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EFFECT OF DIFFERENT WEEDING INTERVALS AND METHODS ON THE YIELD AND YIELD COMPONENTS OF MAIZE HYBRID (PIONEER 3025)

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ABSTRACT

A field experiment was conducted to find out the weeding interval and comparison of hand hoeing and chemical weed control in maize hybrid (Pioneer 3025) at Agricultural Research Institute, D I Khan Khyber Pakhtunkhwa Pakistan during summer season 2013. The experiment was laid out in randomized complete block design (RCBD) with three (3) replications and thirteen (13) treatments. The treatments of hand hoeing and chemical weed control were compared at 14, 21, 28, 35, 42 and 49 days after maize sowing along with a un weeded control. Biological yield and yield components of maize were significantly affected by different weeding intervals. Plant height, number of grains cob^{-1} and 1000 grain weight was maximum when weeding was done from 14 to 35 days after sowing while increased grain yield was obtained when weeding was done after 28 and 35 days after sowing. Significantly higher biological yield was recorded in weeded treatments of 21, 28 and 42 days after sowing. Maximum benefit cost ratio (BCR) and net income was obtained when hand weeding was done after 28 days of sowing while the minimum benefit cost ratio (BCR) and net income was obtained in a plot where no weeding was done. It is concluded that hand weeding is more profitable than chemical weeding. From the study it is also concluded that weeds control measures be carried in the first six weeks of maize sowing for profitable production under agro-ecological condition of Dera Ismail Khan.

Keywords: maize hybrid, hand hoeing, chemical control, weeding interval, grain yield, BCR

INTRODUCTION

In the world after rice and wheat maize is the third most important cereal crop. Botanically it is called Zea *mays* L. while its local name is Makkai and belongs to family Poacae. All over the world maize is the uppermost yielding cereal crop and also of great significance for countries like Pakistan where hurriedly rising population has already out stripped the accessible food supplies. During 2014-2015 maize was sown on an area of about 1.13 m hac in Pakistan with a production of 4.7million tones (Pakistan Bureau of Statistics). In Pakistan maize is used mainly for humans in the form of food while it is used as fodder for animals. The raw materials for industry are also obtained from maize. About 75% of maize production is used as food by the farming community and the remaining is used for starch manufacturing industry, poultry feed and food grain sales (Muhammad, 1979). There are various factors which causes low yield in maize crop but the most important factor is the presence of weeds in maize field and lack of knowledge with farmers. The yield of various crops is reducing by weeds approximately 15 to 100% and low the quality of produce (Bakht *et al*., 1989). Literature stated that weed infestation during the critical stage varied with the nature and status of crop, weed flora composition, level of weed infestation and existing surroundings (Zimdahl, 2004; Knezevic *et al*., 2002). Weeds compete for resources i,e. light, nutrients, soil moisture and space interception which reduce the yield of maize (Khan *et al*., 2002). Weeds are controlled through different methods which include manual, mechanical, biological and chemical. Manual weed control methods include pulling weeds by hand, cutting them with a sickle, hoeing with hand tools. They are the most effective and safest methods, but at the same time the most tedious and highly weather dependent. On the other hand chemical weed control is considered to be the most effective and productive method in modern agriculture but it has also certain draw backs like pollution, development of weed resistance against weedicides etc. Initial growth stages of crops are very sensitive to competition by weeds and there is maximum loss of the crop if weeds are not removed during this period. With passage of time crop establishes and the severity of loss due to weeds gets decreased. So, it is very essential to control weeds during initial periods which are most critical for crop weed competition. These uncontrolled weeds cover the crop and sometimes may result in crop failure. Mishra, (1997) reported critical period of maize weed competition to be 15-45 days. Farmers normally do not practice weeding in maize if they do then either they have no

Knowledge of the critical weed crop competition time or it very late so more yield losses occur (Rashid, 1994). Our farmers lack the knowledge of critical weed crop competition period as a result they waste their inputs and finally yield reduction occurs. The present study was therefore, designed to assess the most suitable timing of weed control in maize crop and also to compare chemical and hand hoeing weed control method in maize.

