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Studies on Weed–Crop Competition in Maize

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ABSTRACT

Studies on the effect of duration of weed infestation and weed eradication on maize growth and productivity were conducted in a field trial at the Agronomy Research Area, University of Agriculture, Faisalabad, during 1991. The experiment was laid out in Randomized Complete Block Design with 4 replications. Both duration of weed eradication and infestation had significant effect on plant height at maturity, number of grains/cob, 1000–grain weight and grain yield. In general, all these parameters increased as the duration of weed maize competition decreased. Total number of maize plants/ plot and number of cob bearing plants were not affected significantly either by duration of weed eradication or weed infestation.

Key Words: Weeds; Eradication; Maize

INTRODUCTION

In Pakistan, maize is grown on an area of 0.8 million hectares with total annual grain production of 1.2 million tonnes and an average grain yield of 1445 kg ha^{-1} (Anonymous, 1997). Maize occupies a key place in existing cropping system, because it is a short duration crop and provides more economic return to the growers. Although the yield potential of our present maize varieties is high, but it has not been exploited fully due to several constraints, among them weed infestation is major factor pulling down the yield of crop.

Weeds adversely affect crop yield and quality, interfere with the harvest, and increase the time and cost involved in crop production. In addition, weeds harbor insects and plant disease organisms and in some cases, they serve as an alternate host for these pests. Weeds and crop plants compete for the nutrients, moisture, light and space (Anderson, 1983), when their supply is limited. Besides the direct effect of weeds in decreasing maize crop yield, the resultant loss of its market value is a set back to the maize growers. Weed control is, therefore, essential for obtaining high yield and better quality. Yield can be increased up to 50% by adopting different recommended practices including weed management (Afzal, 1988). Weed control resulted in an average yield increase of 17.9% (Berzsenyi, 1985).

The magnitude of losses in grain yield due to weed infestation in maize depends upon the composition of weed flora, weed density and the stage of crop growth at which weed crop competition occurs. Severe weed infestation may result in complete crop failure. Yield losses in maize due to weed infestation have been estimated up to 25% (Al–Kaini, 1987). Similarly yield reduction of maize in relation to naturally established population of weed varied from 8 to 82% in yield experiments, in which the maize was grown at a wide range of weed densities (Spitters *et al.*, 1989).

Maize is more sensitive to weed competition at early stages of development and thus maximum reduction in yield occurs. Generally weed competition results significant decrease in grain yield at 3 to 4 weeks of planting. Weeding operations conducted from 6 to 8 weeks after seedling may not give an economical increase in yield (Shad, 1988).

Consequently, studies to find out the critical period of weed crop competition in maize are of adequate practical relevance (Assemat, 1988). This study was, therefore, designed to find the critical period of maize weed competition and its impact on maize growth and production.

MATERIALS AND METHODS

A field experiment on maize was conducted at Agronomic Research Area, University of Agriculture, Faisalabad during the year 1991, on silt loam soil. The experiment was laid out in Randomized Complete Block Design with four replications and a net plot size of 3.6 m x 7 m. The experiment comprised the following treatments:

A. Duration of weed eradication. Weed free till harvest, Weed free for first 3 weeks after emergence, Weed free for first 4 weeks after emergence, Weed free for first 5 weeks after emergence, Weed free for first 6 weeks after emergence, Weed free for first 7 weeks after emergence, Weed free for first 8 weeks after emergence.

B. Duration of weed infestation. Weed competition till harvest, weed competition for first 3 weeks after emergence, weed competition for first 4 weeks after

Table I. Effect of weed eradication and infestation on yield and yield components of maize

Treatments	No. of plant per plot	Plant height (cm)	No. of cob bearing plants	No. of grains per cob	1000–grain weight	Grain yield (Q ha^{-1})
(A) Duration of weed eradication						
Weed free till harvest	137^{NS}	152a	133	438a	258.6a	44.4a
Weed free for first 3 weeks after emergence	134	121cd	126	360d	228.7d	31.8fgh
Weed free for first 4 weeks after emergence	134	123bcd	127	362d	231.3cd	33.8ef
Weed free for first 5 weeks after emergence	135	128bcd	128	367b	238.5c	36.4d
Weed free for first 6 weeks after emergence	135	137abcd	129	399bc	247.5b	39.5c
Weed free for first 7 weeks after emergence	135	141abcde	131	407abc	250.1b	40.9bc
Weed free for first 8 weeks after emergence	137	145ab	131	425abc	255.2ab	42.2b
(B) Duration of weed infestation						
Weed competition till harvest	132	120b	123	358d	226.9d	28.7I
Weed competition for first 3 weeks after emergence	137	143abc	131	428ab	253.6ab	41.3bc
Weed competition for first 4 weeks after emergence	136	142abcd	130	422abc	249.8b	39.5c
Weed competition for first 5 weeks after emergence	136	133abcd	128	395c	237.5c	35.4de
Weed competition for first 6 weeks after emergence	135	127bcd	127	362d	228.8d	32.2fg
Weed competition for first 7 weeks after emergence	134	125bcd	127	359d	228.7d	30.9gh
Weed competition for first 8 weeks after emergence	134	122bcd	125	356d	227.7d	29.9hi

Any two means not sharing a letter in common differ significantly at 5% probability level.

emergence, weed competition for first 5 weeks after emergence, weed competition for first 6 weeks after emergence, weed competition for first 7 weeks after emergence and weed competition for first 8 weeks after emergence.

