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# IMPACT OF PLANTING METHODS AND HERBICIDES ON WEED BIOMASS AND SOME AGRONOMIC TRAITS OF MAIZE

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## ABSTRACT

*An experiment to study the impact of planting methods and herbicides on weed biomass and some agronomic traits of maize hybrid P-3025 was conducted at Agricultural Research Farm, NWFP Agricultural University, Peshawar during summer 2006. The crop was sown on April 22, 2006 in RCB design with split plot arrangement, replicated four times. The treatments included planting methods (Ridge, Broadcast & Flat sowing) in main-plots and herbicides (pendimethalin @0.75, s-metolachlor @ 1.92 and 2,4-D @ 0.80 kg a.i $ha^{-1}$) and a weedy check assigned to the sub-plots. Each sub plot measured 5x3 $m^2$. The data were recorded on fresh and dry weed biomass (g $m^{-2}$), plant height (cm), number of leaves $plant^{-1}$, leaf area ($cm^2$) and biological yield (t $ha^{-1}$). For planting methods, significant differences were noted for fresh and dry weed biomass (g $m^2$), plant height (cm), leaf area ($cm^2$) and biological yield (t $ha^{-1}$). For herbicides, significant differences were depicted for fresh and dry weed biomass (g $m^{-2}$), plant height (cm), leaf area ($cm^2$) and biological yield (t $ha^{-1}$). For interaction, significant differences were deciphered for fresh weed biomass (g $m^{-2}$), dry weed biomass (g $m^{-2}$), plant height (cm), leaf area ($cm^2$) and biological yield (t $ha^{-1}$). Maximum plant height (209.43, 213.41& 218.75 cm ), leaf area (346.79, 349 & 382.18 $cm^2$) and biological yield (10.45, 10.68 & 13.03 t $ha^{-1}$), while minimum values were observed for fresh weed biomass (265.68 g $m^2$, 169.50 g$m^2$ & 147.75 g $m^2$) and dry weed biomass (53.13 g $m^2$, 33.90 g $m^2$ & 29.55 g $m^2$) in Ridge planting, Dual gold 960 EC (s-metolachlor) and their interaction, respectively. Similarly, maximum*

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*values were recorded for fresh weed biomass (306.00 g $m^2$, 414.08 g $m^2$ & 443.75 g $m^2$) and dry weed biomass (61.20 g $m^2$, 82.81 g $m^2$, 88.75 g $m^2$) while, minimum values were obtained for plant height (192.68 cm, 180.58 $cm^2$, & 176.25 cm), and biological yield (6.87 t $ha^{-1}$, 5.00 t $ha^{-1}$ & 4.40 t $ha^{-1}$) in broadcast sowing, weedy check and their interaction respectively.*

**Key words:** Herbicides, planting methods, weeds biomass, agronomic traits, *Zea mays*.

## INTRODUCTION

Maize (*Zea mays* L.) is a well known kharif crop belonging to family Poaceae. It is the second most important crop after wheat in NWFP and is gaining important position in crop husbandry in Pakistan because of its high yielding potentials and short growth duration. Maize is not only used as a staple food of rural population but also a source of animal feed and industrial raw material.

In Pakistan maize is grown over an area of 1042 thousand hectares with an annual production of 3109.6 thousand tons and national average yield of 2984 kg $ha^{-1}$, while in NWFP during the same period area under this crop was 492.2 thousand hectares which produced 782.4 thousand tons with average yield 1590 kg $ha^{-1}$ (MINFAL 2006).

Maize production in Pakistan is low as compared to other maize growing countries of the world. Among various maize yield limiting factors serious infestation of weeds and improper planting methods are of immense importance. Weeds are one of the biggest threat to agricultural as they use the soil fertility, available moisture, nutrients and compete for space and sunlight with crop plant, which result in yield reduction. Different weed control methods are used in maize crop among which chemical weed control is the most economical and effective method to suppress weeds in order to get healthy and vigorous crop stand. Schans *et al*. (1997) obtained best weed control and higher crop yield in herbicide treated plots. Khan *et al*. (1998) and Sharma *et al*. (1998) also concluded that dry weights of all weed species were significantly reduced in herbicides treated plots. Ali *et al.* (2003) concluded that herbicide application increased biological yield and decreased weed biomass significantly.