Materials and methods

Study on weed competition in maize hybrid (Pioneer-3025) as affected by timing of hand hoeing and chemical weed control at Agriculture Research Institute

Dera Ismail Khan was laid out in randomized complete block design with 3 replications and thirteen (13) treatments. There were six rows per plot and a plot size was 5 m X 3 m (15 m^2). The seed was sown during July by dibbling method. Plant to plant distance was 25 cm and row to row distance was kept 75 cm. Before sowing the seedbed was properly prepared by ploughing field twice at appropriate condition of soil moisture followed by leveling and harrowing. The seed was sown at the rate of 25 kg/ha and fertilizer was used at the rate of 120- 80- 60 NPK kg/ha. All the phosphorus and half of the nitrogen were applied during planting time and the remaining nitrogen was applied in two splits. The crop was irrigated as per requirement. Weedicides atrazine and primextra were used @ 250 ml acr^{-1} each. The details of experimental treatments are given as under.

S. No.	Treatments
T_0	Un weeded (control)
T_1	hand hoeing after 14 days of sowing of maize
T_2	chemical control after 14 days of sowing of maize
T_3	hand hoeing after 21 days of sowing of maize
T_4	chemical control after 21 days of sowing of maize
T_5	hand hoeing after 28 days of sowing of maize
T_6	chemical control after 28 days of sowing of maize
T_7	hand hoeing after 35 days of sowing of maize
T_8	chemical control after 35 days of sowing of maize
T_9	hand hoeing after 42 days of sowing of maize
T_{10}	chemical control after 42 days of sowing of maize
T_{11}	hand hoeing after 49 days of sowing of maize
T_{12}	chemical control after 49 days of sowing of maize

Agro meteorological and physico-chemical characteristics of soil

Soil of the experimental site was clayey with PH 8.2 having organic matter 0.166%, nitrogen 80Ppm etc. Metrological data of the experimental location showed that average maximum rainfall was 22 mm in July while minimum rainfall was 5.5 mm during October. Maximum temperature 40 C was recorded during the month of July.

Statistical analysis

Statistical analysis was performed using MSTATC software (Bricker, 1991) and the means were separated using LSD test (Steel and Torrie, 1997).

RESULTS AND DISCUSSIONS

Plant height (cm)

Data presenting the plant height are given in Table-1. The statistical analysis of the data revealed that weeding intervals significantly affected plant height of maize. However, the effect of weeding methods and method x weeding interval was not significant. The contrast between control vs rest was also not significant. Plants were taller when weeds control methods were applied from 14 to 35 days after sowing while short-statured plants were produced when weeds control measures were delayed further. The same result was found in the experiment performed by Umme *et al*. (2012).

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Table-1. Maize plant height (cm) as influenced by various weeding intervals and control methods.

Weeding interval in days after sowing	Weed control methods		
	Hand weeding	Chemical weeding	Mean
14	155	168	162 a
21	172	167	170 a
28	181	173	177 a
35	172	153	163 a
42	138	141	140 b
49	130	135	133 bc
Mean	158	156	
Control	130		
Rest	157		
LSD for time interval	20.17191		
Control vs rest	Non-significant		
Methods	Non-significant		
Time x Methods	Non-significant		

Number of grains cob^{-1}

Number of grains cob^{-1} of maize is given in Table-2 which was significantly affected by weeding intervals. The contrast between control vs rest also significantly affected the number of grains cob^{-1}. However, the effect of weeding methods and interaction of methods × weeding intervals was non-significant. The maximum number of grains cob^{-1} (422) was recorded where weeding was done after 28 days of sowing of maize. The number of grains cob^{-1} was statistically similar when weeding was done from 14 till 35 days after sowing. The minimum number of grains cob^{-1} (274) was obtained when weeding was done after 49 days of sowing which was similar with plot in which weeding after 42 days of sowing of mazie was done. Imtiaz *et al.* (2010) also suggested that weeding after first 4th to 5th weeks of sowing gave more number of grains cob^{-1}.

