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Efficiency and Economics of Integrated Weed Management in Maize

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Abstract: All weed management strategies under study reduced weed growth and increased yield and yield parameters of maize to a varying degree. Maximum grain yields of 4.54, 4.44 and 4.41 tones ha^{-1} were obtained in plots treated with pre-emergence application of Dichlor 50EC (acetochlor) @2.5L ha^{-1} + post-emergence application of Aim + Atratox Copack {Aim 40DF(carfentrazone ethyl) @ 0.05 kg ha^{-1} + Atratox 38EC (atrazine) @ 0.75 L ha^{-1}}, post-emergence application of Aim + Atratox Copack + one hoeing and pre-emergence application of Dichlor + one hoeing, respectively. These treatments were statistically at par to each other. In terms of monitory gain, maximum net benefit of Rs. 27638.29 was obtained from the crop plants which were treated with post-emergence application of Aim + Atratox Copack + one hoeing.

Key words: Maize, Weed control, efficiency, economics, Pakistan

Introduction

The average yield of maize in Pakistan is 1440 kg ha^{-1} which is far below the average yield of leading maize growing countries of the world such as USA where the average yield is 7974 kg ha^{-1}. Weeds are one of the major factors limiting growth and yield of maize crop. They reduce crop yield from 20-40% depending upon weed species and density (Ashique *et al.*, 1997).

Parasad *et al.* (1990) obtained maximum weed control with Atrazine 0.5kg ha^{-1} + hand weeding. Economic returns were also enhanced by this weed control strategy. Aslam (1991) reported that pre-emergence application of Stomp 330 E @ 0.5 L ha^{-1} + one hoeing was most effective in controlling weeds. This method gave maximum values of leaf area, plant height, 1000-grain weight, grain yield and net benefit. Eadle *et al.* (1992) found that one cultivation combined with herbicide applied as a band gave maximum weed control and corn yield on no-tillage system. Porwal (1994) concluded that pendimethaline @ 1.5 kg ha^{-1} + hand weeding twice resulted in the highest grain yield. Singh *et al.* (1994) reported that Atrazine @1.0 kg ha^{-1} + manual weeding 40 days after sowing and pendimethaline + manual weeding 60 days after sowing resulted in the highest grain yield. Biolly (1996) found that cyanazine @ 2.0L feddan^{-1} (1 feddan = 0.42 ha) and hoeing twice were equally effective in controlling weeds in maize. Cox *et al.* (1999) found that chemical + mechanical method was efficient and economical on both tillage systems in maize.

The objective of the study was to design an efficient and economic integrated weed management system for maize under agro-climatic conditions of Faisalabad.

Materials and Methods

To evaluate efficiency and economics of integrated weed management in maize, a field experiment was conducted at the research area, Department of Agronomy, University of Agriculture, Faisalabad, during the year 1999. The experiment was laid out in randomized complete block design with four replications and net plot size was 3 × 7m. Single cross maize hybrid R-2310 was sown in rows 0.6m apart. The treatments comprised weedy check, One manual hoeing, pre-emergence application of Dichlor 50EC (acetochlor) @ 2.5L ha^{-1}, Post-emergence application of Aim + Atratox Copack {Aim 40DF(carfentrazone ethyl) @ 0.05 kg ha^{-1} + Atratox 38EC (atrazine) @ 0.75 L ha^{-1}}, pre-emergence application of Dichlor + one hoeing, post-emergence application of Aim + Atratox Copack + one hoeing and pre-emergence application of Dichlor + post-emergence application of Aim + Atratox Copack. The crop was sown with the help of single row hand drill on July 17, 1999. The crop was fertilized at the rate of 150 kg ha^{-1} nitrogen in the form of urea and 100 kg ha^{-1} P_2O_5 in the form of DAP. Whole of phosphorus and half of the nitrogen were applied at sowing and remaining half of the nitrogen was applied at first irrigation. The crop was thinned at 5 cm height stage to have 20cm distance between plants. The herbicides were applied with the help of solo-hand sprayer fitted with four nozzles on a specially made boom. Pre-emergence herbicide Dichlor 50EC @ 2.5 L ha^{-1} was sprayed immediately after sowing. A post-emergence herbicide Copack {Aim 40DF (carfentrazone ethyl) @ 0.05 kg ha^{-1} + Atratox 38EC (atrazine) @ 0.75 L ha^{-1}} was applied after first irrigation. Hoeing was done 50 days after sowing. The data collected were analyzed statistically by using fisher's analysis of variance technique.