Keeping in view the importance of using best planting methods and application of proper herbicides to reduce weeds threat and to get good crop stand in maize crop, the present experiment was designed to study the impact of planting methods and herbicides on weed biomass and some agronomic traits in maize hybrid P-3025.

## MATERIALS AND METHODS

To study the " Impact of planting methods and herbicides on weed biomass and some agronomic traits of maize Hybrid 'P-3025', an experiment was carried out at Agricultural Research Farm NWFP Agricultural University, Peshawar during Kharif (summer) 2006. The experiment was laid out in RCB design during April 2007, with split plot arrangement having four replications. The planting methods (Ridge, Broadcast & Flat planting) were assigned to main plots, while herbicidal treatments (Stomp 330E @ 0.75 kg a.i $ha^{-1}$, Dual gold 960 EC @ 1.92 kg a.i $ha^{-1}$ and 2,4-D @ 0.80 kg a.i $ha^{-1}$ and weedy check) were allotted to sub plots. Each sub plot measured 3x5 $m^2$. All other agronomic practices were kept constant for all the treatments. Stomp 330E and Dual gold 960 EC were applied as pre-emergence, while 2,4-D 72 (ester) were sprayed at post emergence stage. The herbicides were applied by knapsack hand sprayer fitted with Tee-jet nozzle. The data were recorded on fresh weed biomass (g $m^2$), dry weed biomass (g $m^2$), plant height (cm), number of leaves $plant^{-1}$, leaf area $plant^{-1}$ ($cm^2$) and biological yield (t $ha^{-1}$). The data recorded for each parameter were subjected to ANOVA technique by using MSTATC computer software and significant means were separated by using Fisher's Protected LSD test (Steel and Torrie, 1980).

## RESULTS AND DISCUSSION

### Fresh weed biomass (g $m^{-2}$)

Statistical analysis of the data showed that fresh weed biomass was significantly (P = 0.05) affected by planting methods, herbicides and their interaction. Maximum fresh weed biomass (306.00 g $m^{-2}$) was recorded in broadcast sowing, while minimum fresh weed biomass (265.68 g $m^{-2}$) was noted in ridge planting. For herbicide treatments, the maximum fresh weed biomass (414.08 g $m^{-2}$) was observed in the weedy check, while minimum fresh weed biomass (169.50 g $m^{-2}$) was observed in Dual gold 960 EC. Among interactions, the maximum fresh weed biomass (443.75 g $m^{-2}$) was recorded in broadcast sowing and weedy check, while minimum fresh weed biomass (147.75 g $m^{-2}$) was observed in ridge planting with Dual gold 960 EC (Table-1). It could be inferred from the data that ridge planting and Dual gold 960 EC put sarisfactory effect on fresh weed biomass. The results are in analogy

with those reported by Bakht *et al.* (2006) and Shakoor *et al*. (1986).

**Table-1. Fresh weed biomass (g $m^{-2}$) as affected by planting methods and different herbicides.**

| Herbicides | Planting Methods | | | Herbicide means |
|---|---|---|---|---|
| | Ridge Planting | Broadcast | Flat Planting | |
| Stomp330E | 235.25 de | 259.75 d | 232.50 de | 242.50 c |
| Dual Gold 960EC | 147.75 f | 209.75 e | 151.00 f | 169.50 d |
| 2,4-D 72 (ester) | 298.25 c | 310.75 c | 295.75 c | 301.58 b |
| Weedy Check | 381.50 b | 443.75 a | 417.00 a | 414.08 a |
| Planting methods means | 265.68 b | 306.00 a | 274.06 b | |

$LSD_{0.05}$ for planting methods = 26.97
$LSD_{0.05}$ for herbicides = 21.68
$LSD_{0.05}$ for interaction = 28.87

