Research Article

Herbicidal Eradication of Weeds in Maize Crop

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Abstract | The present study highlighted the weed management in maize and response of maize to herbicide mixture of Atrazine plus Mesotrion. The research was investigated in a randomized complete block design (RCBD) with split plot arrangements. The varieties were allotted to main plots and weed management practices were allocated in subplots. This study focused on the parameters about weed densities before and after weed management and other agronomic parameters including grain yield. Relative weed densities of *Cyprus rotundus* L., *Eleusine indica* L., *Cynon dactylon* L., *Trianthene portulacastrum* L., convolvulus, and other miscellaneous weeds were registered before and after weed management. Results indicated that chemical control significantly best over control (No Treatment) after hand weeding. Agronomic parameters i.e., germination percentage (%), 50% tasselling, 50% silking, ear height (cm), stem diameter (cm), leaf area (m^2), Biological yield (t ha^{-1}), and grain yield (t ha^{-1}), significantly affected by different weed management practices in three maize varieties. Maize variety Afghoiy interacted with Dafli (herbicide) after hand weeding registered the best treatment in all regards. However, Herbicides (Dafli and Xiawang 1X) seemed more effective in weed management over control. Horse purslane (*Trianthene portulacastrum* L.) increases its interference in maize crop both before and after weed management.

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Introduction

Maize is a major cereal crop after wheat and rice throughout the world including Pakistan. It is a staple food for humans and feeds for livestock around the world respectively. Maize stalk can be used as fodder and making silage after fermentation. Maize contribution in GDP is 0.5 percent and value addition in agriculture is 2.6 percent (GoP, 2018). Maize production and area have decreased due to an increase in area under other crops like sugarcane, cotton, rice, and vegetables. Maize was sown on 1251 thousand hectares with an average yield of 4718 kg ha^{-1} and total production of 5.902 million tons (GoP, 2018). Maize is also used as fodder for animals throughout the world as hay and silage (Arain, 2013). Pakistan's maize yield per hectare is very low despite favorable environmental conditions and high-yielding

varieties. Maize is grown under various climatic conditions of Pakistan. Due to the best adaptability of the environment, its most cultivation is in the autumn season (Ashiq and Ata, 2005). Weeds also grow well during this rainy season, impose a loss on this crop and reduce its yield significantly. So, weeds are considered as most limiting element for cost-effective crop production (Tanveer *et al*., 2018). Weed plants grow faster, spread quickly, reproduce generation in high numbers and produce massive quantities of seeds that make them able to start a kingdom of their own with a short period (Singh and Dangwal, 2012).

Poor stand establishment due to weeds is the major problem for lower maize grain as well as fodder yield. Among various factors, weed infestation is a major factor in reducing the maize yield. Weeds are one of the main problems in a cropped area (irrigated or rainfed) which reduces the maize yield by 25-50%. In rainy areas, weeds in the maize field are controlled by inter-culture, which is an expensive and time-consuming method (Riaz et al., 2015). Maize yield is significantly reduced due to season-long competition by weeds (Dalley *et al*., 2006). Uncontrolled weed growth is responsible for a 35-70 % decrease in maize grain yield (Ford and Pleasant, 1994). Usman *et al*. (2001) reported that unmanaged weed growth reduces maize average grain yield by 83%.

Maize crop was infested mostly by weeds which are: Prostrate pigweed (*Amarantus blitoids* L.), Sodan grass (*Brachiaria ramosa* L.) Della (*Cyperus rotandus* L.), Kanshira (*Commila benghalensis* L.). Wild haloon (*Coronopus Didymus* L.), Khabocha (*Cucurbita maxima* L.), Chavali (*Bromus cathertius* L.), Madhana grass (*Dactyloctenium aegyetium* L.), Purple morning glory (*Ipomea purpurea* L.), Itsit (*Trainthema portulacastrum* L.) Muhabbat booti (*Xanthium starium* L.), Lehli (*Convolvulus arvensis* L.), Tandala (*Digera arvensis* L.), Bhoeen (*Cyperus irri* L.), and Hoora grass (*Fimbristylis dichtoma* L.). While the most susceptible weeds in the Dera Ismail khan district are: Lehli (*Convolvulus arvensis* L.), Bhoeen (*Cyperus irri* L.), Deela (*cyperus rotundas* L.), Goosegrass (*Eleusine indica*), Bermuda grass (*Cynon dactylon*), and Horse purslane (*Trianthene protulacastrum* L).

