The Journal of Animal and Plant Sciences, 22(2 Suppl.): 2012, Page: 67-69
ISSN: 1018-7081

SUPPRESIVE CAPABILITY OF HERBICIDES AND PLANT EXTRACTS AGAINST CHICKPEA WEEDS

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ABSTRACT

The effect of different herbicides (pre-emergence and post emergence) and two plants water extracts (Parthenium and Eucalyptus) on weeds and yield of chickpea was evaluated in a field trial at Agricultural Research Station Ahmad Wala, Karak, Khyber Pakhtunkhwa Province of Pakistan, during rabi season of 2010-11. Isoproturon 500 EW was very effective in controlling the weeds and reduced the weed density (98 m^{-2}) significantly as compared to control (368.3 m^{-2}). Moreover, significantly highest plant height 56.77cm each was recorded for both Parthenium and Eucalyptus extracts. Maximum 100 seed weight of 20.25 g was recorded in Isoproturon 500 EW treated plots followed by Eucalyptus extract that gave 19.25 g. Further results revealed that maximum biological yield (4000 kg ha^{-1}) was recorded under Parthenium treated plots, while the weedy check produced significantly lower biological yield (2500 kg ha^{-1}).

Key words: Chickpea, herbicides, weed control, weeds extracts.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is a cool-season legume crop, mainly grown for human consumption with annual area sown fluctuating between 9.3 and 12 million ha over the previous decade (FAOSTAT, 2007). Being a source of protein, it plays an important role in human nutrition for large population in the developing world and is considered to be a healthy food in many developed countries (Abbo *et al*. 2003). Chickpea also play a main role in the increasing of soil fertility due to its nitrogen-fixing ability (Maiti, 2001). On the basis of seed color and geographic distribution, it has been categorized into two main types, Desi (Indian origin) and Kabuli (Mediterranean and Middle Eastern origin). The seed of Kabuli type is large having cream colored seed coat while the seed of Desi type is small and has black or green colored (Chavan *et al.* 1986).

In Pakistan, Chickpea (*Cicer arietinum* L.) has also a great importance due to its use in many products. The area which was cultivated under chickpea crop during 2008-09 in Pakistan was 1080.6 thousand ha and the production was 740.5 thousand tons, while the average yield was 685 kg ha^{-1}. In Khyber Pakhtunkhwa it was cultivated on an area of 42 thousand ha with production of 20 thousand tons (MINFAL, 2009). Due to many reasons, the average yield of chickpea is low in Pakistan as compared to other chickpea producing countries of the world but the most important one is the presence of weeds. The competition of weeds with the crop for nutrients, sunlight, moisture and space leads to the low yield of crop.

The important weeds present in chickpea crop in rainfed areas are *Lathyrus aphaca* L., *Cyperus rotundus* L., *Convolvulus arvensis* L., *Medicago ploymorpha* L., *Anagallis arvensis* L., *Fumaria indica, Cynodon dactylon* (L.) Pers, and *Carthamus oxycantha* L. (Saxena, 1979). The competition of weeds with crop is mainly for available nutrients, moisture, space and sunlight etc. The quality of chickpea seed can also be deteriorated by weed infestation which creates storage problem and also affects market rate (Saxena, 1979). The annual broad-leaf weeds compete more with chickpea crop due to their similar growth pattern with chickpea and severity also increases with advance in growth (Bhan and Kukula, 1987). Interference of weeds with agricultural crops causes enormous financial losses in agro-ecosystems (Batish *et al*., 2007). Mechanical methods such as hand weeding are laborious and time consuming. While the continuous herbicidal applications can cause herbicide-resistant in weeds and has a negative impacts upon human health and environment (Vyvyan, 2002). Recently, a lot of efforts have been dedicated to the study of allelopathic effects of different plants and their ability to control weeds in a sustainable manner (Singh *et al*. 2003c). Natural products released from allelopathic and medicinal plant residues may help to reduce the use of synthetic herbicides for weed management and therefore cause less pollution and safer agricultural products (Singh *et al*., 2003a) and (Khanh *et al*., 2007).

Keeping in view the importance of chickpea and the cost on weeds control, the present study was designed to investigate the allelopathic potential of plant water extracts and herbicides for controlling weeds in chickpea with the objectives, to examine the potential of different herbicides and plant water extracts against chickpea weeds, to asses the phytotoxic effects of plants water extracts and herbicides on chickpea growth and to

contrast the affects of plants water extracts and herbicides on weeds control in chickpea.

