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Correlation and Regression Studies of Winter Maize and Weed Interactions

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ABSTRACT

A field experiment was conducted at Crop Research Farm, Department of Agronomy A. A. I (DU), Allahabad during 2002 on winter maize to assess the relationship amongst weed parameters, yield attributes and yield under the influence of different weed management practices. Grain yield of winter maize showed a significant positive correlation with WCE, number of cobs and cob length. On the contrary, these parameters were negatively correlated with the population and biomass of weeds at 60 DAS. A unit increase in weed population and weed biomass/m^2 estimated reduction in grain yield by 0.79 and 1.418 q/ha, respectively. Similarly, the increase in the grain yield due to a unit increase in WCE (%) was estimated at 0.575 q/ha.

INTRODUCTION

Rabi or winter maize has been found to give higher yield as compared to **kharif** and **zaid** season maize crops. It is mainly due to less attack of insects, pests and diseases but still lot of yield reduction was due to presence of weeds. The maize being C_4 plant is heavily fertilized and sparsely grown, both of these attract severe weed infestation that results in a reduction in grain yield. In winter maize, weeds start germinating after first irrigation. The weedy environment beyond 30 DAS and upto 50 DAS is detrimental to maize crop and causes yield losses (Porwal, 1998). The objective of this field study was to evaluate the relationship of weed intensity, weed biomass and weed control efficiency with yield and yield attributing characters of maize and also to find out the index of competition based on linear regression of yield on weed intensity, weed dry weight and weed control efficiency.

MATERIALS AND METHODS

An experiment was conducted during winter (**rabi**) season of 2002 at crop research farm, Department of Agronomy, Allahabad Agricultural Institute (Deemed University). The experimental site was situated at an elevation of 98 m above mean sea level between 25.57° north latitude and 81.50° east longitude. The soil was sandy clay loam in texture with pH 7.5, EC 0.28 mmhos/cm, organic carbon 0.60, phosphorus 50 kg/ha and potassium 235 kg/ha. The experiment was laid down in randomized block design comprising two concentrations of alachlor (Pre-emergence i. e. 3 DAS) @ 2.5 and 3.5 kg a. i./ha, two concentrations of atrazine (Post-emergence i. e. 15 DAS) @ 0.50 and 0.75 kg a. i./ha and their combinations including repeated weeding and weedy check. These comprised 10 treatments which were replicated thrice. The winter maize (cv. Ganga Safed 2) was sown with a spacing of 60 x 25 cm at 15 October and grown under normal agronomic practices. The observations on yield attributes and grain yield were recorded. The intensity and biomass of weeds were recorded at 60 DAS by the least count quadrate method. The mean data of three replications of weed intensity, weed dry weight and weed control efficiency (WCE) were correlated with yield attributes and yields. WCE was computed on weed dry weight in treated plots compared to weedy check. The relationship of weed intensity, weed dry weight and WCE with grain yield was described by using linear regression models as described by Dew (1972).

RESULTS AND DISCUSSION

Effect on Crop and Weeds

The combined application of alachlor + atrazine was found more effective in reducing weed population and weed dry weight as compared to their alone application (Table 1). The maximum weed intensity and weed dry weight were observed under weedy check conditions. Amongst all the herbicide treatments, the

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Table 1. Weed intensity and weed dry weight at knee height stage and crop yield as affected by different weed management practices

Treatment	a. i kg/ha	Weed intensity (No./m^2)	Weed dry weight (No./m^2)	WCE (%)	Grain yield (t/ha)	Stover yield (t/ha)
Weedy check	-	8.84 (77.6)	6.56 (42.5)	0.0	4.66	9.76
Alachlor (Pre)	2.5	4.34 (18.3)	3.30 (10.0)	79.52	7.25	9.97
Alachlor (Pre)	3.5	5.37 (28.3)	2.47 (5.6)	87.52	7.28	10.53
Atrazine (Post)	0.5	2.74 (7)	2.63 (6.4)	89.79	8.28	11.20
Atrazine (Post)	0.75	3.24 (10)	2.65 (6.5)	90.94	8.20	11.53
Alachlor (Pre) + Atrazine (Post)	2.5 + 0.5	2.92 (8)	2.42 (5.4)	91.18	9.25	11.72
Alachlor (Pre) + Atrazine (Post)	2.5 + 0.75	2.86 (7.6)	2.10 (3.9)	95.21	9.75	11.92
Alachlor (Pre) + Atrazine (Post)	3.5 + 0.5	2.48 (5.6)	1.82 (2.8)	96.81	11.25	12.70
Alachlor (Pre) + Atrazine (Post)	3.5 + 0.75	2.04 (3.6)	1.44 (1.6)	87.28	10.25	12.49
Weed free	-	0.71 (0.0)	0.71 (0.0)	100	11.91	13.0
LSD (P = 0.05)		0.101	0.0718	-	0.60	0.91

