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Effect of Tillage Intensity and Herbicide Application
On Growth and Yield of Maize (*Zea mays* L.)

Shakeel Ahmad, Mahboob Akhtar, Amer Sohail Bhatti and Tariq Mahmood
Department of Agronomy, University of Agriculture, Faisalabad-38040, Pakistan

Abstract

Effect of different tillage intensities in combination with herbicide application or interculture on growth and yield of maize was investigated at Student Farm, Department of Agronomy University of Agriculture, Faisalabad during 1997. Maximum grain yield (4.92 t h^{-1}) along with highest net benefit (Rs. 38660/ =) per hectare was obtained for the crop raised with tilling the soil twice followed by herbicide application against the lowest grain yield (2.72 t ha^{-1}) and net benefit (Rs. 20890/ =) per hectare for the crop grown at zero tillage followed by interculture.

Introduction

Among various factors limiting yield of various crop, the presence of weeds is of paramount significance. Our conventional practice to control weeds involves repeated tillage or hoeing with the availability of chemical herbicides for efficient weed control, the idea of excessive tillage has been questioned by many researchers as the repeated tillage practices not only adds to the cost of production and is time taking but also is responsible for breaking close contact between root hair and soil. Our soils are sandy clay loam in nature and their natural compaction is appropriate for close contact between soil and the root hair. A new concept of zero or minimum tillage technology is being advocated in the modern agriculture. Bennett *et al*. (1973) reported that germination and seedling growth of corn, plant height and yield were significantly higher with no tilled plus atrazine treatment. Masih (1982) found that atrazine at 3 liter ha^{-1} significantly decreased weed population, increased number of grains per cob, 1000-grain weight, leaf area per plant, grain and stalk yield as well as harvest index over control. Singh *et al*. (1985) achieved the highest grain yields by using 1 kg atrazine/ha and 1.5 kg cynazine/ha. Balyan and Bhan (1987) stated that application of atrazine at 0.5 kg ha^{-1} to maize gave more effective weed control than hand weeding. They further observed that chemical treatment markedly reduced the dry weight of weeds, stimulated the crop height and leaf area development, which ultimately led to higher grain yield. Bicki *et al*. (1991) concluded that the use of herbicides in conjunction with cultivation may be a cost effective and environmentally sound for weed control. Vyn and Raimbult (1993) stated that reduced tillage systems with conventional mold board ploughing resulted in slower plant growth. Buhler *et al*. (1995) concluded that one or two cultivations followed by atrazine or cyanazine increased weed control and grain yield. It is evident from the above information that tillage intensity and the method for controlling weeds play a remarkable role in crop productivity. Keeping in view the importance of these two factors present study was designed to investigate the effect of different tillage intensities in combination with herbicide application or interculture on the productivity of maize.

Materials and Methods

The effect of tillage intensity and herbicide application in maize (*Zea mays* L.) were studied at Agronomic Research Area, University of Agriculture, Faisalabad during 1997 by using Randomized Complete Block Design with four replications. Net experimental plots measured 3x8 m. Various treatments comprised of zero tillage followed by herbicide, zero tillage followed by interculture, one tillage followed by herbicide, one tillage followed by interculture, two tillage followed by herbicide, two tillage followed by interculture, three tillage followed by herbicide and three tillage followed by interculture (Control). Maize variety "Golden" was sown in the second week of August, 1997. Sowing was done with the help of a single row hand drill in 75 cm apart rows using a seed rate 30 kg ha^{-1}. Plant to plant spacing was maintained at 25 cm by thinning the crop at 4 leaf stage. Recommended dose of fertilizer i.e., 185 kg nitrogen and 85 kg phosphorus ha^{-1} (Zafar, 1997) was applied to the crop. Six irrigations were applied in all to the crop in addition to the natural precipitation of 226 mm received during this period. The herbicide was sprayed in the respective treatments with the help of a knap-sack hand sprayer fitted with fine Jet nozzles. The crop was treated once with Furadon 3-G against maize borer (Chao partellus). Economics of different treatments was calculated for each treatment. The data s6 collected were analysed statistically by using Fisher's analysis of variance technique and difference among the treatment means was compared using least significant different (LSD) test at 0.05 probability level (Steel and Torrie, 1980).

