Yield and Economic Returns With Different Weed Control Methods in Rainfed Maize

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ABSTRACT

Studies on methods of weed control in rainfed maize were carried out on farmer's fields in Islamabad Capital Territory (ICT) of Pakistan during 1986 and 1987. The weed control methods were use of primextra and two "seelings" (Mechanical method). The data at harvesting were recorded on plant population, total number of cobs and fodder and grain yields. Application of primextra @ 0.5 kg. a.i/ ha + one "seeling", proved to be the most productive as it gave highest grain yield (2097 kg/ ha). The yield (1674 kg/ ha) in plots treated with two "seelings" was significantly lower than the chemical as well as chemical + mechanical methods which gave net benefit of Rs. 1054 and Rs. 1097/ ha over mechanical method alone.

INTRODUCTION

Among the cereals in Pakistan, maize ranks third after wheat and rice. In Islamabad Capital Territory (ICT) it ranks second to wheat with an area of seven thousand hectare and an average yield of 0.7 tons per hectare. Wheat occupies an area of 15.8 thousand hectare in ICT (Agri. Stat. Pak, 1986). National yield of progressive farmers and at the experimental stations are 86, 671 and 1186 percent higher respectively than the average yield of ICT. There are many socio-economic, physical and biological factors which limit the productivity of maize crop in the area. A lot of work is being done to identify these limiting factors. One of the major problems in the area is posed by the weeds which have shown to reduce the yields from 25 to 50% (Marais, 1985; Al-Kaisi, 1987). In some years even higher losses in grain yield have been observed especially when there are continuous rains during the season.

In Islamabad area "seeling" (interculture of maize field with local bullocks driven or tractor mounted cultivator in the early stage) is done for controlling weeds and for aeration of soil. This method is costly, time and labour-consuming. Chemical weed control is the need of the day because of its low cost and effectiveness. The efficacy of herbicide is influenced by the change in climate, soil type, crop species, time and method of application (Saghir, 1970). The diversity of these factors suggested that a herbicide must be thoroughly tested under farmer's conditions before recommending it to be used by the growers. Previous work done also established superiority of herbicide over the farmers practices. (Forth annual report Weed Science programme, NARC 1987). The purpose of this study was to investigate methods

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which can effectively and economically control the weeds in maize crop.

MATERIALS AND METHODS

Experiments were laid out during 1986 and 1987 at Tarlai, Thanda Pani, Bhara Kahu, Golera, Sehala and Rawat in ICT area of Pakistan. The treatments were:

1. Use of primextra @ 0.75 kg.a.i/ ha just after sowing.
2. Use of primextra @ 0.5. a.c/ ha just after sowing + one "seeling" at 4 to 5 leaf stage.
3. Farmer practice (two "seelings" at 4 to 5 leaf and 7 to 9 leaf stages).

Seed rate used in treatment 1 was 30 kg/ ha whereas in treatments 2 and 3 it was 60 kg/ ha (farmer's seed rate in the area). All other practices and inputs were constant and performed by the farmers. Herbicide was sprayed just after sowing of crop. Seeling in T_2 and first seeling in T_3 was performed 15-20 days after planting whereas second seeling in T3 was performed 15-20 days after planting whereas second seeling in T_3 was done after 24 to 30 days after planting using bullock drawn local plough.

Each location was considered as one replication. An area of three quadrates of 3x3 m was harvested. Data on plant population, fodder weight, number of productive tillers, ear weight and moisture percentage was taken at the time of harvest. Grain yield was calculated at 15% moisture content using following formula: (Annual report of CCRI, 1986).

$$\frac{\text{Fresh Ear wt(100-moisture content) } 0.8 \times 10000}{85 \times \text{area harvested}}$$

0.8 = constant for shelling percentage
85 = constant for 15% (100-15) moisture
10000 = per hectare

Analysis was performed by computer using RCBD, (2 factors factorial with split).

RESULTS AND DISCUSSION

Results of final count revealed that seeling method reduced plant density in T_2 and T_3. This is one of the reasons that higher seed rates were used in these treatments in accordance with the normal practice in the area. However differences between the plant population in different treatments were not significant (Table 1).

Considering the productivity of the plants (no. of plants with cobs), T_2 produced the higher number of productive plants (99.8%) followed by T_3 (98%) and T_1 (96.5%) (Table 1). This was probably due to a decrease in plant density and effect of seeling which increased the productivity of maize.

