EVALUATION OF DIFFERENT HERBICIDES FOR THE CONTROL OF WEEDS IN MAIZE (*ZEA MAYS* L.)

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The study was aimed to evaluate the effect of stomp-330E (Pendimethalin), Primextra-50WP (Atrazine + Metalachlor), Banvel-P (Dicamba + Mecoprop), Bladex plus (Aatrex + Bladex), Basta-20SL (Glufosinate ammonium), Gramoxone-20EC (Paraquat) and hand weeding on weeds in maize field. Directed post-emergence application of Gramoxone-20EC and Basta-20SL was more effective than pre and post-emergence application of Stomp-330E, Primextra-50WP, Banvel-P and Baladex plus in controlling weeds. However, none of the herbicides completely controlled *Cyperus rotundus* and *Cynodon dactylon*. Higher grain yield of 5.2 t ha^{-1} was obtained by hand weeding closely followed by Gramoxone-20EC.

INTRODUCTION

Weed infestation is one of the major constraints responsible for low yield of maize. Weed control by cultural and mechanical methods in maize is in practice since long. These methods no doubt are effective and useful but are labour intensive, and time consuming. Moreover, migration of rural labour to urban areas and increasing labour cost has forced maize growers to search for other alternatives like chemical weed control. It is more effective, time and labour saving method which shifts the weed-crop competition in favour of crop plants by killing the weeds in least possible time. Gesaprim gave higher yield (7.89 - 8.90 t ha^{-1}) than mechanical weeding (5.50 -7.47 t ha^{-1}) as reported by Sparacino (1983). Veselovskii (1983) obtained 6.32 t ha^{-1} yield by using Primextra @ 4 kg ha^{-1} against 5.93 t ha^{-1} with two hand weedings. Shakoor *et al.* (1986) reported that Gesaprim @ 3 kg a.i. ha^{-1} and Primextra @ 2.5 kg a.i. ha^{-1} increased grain yield by 1436 and 693 kg ha^{-1}, respectively over the unweeded control. Use of accurate dose, time and method of application of selective and non-selective weedicides for safe and effective use on crops is of supreme importance. Present study was, therefore, undertaken to evaluate already recommended pre and post-emergence weedicides with newly introduced non-selective weedicides as directed post-emergence application.

MATERIALS AND METHODS

The experiment was carried out at Agronomic Research Area, University of Agriculture, Faisalabad, during, 1989 following Randomized Complete Block Design with four replications and a net plot size of 3.6 x 8 m. Maize variety "Sunehri" was used as a test crop, using a seed rate of 35 kg ha^{-1}. Sowing was done with the help of single row hand drill in 60 cm apart rows and plant to plant distance of 22.5 cm was maintained by thinning. Fertilizer was applied at the rate of 160 kg N and 80 kg P_2O_5 ha^{-1}. Whole of the phosphorus and half of the nitrogen was applied at sowing while remaining half of nitrogen was applied with second irrigation.

Effectiveness of six weedicides namely

Table 1. Effect of herbicides on weed density and weed biomass in maize

Treatment	Weed density before spray	Weed density 20 days after	Mortality (%)	Weed biomass	
				Fresh weight	Dry Weight
Stomp 330 E (Pre-emergence)	-	43.5 b	-	202.2 b	33.7 b*
Primextra 50 WP (Pre-emergence)	-	40.6 b	-	200.0 b	33.4 b
Banvel-P (Post-emergence)	139.3	38.5	72.3	140.1 bc	22.9 bc
Bladex-plus (Post-emergence)	154.0	37.9 b	75.4	124.9 bcd	21.2 bcd
Basta 20 SL (Directed post-emergence)	152.5	30.9 c	79.8	65.6 cd	11.0 cd
Gramoxone 20 EC (Directed post-emergence)	168.5	23.5 d	86.1	58.6 d	9.8 d
Hand weeding	157.3	28.5 cd	81.9	116.2 cd	19.8 cd
Weedy check	154.2	185.3 a		259.4 a	67.2 a