Various types of chemicals with different modes of action are used for weeding control in summer maize i.e., Atrazine, Mesotrione, Nicosulfuron, Rimosulfuron, Acetochlor, and Metochlor (Pesticides and Authority, 2015).

Keeping the above views in consideration it was hypothesized that combined application of herbicides reduces weed infestation to enhance maize production. Therefore, a research project was envisaged with the main objective of investigating the response of weeds in maize crop after Atrazine and Mesotrion (Herbicide) blended application.

Materials and Methods

A field experiment was conducted at the Research Area of Faculty of Agriculture, Gomal University, Dera Ismail Khan, Khyber Pakhtunkhwa, (31.8188° N, 70.8971° E) Pakistan to integrate three maize open-pollinated varieties for agronomic, physiological, and yield traits against the different concentration of Mesotrion plus Atrazine herbicide during summer season 2017. The experiment was laid out in Randomized Complete Block Design (RCBD) with split plot arrangements having three replications. The size of one subplot was 1.5 m x 4.5 m. Three maize varieties (open pollinating) were sown in main plots whereas five treatments including herbicide doses were applied in the sub-plots. This plot was already infested by summer weeds before sowing. The plant-to-plant distance was 30 cm and a plant density of 15 plants was kept in each line. The seed of maize varieties was sown on 15th July 2017 using the dibbling method on ridges at the seed rate of 25 kg ha^{-1}. A fertilizer dose of NPK (Nitrogen, Phosphorous, and Potassium) was applied @ 110:60:45 kg ha^{-1} to get better germination, better growth, and maximum yield. All PK dose and 1/6 (18 kg) of nitrogen were applied at sowing time, 1/4 (27.5 kg) of nitrogen was applied at 1st irrigation and 1/3 (37 kg) of nitrogen was applied at 2nd irrigation. While last 1/4 (27.5 kg) nitrogen dose was applied before the flowering. Ten irrigations were applied after 8-10 days intervals according to crop water requirements. The maize crop was harvested when reached physiological maturity in October 2017. The ears were set under the sun for 6 days to diminish the moisture for avoiding the hazard of deterioration by grain moisture.

Weedicides were applied after 40 days of sowing using a hand pump with a flat jet nozzle in the afternoon. Maize varieties used were MMRI yellow, Pearl white, and Afghoiy.

Herbicides composition and other information are given as under:

Dafli

It is available in the market as a wet able powder (WP) from having trade name Dafli. It comprises of Atrazine @ 400 g kg^{-1} (40% w/w) and Mesotrion @ 100 g kg^{-1} (10% w/w) with inert material to complete the percentage of 100%. It is highly soluble in water and can be applied as an aqueous solution on weeds and is recommended @ 1250 g ha^{-1} for effective weed control.

Xiaowang (1 X)

It is available in the market as a liquid form (L) form having trade name Xiaowang. It comprises Atrazine 500 g L^{-1} (44% w/w) and Mesotrione 50 g L^{-1} (5% w/w) with an inert material to complete the percentage of 100%. It is highly soluble in water and can be applied as an aqueous solution on weeds and is recommended @ 1250 ml ha^{-1} for effective weed control.

A reduced dose of Xiaowang (½ X)

A reduced half dose of Xiaowang was also used @ 625 ml ha^{-1}.

There were 5 treatments utilized, which are specified here in detail.

