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# EFFICACY OF VARIOUS HERBICIDES AGAINST WEEDS AND THEIR IMPACT ON YIELD OF MAIZE

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## ABSTRACT

*A field experiment was conducted at Agriculture Research Institute Tarnab, Peshawar during Kharif season 2008. The experiment was laid out in randomized complete block design having four replications. The experiment considered six herbicide treatments (Primextra gold, Dual gold, Atarax, 2,4-D, hand weeding and weedy check). The soil was fertilized with 120 kg ha$^{-1}$ N and 90 kg ha$^{-1}$ P in the form of urea and single super phosphate, respectively. The seeds of maize variety 'Azam' were sown in plots. Weeds control treatments significantly affected weed density m$^{-2}$, weeds flora, plant height, grain yield, biological yield and harvest index of maize crop. Application of Dual gold as foliar spray resulted in lower weed density (12 m$^{-2}$) and higher biological yield (9185 kg ha$^{-1}$). Maximum plant height (164 cm), grain yield (3147 kg ha$^{-1}$) and harvest index (34.8 %) were recorded in hand weeding. Weedy check resulted in high weed density, dwarf plants (149 cm), lower biological yield (6822 kg ha$^{-1}$), lower grain yield and harvest index. It is concluded that application of Dual gold significantly decreased weeds density m$^{-2}$ and increased grain yield among the herbicides applied and hence recommended for obtaining higher grain yield of maize.*

**Key words:** *Zea mays*, herbicides, weeds, grain yield, maize.

## INTRODUCTION

Maize is a high yielding cereal crop in the world and is of significant importance for countries like Pakistan, where population increases at a faster pace than the increase in our food resources. It is the third most important cereal crop in Pakistan after wheat and rice and was planted on an area of 1.042 m ha with an annual production of 3.1096 m t at the rate of 2984 kg ha$^{-1}$ during 2006-07; whereas the figures for total area under maize cultivation, total annual maize

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production and maize yield in North West Frontier Province (NWFP) were 0.492 m ha, 0.782 m t and 1590 kg $ha^{-1}$, respectively (MINFAL, 2006).

Maize is a high-risk crop, mainly due to the varying climatic conditions as well as inadequate management practices; specifically weeds control that result in low yields. Many important weed species in maize have extensively been studied in the country. Weeds are perceived by many farmers as being the greatest cause of yield loss in agricultural crops (Owen, 1998). Weeds are the most persistent of all crop pests. One of the main reasons for low yield is high infestation of weeds and poor weed management practices. Modern weed control in maize is an integrated programme involving tillage, cultivation and herbicides. Weeds are one of the obstacles that affect the productivity and quality of maize yield. Farmers use little technology and possess soil with a heavy load of seeds, and therefore, weeds represent a major management problem. Researches indicate that maize plants are very susceptible to weed competition and yield losses are estimated at 35% to complete crop failure (Sharma *et al.* 1998; Zaciragic and Grabo, 2003). Many researchers have investigated the effects of chemical and cultural methods on weed control and grain yield in maize. Hassan and Ahmed (2005) reported that among herbicides treatments, simazine and Ametryn showed superiority to the other treatments in controlling grasses, broad-leaved and the weeds. The studied treatments increased maize growth and yield through their effect in controlling the weeds, more so with hand hoeing. Similarly Salarzai (2001) reported the efficiency of atrazine in controlling the weeds and thus increasing maize yield. Maglhaes *et al.* (2000) obtained greatest maize yield by controlling weeds with paraquat plus extavon and ametryn. They further added that post-emergence herbicide application was effective in controlling weeds with no phytotoxic effect. Khan *et al.* (1991) studied pre-emergence herbicides, metolachlor plus atrazine, pendimethalin and cyanazine plus atrazine and reported that these decreased weed population and increased grain yield over weedy control. Khan *et al.* (1991), Khan *et al.* (1993) and Khan and Hassan (2003) reported good weed control and increased crop yield with herbicides in maize.