Maize variety, "Sunehri" was used as a test crop. The crop was sown with single row hand drill on a well prepared seed bed on August 12, 1991. Row to row distance was maintained at 60 cm. Crop was thinned to a plant to plant distance of 25 cm at 3–4 leaf stage, maintaining a uniform population in all the experimental plots. Seed rate used was 30 kg ha^{-1}. Whole phosphorus (100 kg P_2O_5 ha^{-1}), Potash (100 kg K_2O ha^{-1}) and half of nitrogen (200 kg ha^{-1}) was applied at sowing as a basal dose. The remaining half of nitrogen (200 kg ha^{-1}) was added with first irrigation.

First irrigation was applied after root development stage, while the subsequent irrigations were adjusted according to crop requirements, avoiding over–irrigation or severe wilting of maize crop. In all seven irrigations of 3 acre–inches each, were given to the crop; 4 acre–inches of "Rauni" (soaking irrigation) in addition to precipitation (0.47 mm/week) received during the growing period of the crop. Crop was harvested on November 22, 1991. Uniform and recommended cultural practices were followed throughout the field experiment. Standard procedures were followed for recording the data on growth and yield parameters of maize.

Observations on average plant height at maturity, total number of plants per plot, number of cob bearing plants per plot, number of grains per cob, 1000–grain weight (g) and grain yield per plot per hectare were recorded.

The data collected were analysed statistically using the analysis of variance technique and differences among treatment means were compared by using Duncan's Multiple Range Test at 5% probability level (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

1.Total number of plant per plot. Number of maize plants was not affected significantly by the varying durations of weed eradication and weed infestation during maize growth. However, number of maize plants per plot ranged between 132 and 138. It is evident that weed infestation did not effect the maize plant stand significantly. These findings are in accordance with Noguchi and Nakeyama (1978).

2. Number of cob bearing plants per plot. Number of cob bearing plants per plot was not affected significantly by the duration of either weed infestation or weed eradication. The data given in Table I reveal that maximum number of cob bearing plants per plot (133) was found where the weed eradication was done for the whole growth period. While the minimum number of cob bearing plants (123) was found in case of weed infestation throughout the growth period.

3. Plant height. It is evident from the data in the table that plant height increased significantly in case of weed free plots till harvest (152 cm) or where the crop was kept free of weeds for first 6 to 8 week after

emergence. Similarly, where competition was allowed for first 3 to 5 weeks plant height increased significantly, but decreased beyond 6 weeks of competition. These results revealed that weed–crop competition from 6–8 weeks after emergence was very critical as for as plant height is concerned. These results are in accordance with Atkinson (1978) and Singh *et al.* (1985).

4. Number of grains/cob. The maximum number of grains per cob (437.67) was obtained where the crop was kept weed free till harvest, while the minimum number of grains (358.38) was found in case of weed infestation till harvest. Weed infestation of first 6, 7 and 8 weeks of maize growth as well as weedy check were statistically at par with the weed eradication for first 3, 4 and 5 weeks after emergence. As the duration of weed–crop competition increased, the number of grains per cob decreased.

5. 1000–Grain weight. 1000–grain weight was affected significantly by the duration of both weed eradication and infestation. The 1000–grain weight decreased significantly when weeds were allowed to grow for longer duration in the crop. Maximum 1000–grain weight (258.6 g) was found, the crop was kept weed free throughout the maize growth period and minimum 1000–grain weight (226.9 g) was recorded, when weeds were allowed to grow throughout the growth period of the crop. Hence, weed–maize competition, if allowed for longer time, will result in reduced 1000–grain weight significantly. It is imperative to control the weeds in maize before the critical weed–maize competition period begins. The results are in line with Viswanath (1977) who reported that weed competition decreased the 1000–grain weight.

6. Grain yield. Weed eradication throughout the maize growth period, produced the highest grain yield (44.38 q ha^{-1}), while lowest grain yield (28.73 q ha^{-1}) was recorded in case of weed infestation throughout the maize growth period. Grain yield decreased significantly with an increase in the duration of weed infestation in maize, while it increased significantly with the increasing duration of weed free period. Significantly lower grain yield in case of weed infestation for more than first 5–weeks of maize growth is attributed to comparatively higher weed densities, volume/size of weeds and competition of nutrients, moisture, etc. It is evident that when maize was infested with weeds, for the first 6–8 weeks of its growth a drastic decrease in the grain yield occurred. Therefore, weeds must be eradicated before the commencement of the 6th week of maize growth in order to harvest a good grain yield. These results also suggest that crop must be kept free of weeds from 6–8 weeks in order to eliminate the weed–crop competition. These results are in accordance with the findings of Shad (1988) who concluded that weeding operation completed up to 6 weeks may result in yield as good as obtained from a treatment, where the field was kept weed–free throughout the growing season.

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