Figures within parentheses indicate the original values.
The weed data are subjected to square root transformation $\sqrt{x}+0.5$.

minimum weed intensity and weed dry weight were observed in pre-emergence application of alachlor @ 3.5 kg a. i./ha followed by post-emergence application of atrazine @ 0.75 kg a. i./ha. However, higher yield after weed free plots was observed by pre-emergence application of alachlor @ 3.5 kg a. i./ha followed by post-emergence application of atrazine @ 0.50 kg a. i./ha. It was observed that although combination of alachlor and atrazine increased yield compared to alone application but at their higher concentrations i. e. pre-emergence application of alachlor @ 3.5 kg a. i./ha fb post-emergence application of atrazine @ 0.75 kg a. i./ha were found to have phytotoxic effect on crop plants thereby decreasing yield.

The phytotoxic effect due to increased doses of herbicides was also reported by Saini and Angiras (1998).

Relation of Weeds and Crop

The correlation matrix (Table 2) revealed that all characters under the study viz., weed intensity, weed dry weight, WCE, number of cobs, cob length and grain yield of winter maize were significantly related to each other either directly or inversely except the WCE with cob length (correlation coefficient r=0.628). The highest degree of positive association was observed between weed intensity and weed biomass (r=0.963**). This was followed by cob length with grain yield (r=0.959*). In most of the cases, the correlations were highly significant (at 1% probability level). The correlation coefficients amongst weed control efficiency, number of cobs, cob length and grain yield were positive (r=0.628 to 0.959). However, these parameters were negatively associated with weed intensity and weed biomass (r=-0.653 to -0.997*). The two weed parameters (weed population and weed biomass) were also positively correlated to each other (r=0.963**). The regression equations in Table 3 also reveal the negative relationship of grain yield with weed population and weed biomass (Mishra *et al*., 1996). The regression equation predicted linear reduction in

Table 2. Correlation coefficient values of weed population, weed biomass and WCE with yield and yield attributing characters of maize

Independent characters	Weed population	Weed biomass	WCE	No. of cobs	Cob length	Grain yield
Weed population	-	0.963**	-0.970**	-0.854**	-0.687*	-0.846**
Weed biomass	-	-	-0.997**	-0.822**	-0.653*	-0.815**
WCE	-	-	-	0.807**	0.628	0.797**
No. of cobs	-	-	-	-	0.938**	0.985
Cob length	-	-	-	-	-	0.959**

*, **Significant at P=0.05 and P=0.01 level, respectively.

Table 3. Regression of grain yield (q/ha) of maize on weed population/ m^2, weed biomass (g/m^2) and weed control efficiency (%)

Independent characters	Y = a + bx
Weed population	$101.143 - 0.790\ X_1$
Weed biomass	$100.06 - 1.418\ X_2$
WCE	$40.373 + 0.575\ X_3$

the grain yield with a unit increase in the population and biomass of weeds. The extent of reduction could be 0.79 and 1.418 q/ha for weed intensity and weed dry weight (Raut and Satapathy, 1996). The reduction in grain yield was attributed to the reduction in yield attributes as was evidenced from correlation coefficients. The evaluation of weed control efficiency of the different treatments and the regression of yield on it revealed that 1% increase in the weed control efficiency increased the grain yield by 0.575 q/ha. The increase in grain yield by unit increase in WCE was also reported by Kurmi (1997). Thus, it is concluded that by controlling weed population at critical stage reduces weed dry matter accumulation which increases WCE which in turn increases yield attributes and consequently grain yield of winter maize.

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