Regarding fodder weight, significant differences between the treatments were found (Table 2). Highest fodder wt. was produced in treatment 1 and lowest in treatment 3. This was mainly due to the higher plant density and the absence of weeds in treatment 1 and 2 than control (Treatment 3) where there was intense weed competition through out the growing season.

Table 1. Plant density and number of cobs per hectare in maize as affected by different methods of weed control. ICT, 1986-87.

Treatment	Plant Density			No. of cobs			Productivity (%)
	1986	1987	Mean	1986	1987	Mean	
Herbicide (0.75 kg/ha)	52222	58704	55463	50370	56667	53519	96.5
Herbicide (0.05 kg/ha) + one seeling	42593	56852	49722	14852	57407	49360	99.8
Two seelings	44444	48333	46389	42259	46667	45462	98.0
L.S.D.			N.S			N.S	
CV%			17.97			20.5	

Note: All analysis was done by RCB = 2 factor factorial with split Design on Computer by using MSTAT Programme.

Table 2. Average Grain and Fodder Yield and Grain/fodder Ratio in Maize as affected by different methods of weed control. ICT, 1986 & 87.

Treatment	Fodder Yield (kg/ha)			Grain Yield (kg/ha)			Grain Fodder Ratio
	1986	1987	Mean	1986	1987	Mean	
Herbicide 0.57 kg/ha	5215	7787	6501	1745	2413	2079	1:3.13
Herbicide 0.5 kg/ha + one seeling	4422	8107	6265	1800	2557	2178	1:2.88
Two seelings	3676	5972	4824	1119	2176	1647	1:2.93
L.S.D.			727.71			409.53	
CV%			14.58			24.43	

The grain yield is the function of integrated effect of various yield parameters. The data pertaining to grain yield as affected by various weed control methods are given in Table 2.

Combination of two methods of weed control (herbicide + seeling) produced the highest grain yield (2178 kg/ ha). This was significantly higher than mechanical weed control (1647 kg/ ha) alone but was at par with chemical weed control method (2079 kg/ ha).

Maize, under the combination of chemical and farmer's practice of weed control, gave the lowest grain/ fodder ratio of (1:2.88) as compared to chemical control (1:3.13) and farmer's practice (1:2.93) Table 2). This shows that maximum net assimilation towards grain formation occurred when seeling and chemical weed control methods were combined.

In farmers practice (seeling), both net assimilation and %age of productive plants were higher than chemical control but still yields were significantly lower. The major reason could be the intense competition of weeds throughout the growing season in farmers practice which not only reduced grain yield but also the stalk yield of the crop.

Our findings are consistent with hoeing in increasing maize yield and yields components (Zahan, 1984, Gab-Allah et al, 1985). This is probably due to better weed control with herbicide and aeration of the soil. However, Siemens and McGlamery (1985) found that when herbicide application was combined with tillage practice, the herbicide effectiveness decreased only slightly as the tillage was reduced.

Economic Aspect of Weed Control Methods

The ultimate utility of any weed control method is determined by its economic returns. It is clear from the data that highest variable cost was in treatment 2 which involve both the operations of seeling and herbicide application.

The variable cost in treatment 2 and 3 was 39 and 21.87% higher than in treatment 1, but the highest gross income (Rs. 4529) was obtained when herbicide and mechanical weed control methods were combined and lowest income was obtained in the farmer's practice (Rs. 3432). The net economic benefit over the normal farmer's practice to two seelings was Rs.1054 and Rs.1097 when herbicide was sprayed alone and in combination with one seeling respectively (Table 3, Figure 1).

On the basis of our findings, it can be recommended that the farmer should use herbicide (Primextra) in combination with one seeling for better economic returns instead of two seelings to control weeds.

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Table 3. Economic benefits with the use of different weed control methods

	Yield (kg/ha) Grain	Stalk	Value (Rs/ha) Grain	Stalk	Total value Rs/ha	Variable cost (Rs/ha)	Net Income (Rs/ha)	Benefit over control (Rs/ha)
Herbicide (0.75 kg/ha	2078	6500	4156	650	4806	320	4486	1054
Herbicide (.05 kg/ha) + one seeling	2178	6264	4356	626	4982	445	4529	1097
Two seeling	1674	4824	3348	482	3830	390	3432	

Variable cost	Seed (Rs/ha)	Herbicide (Rs/ha)	Seeling (Rs/ha)	Total (Rs/ha)
Herbicide (0.75 kg/ha)	60	210+50		320
Herbicide (.05 kg/ha) + one seeling	120	140+50	135	445
Two seeling	120		270	390

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