Control/weedy check: No application of any weed control (herbicides or mechanical) was followed.

Hand weeding: Weeding was finished by hand pulling or utilization of hand weeding tool (shovel) and weed-free crop was maintained during the crop season.

Dafli: It was splashed with the utilization of a hand pump having a flat jet nozzle in the afternoon.

Xiaowang (1 X): It was splashed with a hand pump having a flat jet nozzle in the afternoon.

Xiaowang reduced dose (½ X): It was splashed with a hand pump using a flat-fan nozzle in the afternoon. The data was recorded on the following parameters in the field.

Germination (%)

Seedlings of maize were recorded after 15 days. Germination (%) was calculated by using the following formula.

$$\text{Germination (\%)} = \frac{\text{The total seed germinated x 100}}{\text{Total seed sown}}$$

Days to 50% tasseling: Days to 50% tasselling was recorded when 50% of plants in each sub-plot produced tassels.

Days to 50% silking: Days to 50% silking was also recorded when half plants in each sub-plot delivered silking.

Ear height (cm) at maturity: Ear height was noted at maturity with the assistance of a meter rod from ground level to the node bearing ear.

Stem diameter (cm): Stem diameter was recorded at maturity by utilizing Vernier Caliper from the first internode above the soil.

Leaf area (cm^2): Ten plants were selected randomly from each subplot. The length and width of 5 leaves on each plant were recorded with help of scale.

The leaf area of plants was calculated in each sub-plot by using the formula.

$$\textit{Leaf area} = \textit{leaf length} \times \textit{leaf width} \times \textit{correction factor} \times \textit{number of leaves per plant}$$

The correction factor for leaf area is also known as the K coefficient and its value for maize plant is 0.75 (Musa *et al.*, 2016).

Biological yield (t ha^{-1})

The biological yield was recorded immediately after cutting the mature maize in each subplot separately. An area of 6 m^2 (two rows) was harvested from each subplot and the biological yield was converted into ton ha^{-1}.

Grain yield (t ha^{-1})

The grain yield was acquired after drying the moisture by presenting to daylight for 5-8 days to lower the moisture percentage present in grains to avoid the hazard of deterioration. The grain yield of each subplot was converted into ton ha^{-1}.

Statistical analysis

Data were recorded and analyzed using analysis of

variance technique (Steel *et al*., 1997) with subsequent comparison of individual treatment means through Tukey's HSD Test (Black, 2011). The analysis was performed by utilizing the "Statistix" computer software program.

Results and Discussion

Weed density (m^{-2}) before chemical spray

Weeds density in the crop is a significant problem in gaining maximum economic yield. It is the single important constraint in increasing the productivity of crops. Data about the weed density m^{-2} before the use of herbicides are presented in Table 1. Non-significant differences were found in treatment means. Interaction between varieties and treatments also remained non-significant. Although varieties have a significant role to suppress the weed density before spray. Afghoiy variety of maize has the minimum number of weeds as compare to MMR1 yellow and pearl white. This might be due to the allelopathic potential of this cultivar which suppresses the weeds number. The highest weed density was found in the weedy check (control). Statistically similar results in treatments and their interaction with varieties were may be due to no application of herbicides and found similar conditions for growth and development of weeds. Our results confirmed the results of Seyyedi *et al*. (2016). The maximum density of total weeds was registered in control after 45 days of emergence. While in the early growth period non-significant weed density was found in their trial. The results of Hassan et al. (2010) concluded that short stature cultivars of maize have a more suppressing impact on weeds than other varieties. 'Afghoiy' has more potential to compete and suppressed the weeds than other varieties.

Weeds density (m^{-2}) after spray

Data about weed density (m^{-2}) after spray of chemical herbicides are elucidated in Table 1. After the emergence of maize (40 days of sowing) total weed density was found maximum in weedy check. A similar result of weed density was also determined where no application of a chemical (Atrazine + Mesotrion) in the Table 2 (weedy check). Weed density was maximum (116.02) in a variety of pearl white. This was followed by MMRI yellow and Afghoiy respectively. This might be due to some weeds like Cyprus rotundas and, horse purslane, and convolvulus, which are not only resistant to herbicides but also re-germinate during the whole growing season.

