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INFLUENCE OF SYNTHETIC AND BIOHERBICIDES ON MANAGEMENT OF HORSE PURSLANE (*Trianthema portulacastrum* L.)

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ABSTRACT

*A field experiment was carried out to investigate the effect of different commercial herbicides and allelochemicals as water extracts on the germination and growth of horse purslane (Trianthema portulacastrum L.). The "Azam" variety of maize was used in the research. The experiment was laid out at ARI, Tarnab-Peshawar during summer, 2014, using Randomized Complete Block Design (RCBD) having three replications with 75 cm row to row distance and 20 cm plant to plant distance. Various commercial herbicides {Primextra gold 720 SC (Atrazine + s-metalachlor), Click 72.4 SE (Atrazine + acetachlor) and Buctril Super 60 EC (Bromoxynil + MCPA)} and allelochemicals {Johnson grass (Sorghum halepense L.) and sunflower (*Helianthus annuus *L.) aqueous extracts PRE- and POST-emergence.} were used to manage horse purslane in maize crop. Data were recorded 1000 grains weight (g) and grain yield (kg ha^{-1}) of maize and horse purslane density (m^{-2}) as well as cost benefit ratio (CBR) of the various management methods in maize. Results showed that minimum density of horse purslane as well as highest 1000 grains weight and grain yield was noted in Primextra Gold 720 SC as compared to other herbicides and allelopathic water extracts. Among plants extracts, post application of Johnson grass showed satisfactory results in suppressing horse purslane growth with a positive effect on crop yield. The economic analysis revealed that maximum net return to the farmers (1:5) might be obtained from Primextra Gold 720 SC. Hence, in light of the experimental results it is recommended for the maize growers in the agro-ecological conditions of Peshawar to use Primextra gold 720 SC @ 1.91 L. ha^{-1} in rotation with post application of Johnson grass extract for the better management of horse purslane.*

Key words: Maize, horse purslane, allelopathic extracts and synthetic herbicides.

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INTRODUCTION

Maize is one of the important cereal crop belongs to family Poaceae and stands third in Pakistan after wheat and rice. It is high yielding and short duration crop. It is grown for dual purposes, fodder as well as for grain, throughout Pakistan. In Pakistan maize was cultivated on an area of 1.0873 million ha with an average yield of 3990 kg $ha^{-1}$and total annual production was 4.3383 million tons. However, in Khyber Pakhtunkhwa it was cultivated on an area of 0.4753 million ha with an average yield of 1868 kg ha^{-1} and total annual production was 0.887.8 million tons (MNFSR, 2012). The average yield of maize in Pakistan is very low as compare to developed countries, while in Pakistan Khyber Pakhtunkhwa produces lesser than the average yield as compared to other provinces. Among the various reasons for low production in maize crop, poor weed management practices, improper planting methods and high weed infestations are common problems (Chikoye and Ekeleme, 2003). Weeds caused more losses to maize crop at initial growth stage i.e. 3-4 weeks due to the more space and nutrient availability to the weeds and lesser canopy coverage of the crop as well as its early slow growth (Kayode and Ademiluyi, 2004).

Weeds may cause a decline of 83% in average grain production if not controlled (Usman *et al*., 2001). The common weeds found in maize are *Trianthema portulacastrum*, *Amaranthus viridis, Convolvulus arvensis, Cynodon dactylon, Cyperus rotundus, Digitaria sanguinalis, Digera arvensis, Echinochloa crus-galli, Portulaca olereacea, Leptochloa* sp. and *Sorghum halepense etc.* (Abdullah *et al*., 2008). Among these weeds horse purslane (*Trianthema portulacastrum*) is the most common and problematic weed infesting maize crop

Trianthema portulacastrum is an annual, much branched and prostrate terrestrial weed belongs to family Aizoaceae. It is also the most common and problematic weed of maize which reduces the crop yields up to 32% (Hashim & Marwat, 2002). This weed is mostly controlled through mechanical means, however this method is time consuming and very expensive (Alister and Kogan, 2005). Therefore, in view of these limitations, herbicides are the most common option for controlling horse purslane, it reduce its population by 70-80% (Grichar, 2008). But in some situations because of higher costs it seems to be uneconomical to the local farmers (Cheema *et al*., 2003).

Among all other options, allelopathy is the natural and an environment-friendly technique which may prove to be a unique method for weed control, increase crop yields, improve the ecological environment and decrease our reliance on pesticides (Lovelace *et al*., 2001).