Keeping in view the importance of losses due to weed infestation in maize crop, the present study was designed for the development of integrated weed control system in maize.

## MATERIALS AND METHODS

An experiment was conducted at Agricultural Research Institute Tarnab, Peshawar, Pakistan during Kharif season, 2008. The

experiment was laid out in randomized complete block design having four replications. The experiment consisted of six herbicide treatments i.e. Primextra Gold, Dual gold, Atarax, 2, 4-D, Hand weeding and weedy control. Herbicides were applied as pre emergence except 2,4-D which was used as post emergence. Prior to seed sowing, the seedbed was prepared by ploughing the field twice followed by harrowing. The land was prepared according to the standard practices in order to improve moisture conservation of the soil required for soil seed interaction, good seed germination, emergence, and growth of the crop. The soil was fertilized with 120 kg $ha^{-1}$ N in the form of urea and 90 kg $ha^{-1}$ P in the form of single super phosphate before sowing. All P and one third of the N was applied at the time of sowing while remaining N was applied in two split applications i.e. at first irrigation and at 6-7 leaf stage. The seeds of maize variety 'Azam' were sown on June 25, 2008. All other agronomic practices were kept uniform for all treatments. Data were recorded on weeds density $m^{-2}$, weeds flora, plant height, grain yield, biological yield and harvest index.

**Statistical Analysis**

The data were statistically analyzed by using MstatC according to the procedure outlined by Steel and Torrie 1984.

## RESULTS AND DISCUSSION

**Weed density $m^{-2}$**

Data relating weed density $m^{-2}$ and weed flora are shown in Table-1. Statistical analysis of the data indicated that herbicides and hand weeding significantly controlled the weeds ($p<0.05$). Hand weeding significantly reduced the weed density to 13 weeds $m^{-2}$. Among the herbicides, Dual gold, Primextra gold, 2,4-D and atarax decreased the weed density to 12, 16, 17 and 26 $m^{-2}$, respectively. Herbicides had considerable phytotoxic effect on weeds and reduced their population to a significant level as compared to control treatment, where maximum weed density of 89 $m^{-2}$ was recorded in weedy check. Different weed species were also significantly decreased with application of herbicides and hand weeding as compared to control treatment. Similar results were reported by Khan *et al.* (1991) who reported decrease in weed population with the application of pre-emergence herbicides viz. metolachlor plus atrazine, pendimethalin and cyanazine plus atrazine.

**Plant height (cm)**

Plant height is a key factor that contributes significantly to maize biological and grain yield because taller plants capture more light and therefore had more photosynthate available for grain filling.

**Table-1. Different weed species $m^{-2}$ as affected by different weed control treatments.**

| Weeds $m^{-2}$ | Weedy control | Primextra gold | Atarax | Hand weeding | Dual gold | 2,4-D | LSD |
|---|---|---|---|---|---|---|---|
| *Digitaria sanguinalis* | 22 a | 4 be | 6 b | 3 c | 2 c | 6 b | 2.83 |
| *Digitaria adscendent* | 10a | 2 b | 3 b | 2 b | 3 b | 2 b | 2.72 |
| *Sorghum halepense* | 9 a | 2 b | 3 b | 1 a | 1 a | 1 a | 2.95 |
| *Cyperus rotundus* | 12 a | 3 b | 3 b | 2 b | 2 b | 1 b | 2.98 |
| *Cynodon dactylon* | 6 a | 1 b | 1 b | 1 b | 1 b | 2 b | 2.15 |
| *Digera arvensis* | 6 a | 1 b | 3 b | 1 b | 1 b | 2 b | 2.26 |
| *Trianthema monogyna* | 11a | 2 b | 2 b | 2 b | 1 b | 1 b | 2.31 |
| *Amaranthus retroflexus* | 6 a | 1 b | 2 b | 1 b | 2 b | 2 b | 2.31 |
| *Convolvulus arvensis* | 8 a | 2 b | 3 b | 2 b | 1 b | 1 b | 2.22 |
| All weeds | 89 a | 16 c | 26 b | 13 c | 12 c | 17 c | 7.90 |