**Dry weed biomass (g $m^{-2}$)**

Analysis of the data indicated that dry weed biomass was significantly ($P \leq 0.05$) affected by various planting methods, herbicide treatments and their interaction in maize crop. However, comparison of means (Table-2) revealed that maximum dry weed biomass (61.20 g $m^{-2}$) was recorded in broadcast sowing, while minimum dry weed biomass (53.14 g $m^{-2}$) was noted in ridge planting, however it was statistically similar with flat sowing. For herbicide treatments, the maximum dry weed biomass (82.81 g $m^{-2}$) and minimum dry weed biomass (33.90 g $m^{-2}$) were recorded in weedy check and Dual gold 960 EC treated plots, respectively. For interactions, the maximum dry weed biomass (88.75 g $m^{-2}$) was noted in broadcast sowing and weedy check, while minimum dry weed biomass (29.55 g $m^{-2}$) was recorded in ridge planting and Dual gold 960 EC. The results were in agreement with Shakoor *et al*. (1986). They observed that dry matter of weeds from weedy check plots was significantly greater than chemically weeded plots. Khan *et al.* (1998), Hafeezullah (2000), Ford and Pleasant (1994) and Ali *et al*. (2003) presented similar results and concluded that dry weight of weeds was significantly affected by different herbicidal treatments.

**Table-2. Dry weed biomass (g $m^{-2}$) as affected by planting methods and different herbicides.**

| Herbicides | Planting Methods | | | Herbicide Means |
|---|---|---|---|---|
| | Ridge Planting | Broadcast | Flat Planting | |
| Stomp330 E | 47.05 de | 51.95 d | 46.50 de | 48.50 c |
| Dual Gold 960EC | 29.55 f | 41.95 e | 30.20 f | 33.90 d |
| 2,4-D 72 (ester) | 59.65 c | 62.15 c | 59.15 c | 60.32 b |
| Weedy Check | 76.30 b | 88.75 a | 83.40 a | 82.81 a |
| Planting methods means | 53.14 b | 61.20 a | 54.81 b | |

$LSD_{0.05}$ for planting methods = 5.394
$LSD_{0.05}$ for herbicides = 4.335
$LSD_{0.05}$ for interaction = 5.773

**Plant height (cm) of maize**

Statistical analysis of the data revealed that plant height was significantly ($P \leq 0.05$) affected by planting methods, herbicides and their interaction. Means of the data indicated that maximum plant height (209.44 cm) was recorded in ridge planting, while minimum plant height (192.68 cm) was noted in broadcast sowing. Majid *et al*. (1986) reported similar results. They concluded that maximum plant height was obtained with ridge planting. For herbicide treatments, maximum plant height (213.42 cm) and minimum plant height (180.58 cm) was recorded in Dual gold 960 EC treated plots and weedy check respectively. Among interactions, the maximum plant height (218.75 cm) was recorded in ridge planting and Dual gold 960 EC, which is statistically at par with ridge planting and Stomp 330E and ridge planting and 2,4-D, while minimum plant height (176.25 cm) was measuredin broadcast sowing and weedy check (Table-3). It is due to the fact that weeds were controlled in herbicide treated plots as compared to check plots and crop plants availed nutrients, moisture and light and grew taller and vigorous. Akhtar *et al.* (1998), Nawab *et al*. (1999) and Ali *et al.* (2003) also supported plant height differences. They reported that plant height was increased in those plots in which weeds were controlled. Kamel *et al.* (1983) revealed that difference in plant height is attributed due to various intensities of weed competition with maize plant.

**Table-3. Plant height (cm) as affected by planting methods and different herbicides.**

| | Planting Methods | | | |
|---|---|---|---|---|
| | Ridge Planting | Broadcast | Flat Planting | |
| Stomp330 E | 218.25 a | 200.50 d | 213.00 b | 210.58 b |
| Dual Gold 960EC | 218.75 a | 207.75 c | 213.75 b | 213.42 a |
| 2,4-D 72 (ester) | 217.00 a | 186.25 e | 209.75 c | 204.33 c |
| Weedy Check | 183.75 ef | 176.25 g | 181.75 f | 180.58 d |
| Planting methods Means | 209.44 a | 192.68 c | 204.56 b | |

$LSD_{0.05}$ for planting methods = 2.337
$LSD_{0.05}$ for herbicides = 2.011
$LSD_{0.05}$ for interaction = 2.678

**Number of leaves plant$^{-1}$**

Analysis of the data showed that planting methods, herbicides and their interaction had non-significant effect on number of leaves plant$^{-1}$ in maize. However, the data presented in Table-4 show that maximum (12.75) number of leaves plant$^{-1}$ was recorded in broadcast sowing which is statistically similar with the rest of treatments. Among herbicides, higher (12.75) number of leaves plant$^{-1}$ were recorded in weedy check, which was numerically similar with other the herbicide treatments. The interaction of planting methods with herbicides revealed the maximum (13.00) number of leaves plant$^{-1}$ for broadcast sowing and 2,4-D, while minimum (12.00) number of leaves plant$^{-1}$ was recorded for flat sowing and Dual gold 960 EC. The possible reason for it is that the leaf number is strictly under genetic control.