Keeping in view the importance of maize crop and yield losses due to horse purslane a study was initiated with the objective to select the best synthetic and bio-herbicide for the effective control of horse purslane to increase maize productivity in the study area.

MATERIALS AND METHODS

Field experiment was carried out at Agriculture Research Institute, Tarnab-Peshawar during June, 2014. The experimental was laid out in Randomized Complete Block Design (RCB) having three replications. There were 6 rows in each treatment, having a row length of 4m each with row to row distance of 75 cm and plant to plant distance of 20 cm. The individual treatment size was 4 m x 4.5 m (18 m^2). Maize variety "Azam" was sown on already infested field of horse purslane. A recommended basal dose of 60 kg ha^{-1} nitrogen and 90 kg ha^{-1} phosphorus was applied to soil before sowing of maize and half dose of nitrogen was applied at first irrigation. Experiment was conducted on horse purslane infested field. After crop sowing all the other weeds were manually removed from the experimental plot regularly except horse purslane in order to check the efficacy of tested control techniques against horse purslane. The pre-emergence herbicides and plants extracts were sprayed soon after crop sowing whereas, post-emergence herbicide and plants extracts were applied after 20 days of sowing. Chlorpyrifos 40% EC @ 1.5 L ha^{-1} at 4 weeks after sowing was sprayed to protect the crop from the maize stem borer attack

The treatments used were primextra Gold 720 SC (Atrazine+s-metolachlor) @ (1.91 lit h^{-1}) and Click 72.4 SE (Atrazine+acetachlor) @ (1.85 lit h^{-1}) as Pre-emergence, Buctril Super 60 EC (Bromoxynil + MCPA) @ (0.80 lit h^{-1}) as Post-emergence, Johnson grass (*Sorghum halepense* L.) and sunflower (*Helianthus annuus* L.) extracts as Post-emergence @ (125 g L^{-1}). Similarly the same concentration of both the plant extracts were also used as Pre-emergence along a weedy check for comparison. The data were recorded on horse purslane density (m^{-2}), 1000 grains weight (g) and grain yield (kg ha^{-1}) of maize.

RESULTS AND DISCUSSION

Horse purslane density (m^{-2})

Statistical analysis of the data showed that different treatments had significantly been affected by horse purslane density after their application when compared with the data taken before their application.

It was observed that maximum inhibition in horse purslane density (15.51 m^{-2}) was resulted in treatments which received Primextra Gold 720 SC herbicide followed by Click 72.4 SE (21.6 m^{-2}). Among the plant extracts, least horse purslane density (29.7 m^{-2}) was noticed in post application of Johnson grass while most horse purslane density (119.74 m^{-2}) was observed in weedy check (Table-1). The present study findings revealed that among the tested treatments, the pre-emergence herbicides notably reduced the horse purslane density while amongst plants extracts the post emergence showed significant results. The reason for the lower horse purslane density in Primextra Gold 720 SC treated plots might be due to better phytotoxic effect of the herbicide. Similarly the lack of control strategy in weedy check plots resulted in highest weed density. Khan *et al*. (2002) and Fathi *et al*. (2003) reported that weed number m^{-2} was highest in weedy check plots and lowest in herbicidal treatments. Similarly, in other study Gover *et al*. (2003) also stated that herbicide Primextra Gold had significantly controlled the horse purslane in maize crop.

1000-grains weight (g)

The result of the present study showed that different treatments had significant effect on 1000-grains weight of the maize. The mean data revealed that better results were obtained in herbicide Primextra Gold 720 SC (370.33 g). Similarly among plant extracts the higher 1000-grains weight (275.67 g) was noted in post application of Johnson grass water extracts as compared to the lowest 1000 grains weight 143.00 g recorded in weedy check (Table-1). The overall results revealed that thousand grains weight was significantly affected by using different herbicides and allelopathic plant extracts as compared to control treatment. Gregory (2000) also observed increased increase in grain size due to effective weed management through herbicides. The higher 1000 grains weight might be due to less weed crop competition and more nutrients absorption from the soil which positively influenced seed weight (Varshney and Arya, 2004; Tewari and Tiwari 2004 and Nadeem *et al*. (2006).