These treatment means were significantly affected by weed control measures. Minimum weeds appear in hand weeding (44.33). Data in the Table 2 indicated that Dafli (50.44) is more effective in controlling weed density than Xiaowang (1 X) and (½ X). The interaction among varieties and treatments was found significantly. Minimum density was found in herbicides Dafli X Afghoiy after hand weeding. However, both treatments were insignificant statistically.

The results are coinciding with Stephenson et al. (2004) which states that the weeds control can be achieved up to 95% by exogenous Mesotrion chemical applications. Dafli has a more controlling effect on this after hand weeding.

Table 1: *Effect of weedicides on weed density, germination and tasseling.*

Treatments/ Varieties	Weed density (m^{-2}) before spray				Weeds density (m^{-2}) after spray			
	Afghoiy	MMRI yellow	Pearl white	Means	Afghoiy	MMRI yellow	Pearl white	Mean
Weedy check	144.33 ^{NS}	157.33	194.67	165.44^{NS}	167.33 b	278.00 a	296.00 a	247.11 a
Hand weeding	151.00	144.67	190.33	162.00	24.00 e	42.67 e	66.33 d	44.33 e
Dafli	120.67	148.33	209.66	159.55	31.00 e	64.67 d	55.67 d	50.44 d
Xiaowang (1 X)	102.33	154.33	242.33	166.33	43.00 d	62.33 d	77.67 c	61.00 c
Xiaowang (½ X)	134.67	151.00	186.00	157.22	44.67 d	84.67 c	85.33 c	71.55 b
Mean	130.06 c	151.13 b	204.59 a		62.00 c	106.48 b	116.02 a	
	Germination %				Days to 50% tasseling			
Weedy check	98.96^{NS}	79.17	81.67	86.60^{NS}	60.67 a	61.33 a	62.67 a	61.55 a
Hand weeding	100.00	83.33	81.67	88.33	51.67 b	53.00 b	55.67 ab	53.45 e
Dafli	91.67	95.83	85.00	90.83	53.33 ab	55.33 ab	56.33 ab	55.00 d
Xiaowang (1 X)	91.67	95.83	84.00	90.50	55.33 ab	56.00 ab	59.33 ab	56.88 c
Xiaowang (½ X)	95.83	100.00	87.50	94.44	57.33 ab	54.00 b	61.33 a	57.55 b
Mean	95.62 a	90.83 ab	83.9 b		55.66 a	55.93 a	59.00 a	

Table 2: *Effect of weedicides on silking, ear height, stem diameter and leaf area of maize.*