Table-2. Number of maize grains cob^{-1}as influenced by various weeding intervals and control methods.

Weeding interval in days after sowing	Weed control methods		
	Hand weeding	Chemical weeding	Mean
14	341	389	365ab
21	383	416	395 a
28	440	403	422a
35	400	327	363ab
42	235	346	291b
49	281	267	274bc
Mean	347	358	
Control	301b		
Rest	352a		
LSD for time interval	73.99872		
Control vs rest	Significant		
Methods	Non significant		
Time x Methods	Non significant		

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1000 Grain weight (g)

The data for 1000 grain weight (g) is shown in Table-3. Statistical analysis showed that weeding intervals and contrast between control vs rest significantly affected 1000 grain weight of maize. However, the effect of weeding methods was non- significant. The interaction between weeding methods × weeding intervals was also non-significant. The maximum and statistically similar 1000 grain weight was found where weeding was done from 14 to 35 days after sowing. While the minimum and statistically similar 1000 grain weight (245 and 247g) was recorded where weeding was done after 42 and 49 days of sowing, respectively. The control treatment (unwedded) produced significantly lighter grains (254 g) than the weeded treatments (262 g). The reason might be due to the weed control measures that shifted weed-crop competition in favor of maize crop thereby producing heavier grains and vice versa. Umm *et al* (2012) also performed an experiment that supported my results.

Table-3. 1000 grains weight (gm) of maize as influenced by various weeding intervals and control methods.

Weeding interval in days after sowing	Weed control methods		
	Hand weeding	Chemical weeding	Mean
14	257	272	265ab
21	268	268	268ab
28	284	269	276a
35	271	271	271a
42	242	249	245bc
49	254	239	247b
Mean	263	261	
Control	254b		
Rest	262a		
LSD for time interval	15.35993		
Control vs rest	Significant		
Methods	Non significant		
Time x Methods	Non significant		

Grain yield (t hac^{-1})

Generally the critical weed crop competition remains from 4 to 6 weeks and weeds must be controlled during this duration otherwise yield losses occur. Maize grain yield was significantly affected by weeding with in different time intervals Table-4. The contrast between control vs rest was also significantly affected. While on the other hand different methods of weeding and methods × interval interaction was non-significant. Higher maize grain yield (4.05 t hac^{-1}) was obtained when weeding was done after 28 days of sowing and statistically at par results were obtained in treatment when weeding was done 35 days after sowing. Muhammad *et al*. (2004) who showed that grain yield reduces due to delay in weeding.

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Table-4. Maize grain yield (t ha^{-1}) as influenced by various weeding intervals and control methods.

Weeding interval in days after sowing	Weed control methods		
	Hand weeding	Chemical weeding	Mean
14	3.09	3.02	3.06bc
21	3.10	3.07	3.08b
28	4	3.10	4.05a
35	3.16	3.12	3.12ab
42	3.14	3.11	3.07bc
49	3.09	3.03	3.05bcd
Mean	3.24	3.16	
Control	3.04b		
Rest	4.06a		
LSD for time interval	0.27384		
Control vs rest	Significant		
Methods	Non significant		
Time x Methods	Non significant		

Biological yield (t hac^{-1})

Data regarding biological yield of maize was significantly affected by weeding intervals (Table-5). However the weeding methods were non-significant. The contrast between control vs rest showed significant effect on biological yield of maize. The maximum biological yield (21 t hac^{-1}) of maize was recorded in treatment when weeding was done after 28 days of sowing of maize while the minimum biological yield (13 t hac^{-1}) of maize was obtained when weeding was done after 49 days of sowing of maize. Unweeded control recorded significantly lower biological yield (12 t) as compared to rest of the weeded treatments (18 t). It may be attributed to the timely control of weeds that resulted in maximum reduction of weeds pressure while delay in control of weeds might not proved to have brought timely relief for the crop against weeds. The same result was found in the experiment performed by Stevenson *et al*. (1997).

