17	6.50c
Number of bolls per plant												
40.50c	34.07	56.90b	53.08	42.34c	36.95	60.85bc	56.12	66.60a	59.91	57.60b	53.65	26.70d
Number of opened bolls per plant												
24.80d	27.42	32.75bc	45.04	28.90cd	37.72	35.35a	49.08	38.00a	42.63	30.85b	41.65	18.00e
Number of un-opened bolls per plant												
15.70b	44.59	24.15a	63.98	13.45b	35.32	25.50a	65.88	28.60a	69.58	26.75a	67.47	8.70c
Ginning out-turn percentage												
31.90c	11.50	31.75cd	11.09	32.13b	12.14	31.70cd	10.95	32.83a	14.01	31.65d	10.81	28.23e
Seed cotton yield (kg per hectare)												
2680bc	55.75	26.30cd	54.90	27.20b	56.40	26.00d	54.38	28.80a	58.82	25.80d	54.03	11.86e

Numerical values of the rows followed by similar letter are not significantly different at 5% probability level.

branches per plant showed the similar trend for producing maximum sympodial branches as in plant height where Stomp C.S at 0.66 lit ha^{-1} was effective herbicide treatment.

Total number of bolls per plant, opened bolls, Ginning out-turn percentage, and seed cotton yield, were also significantly higher in the plots where Stomp C.S at 0.66 lit ha^{-1} was incorporated. The results of the study showed that application of various herbicide treatments reduced the weed population and occurrence, but Stomp C.S at 0.66 lit ha^{-1} was much effective. The control of weeds exhibited plants to grow more vigorously and its effect appeared significantly positive in terms of satisfactory maximum seed cotton yield and its ginning out-turn percentage. If the weeds will not be eradicated or controlled properly they may cause serious losses to cotton yield and fibre quality by sharing light, moisture, space, and nutrients resulting the target plant shows the stunted growth which reflect on the total yield and quality of produce. These results are in conformity to those of Hayee *et al.* (1983), Tankar and Mundhe (1982), Jain *et al.* (1982). These results are also in accordance with the reports of Malik *et al.* (1983) who observed that herbicide application in cotton field check weed growth and improved yield contributing characters. Smart *et al.* (1999) also reported that post-emergence application of herbicides increased the cotton lint yield. From the above facts, it is suggested that the effective broad leaved, grasses, and sedge weeds may be controlled as pre-emergence with the application of Stomp C.S at 0.66 lit ha^{-1}.

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