Treatments/ Varieties	Days to 50% silking				Ear height (cm)			
	Afghoiy	MMRI yellow	Pearl white	Means	Afghoiy	MMRI yellow	Pearl white	Mean
Weedy check	68.67 a	70.33 a	71.67 a	70.22 a	38.30^{NS}	40.63	43.92	40.95^{NS}
Hand weeding	61.00 bc	62.33 b	65.00 b	62.77 e	28.07	41.12	50.46	39.88
Dafli	63.33 b	63.67 b	65.00 b	64.00 d	34.50	39.33	44.24	39.35
Xiaowang (1 X)	63.33 b	65.33ab	66.67 ab	65.11 c	38.80	42.92	45.32	42.34
Xiaowang (½ X)	65.00 b	66.00ab	68.67 a	66.55 b	37.45	40.31	44.12	40.62
Mean	64.26 c	65.53b	67.40 a		35.42 c	40.86 b	45.61 c	
	Stem diameter (cm)				Leaf area (cm^2)			
Weedy check	0.91 c	0.87 c	0.79 c	0.85 e	57.98^{NS}	57.38	43.47	52.94^{NS}
Hand weeding	2.5 a	2 .46 a	1.72 b	2.22 a	63.68	57.04	45.80	55.50
Dafli	1.96 b	1.90 b	1.59 b	1.81 b	69.39	48.76	46.47	54.87
Xiaowang (1 X)	1.82 b	1.75 b	1.23 bc	1.60 c	60.36	41.58	58.12	53.35
Xiaowang (½ X)	1.61 b	0.99 c	0.98 c	1.19 d	69.95	51.26	41.85	54.13
Mean	1.76 a	1.60 b	1.26 c		64.27 a	51.20 b	47.14 c	
	Biological yield				Grain yield (ton/ha)			
Weedy check	16.45 f	14.21 g	12.82 h	14.49 e	3.27 g	2.94 h	2.83 h	3.01 e
Hand weeding	19.92 a	18.28 a	17.37 b	18.52 a	4.70 a	4.35 b	4.03 c	4.36 a
Dafli	18.83 b	17.45 b	16.62 d	17.63 b	4.41 b	4.06 c	3.83 d	4.10 b
Xiaowang (1 X)	18.46 b	16.25 e	16.05 g	16.92 c	4.37 b	3.85 d	3.65 e	3.96 c
Xiaowang (½ X)	18.43 b	15.54 f	14.04 h	16.00 d	3.55 ef	3.51 f	3.53 ef	3.54 d
Mean	18.41 a	16.34 b	15.38 c		4.06 a	3.74 b	3.58 c	

Germination (%) of maize

The results about germination (%) are presented in Table 1. Germination and seedling emergence is a key process for the growth and survival of plants during the life cycle (Hadas, 2004). Data showed that varieties were significantly different. Afghoiy achieved maximum germination (95.62%) followed by the variety "MMRI Yellow" with 90.83% germination. The lowest germination (83.93%) was shown by the variety "Pearl White". It was also cleared that the maize variety "Afghoiy" can show better germination in the edaphic conditions of Dera Ismail Khan.

Results further justified that there was no significant effect of treatment on the germination of maize varieties. However, Xiaowang's reduced dose $_{(½\ X)}$ achieved prominent germination (94.44%) followed by Dafli with germination (90.83%). The lowest germination (83.60%) was scored by weedy check.

While interactions between varieties and treatments also remained non-significant. However, interactions (Hand weeding x Afghoiy and Xiaowang reduced dose $_{(½\ X)}$ x MMRI yellow) achieved maximum germination (100%) followed by the interactions (Dafli × MMRI yellow, Xiaowang $_{(1X)}$ × MMRI yellow and Xiaowang reduced dose $_{(½\ X)}$ × Afghoiy) with 95.83% germination. The lowest germination 79.17% was shown by the interaction (Weedy check x MMRI Yellow). These results are supported by Pinto et al. (2012) who stated that maize seed showed different responses of germination at different environmental and soil conditions. Inamullah et al. (2011) and Doebley (2004) reported that the genetics of plants affect growth and development. It means that the germination of different varieties is different due to environmental conditions, moisture availability, soil conditions, and genetics of varieties.

Days to 50% tasselling

Data regarding days to 50% tasselling is presented in Table 1 showing that varieties were found non-significant to each other. However, "Pearl White" scored more days to 50% tasselling (59.00) followed by variety "MMRI Yellow" with 55.93 days of 50% to tasselling. It might be a variety-specific character and presences of weed in them.

Data analysis showed that treatment was significant on days to 50% tasselling. The highest score was

achieved by weedy check having 61.55 days followed by Xiaowang reduced dose (½ X) having 57.55 days of tasselling. The least score among weedicides was achieved by Dafli (55.00 days) while Hand weeding took 53.45 days to 50% tasselling.