Benefit cost ratio (BCR)

Benefit cost ratio is a tool for economic analysis and farmers are actually interested in net income of any farming enterprise. The data regarding benefit cost ratio (Table-6) showed that when hand weeding was done after 28 days of sowing of maize, it gave more net income (Rs 102570) and highest BCR value (2.17). On the other hand in the plot in which no weeding was done that gave minimum net income (Rs 64470) and minimum BCR (1.79). The experiment of Shehzad *et al.* (2012) is in line with my results.

Table-5. Maize biological yield (t ha^{-1}) as influenced by various weeding intervals and control methods.

Weeding interval in days after sowing	Weed control methods		
	Hand weeding	Chemical weeding	Mean
14	15	16	16c
21	18	21	20ab
28	23	19	21a
35	18	19	18bc
42	20	18	19ab
49	14	12	13d
Mean	18	17	
Control	12b		
Rest	18a		
LSD for time interval	2.563213		
Control vs rest	Significant		
Methods	Non significant		
Time x Methods	Non significant		

Table-6. Benefit Cost Ratio (per hectare) of maize crop (PKR) as affected by weeding intervals and methods.

Application methods	Application times	Yield (t ha^{-1})	Cost (PKR)			Income (PKR)			Net Income (PKR)	BCR
			Fixed	Variable	Total	Grains	Straw	Total		
Hand and weeding	Unweeded (Control)	3.24	81,430/-	-	81,430/-	113,400/-	50,000/-	163,400/-	81,970/-	2.01
	14 DAS	3.09	81,430/-	6,000/-	87,430/-	108,150/-	50,000/-	158,150/-	70,720/-	1.81
	21 DAS	3.10	81,430/-	6,000/-	87,430/-	108,500/-	50,000/-	158,500/-	71,070/-	1.81
	28 DAS	4.00	81,430/-	6,000/-	87,430/-	140,000/-	50,000/-	190,000/-	102,570/-	2.17
	35 DAS	3.16	81,430/-	6,000/-	87,430/-	110,600/-	50,000/-	160,600/-	73,170/-	1.84
	42 DAS	3.14	81,430/-	6,000/-	87,430/-	109,900/-	50,000/-	159,900/-	72,470/-	1.83
	49 DAS	3.09	81,430/-	6,000/-	87,430/-	108,150/-	50,000/-	158,150/-	70,720/-	1.81
Chemical weeding	14 DAS	3.02	81,430/-	4,400/-	85,830/-	105,700/-	50,000/-	155,700/-	69,870/-	1.81
	21 DAS	3.07	81,430/-	4,400/-	85,830/-	107,450/-	50,000/-	157,450/-	71,620/-	1.83
	28 DAS	3.10	81,430/-	4,400/-	85,830/-	108,500/-	50,000/-	158,500/-	72,670/-	1.85
	35 DAS	3.12	81,430/-	4,400/-	85,830/-	109,200/-	50,000/-	159,200/-	73,370/-	1.85
	42 DAS	3.11	81,430/-	4,400/-	85,830/-	108,850/-	50,000/-	158,850/-	73,020/-	1.85
	49 DAS	3.03	81,430/-	4,400/-	85,830/-	106,050/-	50,000/-	156,050/-	70,220/-	1.82

CONCLUSIONS

From my studies it is concluded that weeding interval significantly affected yield of maize crop. Highest maize grain yield was obtained when weeding was practiced either 28 or 35 days after sowing. Maximum BCR was obtained when hand weeding was done after 28 days of maize sowing and hence higher net returns as compared to all other treatments. It was further concluded that weeded treatments proved to be more economical than un weeded treatments.

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