Statistical analysis of the data revealed that plant height was significantly affected by different herbicides application ($p<0.05$). Mean values of the data (Table-2) showed that hand weeding resulted in long stature plants (164 cm), followed by Dual Gold (163 cm); while short stature plants (149 cm) were observed by control treatments (where herbicides were not practiced). Our results are supported by Oljaca *et al*. (2007) who reported significant decline in maize plant height due to the weeds infestation. Increased yield loss due to weed competition was associated with reduced plant height and light interception (Coleman and Gill, 2005; Baldoni *et al*. 2000).

**Biological yield (kg ha$^{-1}$)**

Biological yield is the weight of net photosynthetic material, which contributes significantly to the economic yield. In maize, it includes both the cob and stover weights. Perusal of the data showed that different herbicides application and hand weeding significantly increased biological yield of maize. Higher biological yield (9185 kg ha$^{-1}$) was achieved by application of Dual gold herbicide, followed by 2, 4-D (9082 kg ha $^{-1}$) (Table-2). While lowest biological yield (6822 kg ha$^{-1}$) was recorded in control treatment. Increasing biomass of maize may be due to reduction in weed infestation in weed control treatments. Our findings are supported by Cavero *et al*. (1999) and Saayman and Van-de-Venter (1997) who reported that maize biomass was declined by increase in weed competition.

**Grain yield (kg ha$^{-1}$)**

Statistical analysis of the data indicated that grain yield was significantly boosted by weed control treatments. Mean values show that highest grain yield (3147 kg ha$^{-1}$) was obtained by hand weeding, followed by application of Dual Gold (2923 kg ha$^{-1}$), while the lowest grain yield (1978 kg h$^{-1}$) was produced in control treatment (Table-2). Decrease in grain yield in control treatment may be due to the maximum infestation of weed flora. Our results are in line with Khan *et al.* (1991), Khan *et al.* (1993) and Khan and Hassan (2003) who reported excellent weed control and significant yield increases over untreated (control) in corn with herbicides application in maize crop as compared to control. Waheedullah *et al.* (2008) reported that weed management suppressed the weeds and increased the grain yield and yield components of maize.

**Harvest index**

Plant harvest index, the ratio of grain weight to total biomass, is an important trait that reflects the partitioning of photosynthat between the grain and the vegetative plant parts and improvements in the harvest index emphasize the importance of carbon allocation in

grain production. The statistical analysis of data displayed a significant effect ($P<0.05$) of different herbicides application and hand weeding on harvest index. Higher harvest index (34.8%) was recorded in hand weeding, followed by the application of 2, 4-D (31.9%), while the lowest harvest index (29.0%) was evidenced in control plots (Table-2). Our results are supported by Tessema and Tanner (1997) who found that weed species and density varied significantly in their effects on harvest index.

**Table-2. Plant height, grain yield, biological yield and harvest index as affected by different weed control treatments**

| Treatments | Grain yield (kg $h^{-1}$) | Biological yield (kg $h^{-1}$) | Plant height (cm) | Harvest index % |
|---|---|---|---|---|
| Weedy check | 1978 e | 6822 c | 149 c | 29.0 c |
| Primextra gold | 2739 c | 8659 b | 156 b | 31. 6 b |
| Atarax | 2547 d | 8542 b | 150 c | 29.8 be |
| Hand weeding | 3147 a | 9050 a | 164 a | 34.8 a |
| 2,4-D | 2897 b | 9082 a | 159 b | 31.9 b |
| Dual Gold | 2923 b | 9185 a | 163 a | 31.8 b |
| LSD | 158.2 | 303.3 | 3.77 | 2.43 |

## CONCLUSION AND RECOMMENDTION

It is concluded that the application of Dual gold significantly decreased weeds density $m^{-2}$, resulting in long statured plants and increased grain yield of maize among other herbicides and hence recommended for obtaining maximum grain yield of maize.