The interactions among varieties and treatments showed maximum tasselling days (62.67) were recorded for interaction (Pearl white × Weedy check) followed by interactions (MMRI yellow × Weedy check) and (Pearl white × Xiaowang reduced dose (½ X)) both took 61.33 days. The lowest (51.67) days to tasselling were noted in interaction (Afghoiy × Hand weeding). A similar type of results was found by Evans et al. (2003) who stated that weeds delayed the flowering of maize plants.

Days to 50% silking

Results about days to 50% silking are shown in Table 2 which showed that varieties were found significant at p>0.05. "Pearl white" remained prominent with 67.40 days of silking followed by "MMRI yellow" with 65.53 days. Minimum days of silking (64.26) was achieved by "Afghoiy" which might be due to early female flowering potential to grow earlier in any type of situation.

Different weed control methods also showed significant variation. Maximum days to silking (66.55) among three herbicides after a weedy check (70.22) was noted in Xiaowang ($_{1/2}$X). Minimum days to silking (64.00) were recorded for Dafli after Hand weeding.

The interactions among varieties and treatments were also found significant. A maximum number of days (71.67) was noted in (Pearl white × Weedy check) followed by (MMRI yellow × Weedy check) with 70.33 days and least days of silking (61.67) were shown by (Afghoiy × Hand weeding). Weeds interfere with its flowering which was delayed. A similar type of results was found by Evans et al. (2003) who stated that weeds delayed the flowering of maize plants.

Ear height (cm) at maturity

Results on cob height are presented in Table 2 which showed that varieties remained significant. Maximum cob height (45.61 cm) was achieved by "Pearl white" followed by "MMRI yellow" with an ear height of 40.82 cm. Minimum ear height (35.42 cm) was given by "Afghoiy".

Means of treatments were found non-significant. However, the "weedy check" attained maximum ear height (40.95 cm), and minimum cob height (39.55 cm) was achieved by "Dafli".

Interactions also remained non-significant. However, maximum ear height was scored by interactions (Pearl white × Hand weeding) while minimum ear height (28.07 cm) was showed by interactions (Afghoiy × Hand weeding). Differences in ear height might be due to genetic characteristics of cultivars as demonstrated by Zsubori et al. (2002) who reported that different cultivars grown under the same environment may have a difference in ear height.

Stem diameter (cm)

Results about stem diameter are presented in Table 2. Means about varieties regarding stem diameter remained significant. Variety 'Afghoiy" achieved more stem diameter (1.76 cm) followed by "MMRI Yellow" with a diameter of 1.60 cm while "Pearl White" achieved the lowest diameter (1.26 cm).

Treatment means were found significant at a 5% level of probability. Maximum stem diameter (2.23 cm) was attained by "Hand Weeding". It was followed by "Dafli" with a 1.88 cm diameter. The lowest diameter (0.85 cm) was found in "Weedy check". It means that weeds decreased stem diameter. Weed-free whole season enhanced the available resources (nutrients, water, light) to maize crop.

Interactions among varieties and treatments also remained significant. Maximum stem diameter (2.50cm) was reported in interaction (Afghoiy × Hand weeding) followed by interaction (MMRI Yellow × Hand weeding) with a stem diameter of 2.46 cm. These results console with Kiani et al. (2014) who deduced that weed population has a decelerating effect on stem diameter and it can be enhanced by effective weed concealment. It may be due to competition of space, light, and nutrients and allelopathic effects of weeds especially Horse purslane (Ashiq and Aslam, 2015; Mubeen et al., 2021).

Leaf area (cm^2)

Data about leaf area is presented in Table 2. Leaf area across varieties was found significant at p>0.05. "Afghoiy" attained maximum leaf area (63.47 cm^2) followed by "MMRI Yellow" with leaf area 51.20 cm^2 and the minimum score achieved by "Pearl White" (47.14 cm^2).

Treatments effects remained non-significant, however maximum leaf area attained by hand weeding (55.50 cm^2) followed by "Dafli" with a leaf area of 54.47 cm^2. Minimum leaf area was attained by weedy check (52.94 cm^2). Where all weeds interfered with maize crop till harvest.