Results and Discussion

It is evident from the (Table 1) that maximum plant height of 247.9 cm was recorded in case of three tillage and herbicide application (T$_7$ which was at par with T$_5$ (two tillage followed by herbicide).
The leaf area per plant at tasseling, the highest leaf area

Table 1: Effect of tillage intensity and herbicide application with yield, yield parameters and weed biomass in maize

Treatments	Plant height (cm)	Leaf area/ plant at	1000-grain weight (g) Tasseling (cm^2)	Grain yield (t ha^{-1})	Total weed biomass (g/m^2)
T1 = Zero tillage followed by herbicide	203.2f	3757.32c	275.2d	3.22c	27.89b
T2 = Zero tillage followed by interculture	196.4g	3396.75d	269.7d	2.72d	32.04a
T3 = One tillage followed by herbicide	216.0d	4528.79b	304.0c	4.18b	14.94c
T4 = One tillage followed by interculture	209.0e	4341.96b	280.5d	3.93b	15.67cd
T5 = Two tillage followed by herbicides	246.7a	5939.32a	247.2a	4.92a	8.65e
T6 = Two tillage followed by interculture	241.8c	5669.46a	329.5ab	4.67a	10.48de
T7 = Three tillage followed by herbicides	247.9a	5879.14a	342.5ab	4.75a	7.80e
T8 = Three tillage followed by interculture	243.8b	5649.44a	325.5b	4.62a	8.97e

Table 2: Economic comparison among various treatments

		T1	T2	T3	T4	T5	T6	T7	T8
1	Grain yield (t ha^{-1})	3.22	2.72	4.17	3.92	4.91	4.66	4.74	4.62
2	Stalk yield (t ha^{-1})	5.39	4.88	5.98	5.73	6.40	6.21	6.32	6.18
3	Grains value (Rs.)	24150	20400	31275	29400	36825	34950	35550	34650
4	Stalks value (Rs.)	2695	2440	2990	2865	3230	3105	3160	3090
5	Total income	26845	22840	34265	32265	40055	38055	38710	37740
Variable cost (Rs.)									
6	Tillage	-	-	250	250	500	500	750	750
7	Hoeing charges	-	1950	-	1950	-	1950	-	1950
8	Herbicide	895	-	895	-	895	-	895	-
9	Total expenditures	895	1950	1145	2200	1395	2450	1645	2700
10	Net benefits	25950	20890	33120	30065	38660	35605	37065	34040

1. Price of primextra = 550/1; 2. = Hoeing charges = 650 x 3 = 1950; 3. Cultivation = 250/ha; 4. Daily wages of man Rs.50/-; 5. 1 man is needed to spray = 1 hectare; 6. Rent of sprayer per day = Fls.20/-; 7. Men to hoeing one ha = 13; 8. Price of stalk = 500/ton; 9. Price of grain = Rs.7500/ton

(5939.32 cm^2) was obtained in treatment T_5, (two tillage followed by herbicide application which is statistically at par with the treatments T_6, T_7, and T_8. These findings are in agreement with the observations of Masih (1982).

Regarding 1000-grain weight, significant difference between the treatments were found. Treatment T_5 (two tillage followed by herbicide application) produced the maximum 1000-grain weight (347.2 g) which was at par with T_6 and T_7. It is due to more availability of nutrients for better crop growth and grain development as a result of better weed control.

The data regarding grain yield per hectare revealed that differences among treatments were significant. All the treatments controlled weeds to a variable degree and the treatment T_5 (two tillage followed by herbicide) showed better control and ultimately resulted in maximum grain yield,(4.92 t ha^{-1}) and it was at par with T_6, T_7, and T_8. These results are in line with the findings of Buhler *et al*. (1995). Table 1 also revealed that total weed biomass was highly suppressed by different treatments. The minimum weed biomass was recorded in treatments T_5, T_6, T_7 and T_8. A glance at Table 2 on economic analysis reflects that T_5 (two tillage followed by herbicide application) gave the highest net income of Rs.38,660 which was closely followed by T_7, (three tillage followed by herbicide application) with the net income of Rs.37,065 as against the minimum net income obtained in T_2. These results are in agreement with the findings of Bicki *et al*. (1991).

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