**Table-4. Number of leaves plant$^{-1}$ as affected by planting methods and different herbicides.**

| | Planting Methods | | | |
|---|---|---|---|---|
| | Ridge Planting | Broadcast | Flat Planting | |
| Stomp330 E | 12.75 | 12.75 | 12.50 | 12.66 |
| Dual Gold 960EC | 12.50 | 12.50 | 12.00 | 12.33 |
| 2,4-D 72 (ester) | 12.50 | 13.00 | 12.25 | 12.58 |
| Weedy Check | 12.75 | 12.75 | 12.75 | 12.75 |
| Planting methods means | 12.62 | 12.75 | 12.37 | |

**Leaf area (cm$^2$) plant$^{-1}$**

Statistical analysis of the data showed that leaf area was significantly ($P \leq 0.05$) affected by planting methods, herbicides and their interaction. Mean values of the data shown in Table-5, revealed that maximum leaf area (346.78 cm$^2$) for planting methods was recorded in ridge planting however, it was statistically at par with flat sowing, while minimum of leaf area (305.74 cm$^2$) was recorded in broadcast sowing. Among herbicides, maximum leaf area (349.00 cm$^2$) was recorded for Dual gold 960 EC, which was however statistically similar with 2,4-D (332.87 cm$^2$) and Stomp 330E (330.42 cm$^2$) and minimum (298.72 cm$^{-2}$) leaf area was noted for weedy check. For interaction, the maximum leaf area (382.18 cm$^2$) was recorded for ridge planting and Dual gold 960 EC, while minimum leaf area (294.35 cm$^2$) was recorded for broadcast sowing and weedy check. Khan *et al*. (2002) got similar results as ours. He reported maximum leaf area in weed control treated plots and minimum leaf area in weedy check. Leaf is the basic photosynthetic machinery for plant food; hence its size would directly affect the yield and yield components of crop.

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

Statistical analysis of the data showed that planting methods, herbicides and their interaction had significant ($P \leq 0.05$) effect on biological yield in maize crop. Means for planting methods showed higher biological yield of 10.45 t ha$^{-1}$ for ridge planting, while lower (6.87 t ha$^{-1}$) biological yield was recorded for broadcast sowing. For herbicides, maximum biological yield of 10.67 t ha$^{-1}$ was observed for Dual gold 960 EC while minimum biological yield of 5.00 t ha$^{-1}$ was recorded for weedy check. For interactions, the maximum biological yield of 13.02 t ha$^{-1}$ was recorded for ridge planting and Dual gold 960

EC, while minimum biological yield of 4.40 t $ha^{-1}$ was recorded for broadcast sowing and weedy check (Table-6). Kamel *et al*. (1983), Shah (1998) and Malik *et al*. (2006) have reported the similar findings. They reported that higher biological yield was obtained from weed control treated plots as leaf area; number of leaves $plant^{-1}$, plant height, cob length and number of grains contributes in increasing biological yield.

**Table-5. Leaf area ($cm^2$) as affected by planting methods and different herbicides.**

| | Planting Methods | | | |
|---|---|---|---|---|
| | Ridge Planting | Broadcast | Flat Planting | |
| Stomp330 E | 341.29 bcd | 308.50 ef | 341.47 bcd | 330.42 a |
| Dual Gold 960EC | 382.18 a | 314.92 def | 349.90 bc | 349.00 a |
| 2,4-D 72 (ester) | 361.92 ab | 305.19 ef | 331.52 cde | 332.87 a |
| Weedy Check | 301.75 ef | 294.35 f | 300.07 f | 298.72 b |
| Planting methods means | 346.78 a | 305.74 b | 330.74 a | |

$LSD_{0.05}$ for planting methods = 17.98
$LSD_{0.05}$ for herbicides = 22.45
$LSD_{0.05}$ for interaction = 29.92