Interactions among varieties and treatments also remained non-significant. Maximum leaf area (69.39 cm^2) was reported in interaction (Afghoiy × Dafli) while minimum leaf area (41.58 cm^2) was attained by interaction (MMRI Yellow × Xiaowang (1X)). Leaf area has a contribution in the canopy establishment of plants and reducing the weeds: Hence its size will influence grain yield and yield components of maize crop. A similar type of results found by Hassan et al. (2010) who explained that leaf area decreased with weed infestation and increased with effective weed control.

Biological yield

The biological yield of maize responded differently under different weed management interacted with maize varieties. Significant variations in varietal means through different weed management practices and their interaction were mentioned in Table 2. The maximum biological yield was registered in hand weeding (18.52-ton ha^{-1}) followed by herbicide dafli (17.63-ton ha^{-1}). Maximum biological yield (14.49-ton ha^{-1}) was recorded where no weed management was done. Biological yield has significant variation in varieties. Afghoiy provided a higher biological yield (18.41-ton ha^{-1}) than the other two varieties. In interaction, Afghoiy x hand weeding shown the best results followed by Afghoiy × Dafli. Hand weeding treatment with Afghoiy variety resulted in maximum biological yield might be due to availability of necessary uptake of nutrients, moisture and no competition of light and space with ultimately increase in biological yield. Maqsood *et al.* (2018) summarized the results that hand weeding is the best option to eliminate weeds in the field, but it is extremely tough, laborious, and time-consuming operation but the application of two herbicides (Atrazine + Mesotrion) mixture as post-emergence seems too fruitful in this regard.

Grain yield

Statistically, maximum grain yield (4.70-ton ha^{-1}) was recorded in plots where weeds free condition was imposed for the whole season in variety Afghoiy with hand weeding treatment. This may be due to less competition of weeds with a crop which resulted in maximum uptake of nutrients and other resources by the maize crop. However, interaction among varieties and weed control measures also seemed significant Table 2. After hand weeding interaction of Afghoiy × Dafli is better than other interacted values.

Afghoiy variety then remained best over the other two varieties MMRI yellow and pearl white. Application of Dafli herbicides suppressed the weeds and produced maximum grain yield after hand weeding. Akhtar *et al.* (2016) reported that the grain yield of the crop increased 36 percent by weed management. Janak and Grichar (2016) counted the beneficial effect of mixing two herbicides than a single herbicide. They reported high biological yield and grain yield by application of Atrazine + Mesotrion. The lowest grain yield of maize was registered in weedy check (3.01ton ha^{-1}), where all weeds can grow to uncheck statistically second-lowest grain yield (3.54-ton ha^{-1}) was recorded in the half dose of Xiaowang (½ X) application. Our results are akin to Mubeen *et al.* (2009) who reported that minimum grain yield was obtained in treatments where weeds can grow throughout the season and having no weed management.

Conclusions and Recommendations

Herbicides (Dafli and Xiaowang) were effective in controlling weeds and enhancing maize grains yield by promoting its growth and development. The herbicide application is feasible, less expensive, and timesaving than hand weeding. So, these herbicides may be adopted without any danger of any phytotoxicity to the maize crop. Variety Afghoiy seemed best in all parameters studied in this research project over the other two varieties.

Novelty Statement

This article addresses the selection of latest chemistry to eradicate weeds in maize crop.

Author's Contribution

Iqtidar Hussain: Conceived the idea and give technical input every step.
Haroon Shahzad: Wrote the article's abstract, introduction, methodology and results/discussion.
Sami Ullah: overall Management of the article and reference formatting.

Muhammad Jawad Nazir: Collected data.
Muhammad Rizwan: Performed data entry and statistical analysis, Reviewed the paper.

Conflict of interest

The authors have declared no conflict of interest.

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