Grain yield (kg ha^{-1})

Perusal of the data showed that grain yield was significantly affected by various treatments. The data further revealed that highest grain yield (5480 kg ha^{-1}) was resulted by Primextra Gold 720 SC treated plots which was statistically at par with Click 72.4 SE (5187.3 kg ha^{-1}). Whereas, among different allelopathic extracts the maximum grain yield (4798.7 kg ha^{-1}) was resulted in post application of Johnson

grass extract treated plots and the lowest grain yield (3384.3 kg ha^{-1}) was recorded in weedy check plots (Table-1). The overall results indicated that among the treatments all the herbicides positively affected the grain yield over allelopathic plant extracts and controlled treatments. The possible reason for increased in grain yield of the herbicide treated plots might be because of less weed density and more nutrients availability. The results got support by the findings of Sadiq *et al*. (2011) and Santos, 2009 who showed maximum grain yield in herbicide assigned plots as compared to weedy cheek. Khan and Hassan (2003) reported that pre emergence application of Primextra herbicide could increase maize yield significantly due to best control of this noxious weed.

Cost Benefit Ratio (CBR)

The data in Table-2 depicted the CBR for different weed management strategies i.e. herbicides and plants extracts. The maximum CBR ratio (1: 5.48) was resulted in treatments sprayed with Primextra Gold 720 SC fallowed by Click 72.4 (1: 5.13) while among extracts the post application of Johnson grass showed CBR (1: 3.88). The least cost benefit ratio (1:2.57) was recorded for sunflower extract applied as pre-emergence. The cost benefit ratio results revealed that both the herbicides increased the farmer income. Primextra gold 720 SC and post application of Johnson grass effectively controlled the horse purslane infesting the maize crop and thus enhanced the crop and farmers income. The present study results are in line with those of Amir *et al*. (2013) who stated that that the maximum net return to the farmers in term of added of cost were obtained from herbicides Primextra gold and Dual gold. Similarly in another study Chaudhry *et al*. (2011) also concluded that herbicides effectively controlled weeds and positively increased the farmer's income in term of high crop yield.

Table-1. Effect of herbicides and extracts on horse purslane density and yield of maize

Treatments	Horse purslane density (m^{-2}) before treatments application	Horse purslane density (m^{-2}) after treatments application	1000-grain weight (g)	Grain yield (kg ha^{-1})
Primextra Gold 720 SC	111.37 a	15.51 f	370.33 a	5480.0 a
Click 72.4 SE	103.84 b	21.6 e	318.00 b	5187.3 ab
Buctril Super 60 EC	92.49 c	24.24 e	294.67 c	4967.7 ab
Johnson Grass Extract (Post)	102.78 b	29.7 d	275.67 d	4798.7 b
Sunflower Extract (Post)	92.37 c	38.74 c	260.67 de	3944.3 c
Johnson grass extract (Pre)	104.45 b	43.45 c	245.33 e	3640.0 cd
Sunflower Extract (Pre)	101.62 b	59.8 b	207.33 f	3504.7 cd
Weedy Check	91.46 c	119.74 a	143.00 g	3384.3 d
$LSD_{(0.05)}$	4.5807	5.1618	17.65	513.46

Means of the same category followed by different letters are significantly different at P≤0.05 level using LSD test.

Table-2. CBR of different weed control techniques in maize crop.

Treatments	Gross income (Rs)	Added cost (Rs)	Net profit (Rs)	CBR
Primextra gold 720 SC	274000	42226	231774	1 : 5.48
Click 72.4 SE	259365	42276	217089	1 : 5.13
Buctril super 60 EC	248485	42626	205859	1 : 4.82
Johnson grass (Post)	239935	49076	190589	1 : 3.88
Sunflower (Post)	197215	49076	148139	1 : 3.01
Johnson grass (Pre)	182000	49076	132924	1 : 2.70
Sunflower (Pre)	175235	49076	126159	1 : 2.57

CONCLUSION

Horse purslane is the most problematic weed of maize crop in different areas of Khyber Pakhtunkhwa. In the current research project herbicide and allelochemicals were used to inhibit horse purslane growth and development to tackle the problem. The results concluded that among the herbicides Primextra Gold 720 SC @ 1.91 lit h^{-1}(atrazine + s-metalachlor) and Click 72.4 SE @ 1.85 lit h^{-1} (atrazine +

acetachlor) significantly affected all the studied parameters of the tested horse purslane. Moreover, the maximum net return to the farmers was also obtained from Primextra Gold 720 SC. However, among the allelochemicals, the post application of Johnson grass extract controlled horse purslane effectively. Thus, it is recommended to use Primextra Gold 720 SC herbicide in rotation with Post apploication of Johnson grass extract for the better management of horse purslane in maize crop.

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