*Means not sharing a letter in common differ significantly at 5% probability level

Stomp 330E (Pendimethalin) @ 3.5 l ha^{-1} as pre-emergence, Primextra 50WP (Atrazine + Metalachlor) @ 3 l ha^{-1} as pre-emergence, Banvel-P (Dicamba 20 g l^{-1} + Mecoprop 324 g l^{-1}) @ 4 l ha^{-1} as post-emergence, Bladex-plus (Aatrex 80S + Bladex 75 WP) 3.5 l ha^{-1} as post-emergence, Basta 20 SL (Glufosinate-ammonium) @ 2.5 l ha^{-1} as directed post-emergence, Gramoxone 20EC (Paraquat) @ 2.5 l ha^{-1} as directed post-emergence and hand weeding was compared with the control. For pre-emergence application herbicides were sprayed with the help of Knap-sack sprayer CP-3 fitted with four flat fan (8003) nozzles on a boom. For directed post-emergence sprays polijet tips covered with a shield was used to avoid drift. Weed count and biomass was recorded from one meter square area selected at random from each plot. The data on number of cobs per plant, number of grains per cob and 1000-grain weight were also recorded. Statistical analysis of the data was done using Fisher's Analysis of Variance Technique and Duncan's Multiple Range Test was employed to compare the treatment means (Steel and Torrie, 1980). Economic analysis was done by calculating Marginal Rate of Return (CIMMYT, 1988).

RESULTS AND DISCUSSION

The common weeds found in maize field were *Tribulus terrestris* L. (Bhakra), *Amaranthus viridus* L. (Chulai), *Trianthema monogyna* L. (Itsit), *Portulaca oleracea* (Kulfa), *Digera arvensis* (Tandla), *Cyperus rotundus* L. (Deela), *Cynodon dactylon* L. (Khabbal grass) and *Dactyloctenium aegyptium* (Madhana grass).

75.40, 79.75 and 86.05, 20 days after spray (Table 1). Gramoxone 20 E and Basta 20SL gave total control of *Amaranthus viridus* L. *Portulaca oleracea, Digera arvensis* and *Dactyloctenium aegyptium*, and Partial control of *Tribulus terrestris* L., *Trianthema monogyna* L., *Cyperus rotundus* L. and *Cynodon dactylon* L. (Table 2). Primextra 50WP and Stomp 330E were effective against broad leaved weeds. Different de-

Table 2. Population and mortality of individual weeds against check in maize crop

Treatment	Amaranthus viridis L.	Digera arvensis	Portulaca oleracea	Trianthema monogyna	Tribulus terrestris L.	Cynodon dactylon L.	Cyperus rotundus L.	Dactyloctenium aegyptium
Stomp 330 E	2.40 (80.25)	1.50 (77.91)	1.00 (93.37)	7.60 (44.70)	1.50 (68.75)	7.50 (71.29)	17.50 (44.70)	4.50 (75.48)*
Primextra 50 WP	2.65 (78.19)	1.00 (85.27)	1.60 (89.40)	8.50 (87.90)	1.00 (79.16)	6.55 (74.93)	16.00 (49.44)	3.20 (82.54)
Banvel-P	2.35 (80.65)	0.50 (92.64)	2.14 (85.82)	9.50 (86.48)	1.95 (59.38)	5.50 (78.95)	14.56 (53.99)	2.00 (89.10)
Bladex plus	2.50 (79.42)	2.25 (66.69)	1.50 90.06)	8.81 (87.46)	2.56 (46.66)	4.60 (82.39)	13.00 (58.93)	2.65 (85.56)
Basta 20 SL	- (100)	1.50 (77.91)	- (100)	6.73 (92.17)	2.00 (68.75)	5.45 (81.25)	11.55 (70.05)	3.65 (86.38)
Gramoxon 20 E	- (100)	- (100)	- (100)	5.50 (92.17)	1.50 (68.75)	4.90 (81.25)	9.48 (70.05)	2.50 (86.38)
Hand weeding	2.60 (78.60)	- (100)	- (100)	6.50 (90.75)	1.80 (62.50)	4.65 (82.20)	10.15 (67.93)	2.80 (84.74)
Weedy check	12.15	6.79	15.10	70.28	4.80	31.65	18.35	

*Figures given in parenthesis show per cent mortality.