Results and Discussion

Weed density was reduced in all the plots which received a weed control treatment. The minimum weed density was recorded in the plots which received the treatment pre-emergence application of Dichlor + post-emergence application of Aim + Atratox Copack. Maximum weed dry weight was recorded in weedy check plots and minimum weed dry weight was recorded in plots receiving pre-emergence application of Dichlor + post-emergence application of Aim + Atratox Copack. These results show that all weed control practices checked weed growth and weed dry biomass to varying extant over control. Similar observations were made by Ulinici *et al.* (1988), Parasad *et al.* (1990) and Eadle *et al.* (1992). It is evident from the data in Table 1 that the crop plants which received pre-emergence application of Dichlor + post-emergence application of Aim + Atratox Copack gave maximum plant height. This was followed by the crop plants which received post-emergence application of Aim + Atratox Copack + one hoeing and pre-emergence application of Dichlor + one hoeing. More plant height in these plots may be due to reduced competition for nutrients, moisture and light between crop plants and weeds. These results are in line with the findings of Aslam (1991). The leaf area per plant was increased significantly by all weed management treatments over control. The maximum leaf area was recorded in crop plant which received pre-

Table 1: Weed growth, maize yield and yield parameters as influenced by integrated weed management in maize

Treatments	Plant height (cm)	Leaf area (cm^2)	1000-grain weight (g)	Grain yield ($t\ ha^{-1}$)	Net Benefit (Rs.)	Weed density (m^{-2})	weed dry weight ($g\ m^{-2}$)
Weedy check	173.7^{e}	2941.1^{e}	222.3^{c}	2.43^{d}	16678.29	180.71^{a}	77.17^{a}
Mechanical weeding (one hoeing)	182.5^{d}	3076.4^{d}	236.1^{b}	3.05^{c}	19849.75	64.37^{b}	27.49^{b}
Pre-emergence application of Dichlor	200.0^{c}	3216.7^{c}	237.0^{b}	3.65^{b}	22992.75	53.92^{c}	23.03^{c}
Post-emergence application of Aim + Atratox Copack	200.9^{c}	3214.1^{c}	237.6^{b}	3.65^{b}	23380.50	53.41^{c}	22.82^{c}
Pre-emergence application of Dichlor + one hoeing	214.6^{b}	3440.7^{b}	245.5^{ab}	4.41^{a}	27091.79	47.03^{d}	20.09^{d}
Post-emergence application of Aim + Atratox Copack + one hoeing	213.5^{b}	3456.1^{b}	246.1^{ab}	4.44^{a}	27638.29	47.77^{d}	20.40^{d}
Pre-emergence application of Dichlor + Post-emergence application of Aim + Atratox Copack	228.3^{a}	3747.6^{a}	255.0^{a}	4.54^{a}	27613.00	33.37^{e}	14.25^{e}

emergence application of Dichlor + post-emergence application of Aim + Atratox Copack. It was followed by the plots receiving post-emergence application of Aim + Atratox Copack + one hoeing and pre-emergence application of Dichlor + one hoeing. These treatments were on a par to each other. The minimum leaf area per plant was recorded in weedy check plots. Reduced weed crop competition in treated plots facilitated the crop plants to utilize more nutrients for development of leaf area. These findings are in agreement to the results obtained by Aslam (1991)and Biolly (1996). Significantly higher 1000-grain weight in all weed control treatments was recorded. Pre-emergence application of Dichlor + post-emergence application of Aim + Atratox Copack, post-emergence application of Aim + Atratox Copack + one hoeing and pre-emergence application of Dichlor + one hoeing. were equally effective to give significantly higher 1000-grain weight. However, pre-emergence application of Dichlor + post-emergence application of Aim + Atratox Copack and post-emergence application of Aim + Atratox Copack + one hoeing were also statistically similar to post-emergence application of Aim + Atratox Copack, pre-emergence application of Dichlor and one manual hoeing. The high value of 1000-grain weight in plots which received a weed management treatment may be due to availability of more photosynthates for grain development because of competitive advantage of crop plants over weeds. These observations are in confirmatory to Aslam (1991) and Biolly (1996). The data regarding grain yield showed that highest grain yield was obtained by applying pre-emergence application of Dichlor + post-emergence application of Aim + Atratox Copack. However, it was not different from the grain yields obtained when crop plants were treated with post-emergence application of Aim + Atratox Copack + one hoeing and pre-emergence application of Dichlor +one hoeing, respectively. The highest grain yield in these plots is attributed to the effective weed control in these plots resulting in the reduced competition between the weeds and economic plants. The crop plant utilized the entire soil and environmental resources for their growth and development. As a result various yield contributing factors were affected favourably leading to higher grain yield. These findings are similar to Ulinici *et al.* (1998), Parasad *et al.* (1990), Aslam (1991), Eadle *et al.* (1992), Porwal (1992), Singh *et al.* (1994) and Cox *et al.* (1999). The economic analysis showed that post-emergence application of Aim + Atratox Copack + one hoeing was the most profitable. Similar observation were made by Parasad *et al.* (1990), Aslam (1991) and Cox *et al.* (1999). From this study it can be concluded that integrated weed management strategy consisting of post-emergence application of Aim + Atratox Copack + onehoeing was the most economical and feasible under the agro-climatic conditions of Faisalabad.

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