**Table-6. Biological yield (t $ha^{-1}$) as affected by planting methods and different herbicides.**

| | Planting Methods | | | |
|---|---|---|---|---|
| | Ridge Planting | Broadcast | Flat Planting | |
| Stomp330 E | 12.17 a | 7.70 f | 10.10 cd | 9.99 b |
| Dual Gold 960EC | 13.02 a | 8.60 e | 10.40 bc | 10.67 a |
| 2,4-D 72 (ester) | 11.00 b | 6.80 g | 9.50 d | 9.10 c |
| Weedy Check | 5.60 h | 4.40 i | 5.00 hi | 5.00 d |
| Planting methods means | 10.45 a | 6.87 b | 8.75 a | |

$LSD_{0.05}$ for planting methods = 1.842
$LSD_{0.05}$ for herbicides = 0.654
$LSD_{0.05}$ for interaction = 0.872

**REFERENCES CITED**

Akhtar, M., M. Aslam and H.N. Malik. 1998. Effect of various weed control methods on maize (*Zea mays* L.) growth and yield din heavily populated weed fields of Islamabad. Sarhad J. Agric. 14(4): 345-350.

Ali, R.,S.K. Khalil, S.M. Raza and H. Khan. 2003. Effect of herbicides and row spacing on maize (*Zea mays* L.). Pak. J. Weed Sci. Res. 9(3-4): 171-178.

Bakht, J., S.Ahmad, M. Tariq, H.Akber and M.Shafi. 2006. Response of Maize to planting methods and fertilizer N. J. Agric. And Biol. Sci. 1 (3):8-14.

Ford, G.T and M. Pleasant. 1994. Competitive abilities of six corn (*Zea mays* L.) hybrids with four weed control practices. Weed Tech. 8:124-128.

Hafeezullah. 2000. Effect of different sowing and weed control methods on the performance of sunflower. M.Sc (Hons), Thesis, Agric. Univ. Peshawar.

Kamel, M. S., M.S. Abdel-Raouf, E. A. Mahmoud and S. Amer. 1983. Response of two maize varieties to different plant densities in relation to weed control treatments. Annals Agric. Sci. Moshtohor 19(1): 79-93.

Khan, M.A. 2002. Efficacy of different herbicides on the yield and yield components of maize. M.Sc. Thesis, Weed Science Deptt. NWFP Agric. Uni. Peshawar.

Khan, S.A., N. Hussain, I.A. Khan, M. Khan and M. Iqbal. 1998. Study on weed control in maize. Sarhad J. Agric. 14(6): 581-586.

Majid, A., M. Shafiq and M. Iqbal. 1986. Deep tillage and sowing techniques in maize production under high rainfed conditions. Pak. J. Agric. Res. 7: 181-185

Malik, M. A., F. Zahoor., S. H. Abbas, and M. Ansar. 2006. Comparative study of different herbicides for control of weeds in rainfed maize (*Zea mays* L.). WSSP Absts. Weed Sci. Soc. Pak. pp. 62.

MINFAL, 2006. Agricultural Statistics of Pakistan. Ministry of Food, Agriculture and Livestock, Govt. of Pakistan, Islamabad.

Nawab, K., M. Hatam, B. A. Khan, K. Rashid and M. Mansoor. 1999. Study of some morphological characters in maize as affected by time of weeding and plant spacing. Sarhad J. Agric. 15(1): 21-24.

Schans, D., E. Bleumer, H. Schooten and H. Schooten. 1997. More efficient weed control in maize possible. Praktijkonderzoek Rundvee. Schapen en Paarden 10(2): 24-28.

Shah, A. 1998. Study on weed control in maize. Sarhad J. Agric. 14(6): 581-584.

Shakoor, A., M. Naeem and C. O. Ahmad. 1986. Efficacy of different herbicides for control of weeds in maize. Pak. J. Agric. 7(4): 264-269.

Sharma, V., D.R. Thakur and J.J. Sharma. 1998. Effect of metolachlor and its combination with atrazine on weed control in maize (*Zea mays)*. Indian J. Agron. 43(4): 677-680.

Steel, R.G.D. and J.H. Torrie. 1980. Principles and Procedures of Statistics. McGraw Hill Book Co., Inc. New York. pp. 481.