The respective figures for per cent weed control using Banvel-P, Bladex-plus, Basta 20SL and Gramoxone 20E were 72.34, gree of effectiveness of herbicides had also been reported by Veselovskii (1983) and Shakoor *et al.* (1986).

Data reveal that minimum weed biomass was found where Gramoxone 20E and Basta 20SL were applied (Table 1) followed by hand Weeding. It could be attributed to better weed control which ultimately resulted in less nutrient uptake by them.

weight may be attributed to better weed control and elimination of weed-crop competition for light, moisture, and nutrients etc.

Maize grain yield increased significantly with weed control treatments. The increase in yield over the control ranged between 18-54 per cent (Table 3). However,

Table 3. Effect of herbicides on yield and yield components of maize

Treatment	Number of cobs plant^{-1}	Number of grains cob^{-1}	1000-grain weight (g)	Grain yield (t ha^{-1})	% increase in yield over control
Stomp 330 E (Pre-emergence)	1.00	611.4 bc	241.0	3.9 c*	18.0
Primextra 50 WP (Pre-emergence)	1.00	618.4 abc	243.8 abc	4.0 c	19.8
Banvel-P (Pots-emergence)	1.00	623.6 abc	242.8 bc	4.0 c	19.5
Bladex plus (Post emergence)	1.00	628.1 abc	249.3 abc	4.4 b	32.9
Basta 20 SL (Directed post-emergence)	1.02	632.3 abc	247.6 abc	4.8 b	42.2
Gramoxone (Directed post-emergence)	1.02	646.4 ab	254.4 ab	5.1 a	53.3
Hand weeding	1.05	665.1 a	256.1 a	5.2	54.5
Weedy check	1.00	562.9 c	227.3 d	3.34 d	-

*Means not sharing a letter in common differ significantly at 5% probability level.

Different herbicides significantly affected the number of grains per cob and 1000-grain weight (Table 3). Although maximum number of grains (665.10) per cob and 1000-grain weight (256.07 g) was recorded in hand weeding but it did not differ significantly from herbicide treatments. The increase in grain number and 1000-grain

hand weeding and Gramoxone 20EC produced maximum yield but were statistically at par. Significant increase in yield with different weeding methods over the control was also reported by Sparacino (1983), Veselovskii (1983) and Shakoor, *et al.* (1986).

Table 4. Dominance analysis

Treatment	Net benefit (Rs.)	Variable costs (Rs.)	Marginal rate of return
Weedy check	10793.2	-	-
Gramoxone 20 EC	16104.3	372.5	1426.0
Basta 20 SL	15274.6	400.0	-
Primextra 50 EP	12383.0	529	-
Hand weeding	15994.4	600	-
Bladox plus	13720.3	600.5	-
Banvel-P	12149.6	710	-
Stomp-330 E	11928.8	786	-

Market prices:

Stomp-330 E = Rs. 196 l^{-1}
Primextra = Rs. 143 l^{-1}
Banvel-P = Rs. 154 l^{-1}
Bladex-plus = Rs. 143 l^{-1}
Basta 20 SL = Rs. 120 l^{-1}
Gramoxone 20 EC = Rs. 109 $^{-1}$

Hoeing charges = 20 men days @ Rs. 30.00 each.

Spray charges = Rs. 100 ha^{-1}.

Dominance analysis and marginal rate of return (CIMMYT 1988) for different treatments (Table 4) reveal that marginal rate of return was maximum with the directed post-emergence application of Gramoxone 20EC. It means that Gramoxone was the most economical treatment and best alternative for hand weeding.

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