## REFERENCES CITED

Baldoni, G., P. Viggiani, A. Bonetti, G. Dinelli and P. Catezone. 2000. Classification of Italian *X. strumarium* complex based on biological traits, electrophoretic analysis and response to maize interference. Weed Res. 40(2): 191-204.

Cavero, J., C. Zaragoza, M.L. Suso and S. Pardo. 1999. Competition between maize and *Datura stramonium* in an irrigated field under semi-arid conditions. Weed Res. 39(3): 225-240.

Coleman, R. and G. Gill. 2005. Trends in yielding ability and weed competitiveness of Australian wheat cultivars. Proc. Aust. Agron. Conf. Aust. Soc. Agron. (www.regional.org.au).

Hassan, A.A.A. and M.K.A. Ahmed. 2005. The influence of some herbicides and additional hoeing in maize growth and yield and yield components. Int. J. Agri. Biol. 7(5): 708-711.

Khan, M. and W. Hassan. 2003. Effect of s-metolachlor on weed control and yield in different crops. Sarhad J. Agric. 19(3): 333-339.

Khan, M., N. Haq and A.Q. Syed. 1991. The effect of pre and post emergence herbicide on weeds control and grain yield of maize. Pak. J. Weed Sci. Res. 4:118-124.

Khan, M., N. Haq and M. Khan. 1993. The effect of pre-emergence herbicides on weed control and maize grain yield, on farmers' field. Sarhad J. Agric. 9(5): 415-421.

Magalhaes, P.C., J.B. Silva and F.O.M. Duraes, 2000. Toxicity of herbicides post emergents at maize crop initial phase. Pl. Daninhas.18: 227–84.

MINFAL. 2006. Agriculture Statistics of Pakistan (2006-07). Ministry of Food, Agriculture and Livestock (Economic Wing), Islamabad. Pp.18-19.

Oljaca, S., S. Vrbnicanin, M. Simic, L. Stefanovic and Z. Dolijanovic. 2007. Jimsonweed (*Datura stramonium* L.) interference in maize. Maydica 52(3): 329-333.

Owen, M.D.K. 1998. Producer's attitude and weed management. *In* J.L. Hatfield,D.D. Buhler and B.A. Stewart (eds.). Integrated weeds and soil management. Chelsea MI: Ann. Arbor. Press. Pp.43-59.

Saaymna, A.E.J. and H.A. Van-de-Venter. 1997. Influence of weed competition on subsequent germination and seed vigor of *Zea mays*. Seed Sci. Tech. 25(1):59-65.

Salarzai, A., 2001. Effect of different herbicides on weed population and yield of maize (*Zea mays* L.). Pakistan J. Agric. Sci., 38: 75–7.

Sharma, V., D.R. Thakur and J.J. Sharma. 1998. Effect of metachlor and its combination with atrazine on weed control in maize (Zea mays). Indian J. Argon. 43: 677–80.

Steel, R.G.D. and J.H. Torrie.1984.Principles and Procedure of Statistics. 2nd Ed. McGraw Hill Book Co. Inc. New York.

Tessema, T. and D.G. Tanner. 1997. Grass weed competition and calculated economic threshold densities in bread wheat in Ethiopia. African Crop Sci. J. 5(4): 371-384.

Waheedullah, M. A. Khan. S. Arifullah and M. Sadiq. 2008. Evaluation of Integrated weed management practices for maize (*Zea mays* L.). Pak. J. Weed Sci. Res. 14(1-2): 19-32.

Zaciragic, C. and D. Grabo. 2003. Herbicides of BASF–AG Company with emphasis on the protection of major crops wheat and maize. Herbologia, 4: 213–9.