MATERIALS AND METHODS

Chickpea cultivar Karak-1 was sown after light irrigation at the New Developmental Farm of Agricultural University, Peshawar, Pakistan during rabi 2010-11. The experiment was laid out in randomized complete block design. The treatments were consist of pre-emergence herbicides (Dual Gold 960 EC @ 2.0 L ha^{-1} and Stomp 330 EC @ 2.47 L ha^{-1}), post-emergence herbicides (Topik 15 WP@ 0.2 kg a.i ha^{-1} and Puma super@ 2 kg a.i ha^{-1}, Isoproturon 500 EW@125 g ha^{-1}), the post application of Parthenium and Eucalyptus extracts both @125 g L^{-1} and hand weeding. Control plot was kept for comparison. Seed were sown in row to row distance of 30 cm, having individual plot size of 4 x 1.5 m^2. The treatments were replicated four time. Nitrogen was applied @ 20 kg ha^{-1} as a basal dose. Crop was harvested at physiological maturity. Data were recorded on weed density m^{-2}, Plant height at maturity (cm), 100 seed weight (g) and biological yield (kg ha^{-1}). The recorded data for each trait was subjected individually to the ANOVA technique by using MSTATC computer software (Steel and Torrie, 1980).

RESULTS AND DISSCUSSION

Weed density m^{-2}: Data regarding weed density m^{-2} are shown in Table-1. Statistical analysis of the data revealed that before application of the concerned treatments to the plots the weed density were non significant, but after the herbicides and extracts application to the experimental units significant differences were found among the treatments. After the application, maximum number of weeds (368.3 m^{-2}) were recorded in control plots (weedy check) followed by plots assigned with Stomp 330 EC (188 m^{-2}). Minimum weed density was recorded in the plots treated to Isoproturon 500 EW (98 m^{-2}) followed by Hand weeded plots (112.3 m^{-2}). In the earlier studies Ahmad *et al,* (1990) and Sigh and Singh, (1998) reported that Stomp 330 EC has great tendency of controlling weeds in chickpea.

Plant height at maturity (cm): The statistical analysis of the data showed that the maximum numerical plant height 56.77cm each was recorded in Parthenium extract and Eucalyptus extract treated plots. (Table-1), while the minimum plant height (50.52 cm) was recorded in Stomp 330 EC. The differences among the treatments were however non-significant statistically. The data thus depicts that plant height is strictly under genetic control and the environment has lesser control on it. Similarly Khan *et al.* (2000) reported a non significant effect on plant height with the application of some herbicides.

100 seed weight (g): The 100 seed weight was significantly affected by the herbicides and weed extracts. Among the treatments, maximum seed weight of 20.25 g was recorded in Isoproturon 500 EW followed by Eucalyptus extract (19.25 g) and Topik 15 WP (19.12 g). The minimum 100 seed weight of 17.28 and 17.78 g was observed in weedy check and Stomp 330 EC respectively. The present finding is in collaborating with the results of Qureshi *et al.* (2002) reported that weed infestation ultimately reduced 100 seed weight.

Biological yield (kg ha^{-1}): Statistical analysis revealed that Biological yield (kg ha^{-1}) was significantly influenced due to different treatments. Application of Parthenium extract was found superior and registered significantly higher biological yield (4000 kg ha^{-1}) as compared to all other treatments. Conversely the values of biological yield of Dual Gold 960 EC, Puma super 75 EW and hand weeded plots were statistically at par. The weedy check recorded significantly lower Biological yield (2500 kg ha^{-1}). Our results are in similarity with that

Table 1. Weed density (m^{-2}), Plant height at maturity (cm), seed weight (g) and Biological yield (kg ha^{-1}) affected by weed control techniques in chickpea.

Treatments	Weed density m^{-2}	Plant height at maturity (cm)	100 seed weight (g)	Biological yield (kg ha^{-1})
Dual Gold 960 EC	116.0c*	53.17	18.06 b	3208.3ab
Stomp 330 EC	188.0b	50.52	17.78 bc	2541.7b
Topik 15 WP	147.0bc	55.32	19.12 ab	3416.7ab
Puma super 75 EW	141.0bc	55.65	18.31b	2958.3ab
Parthenium extract	132.3c	56.77	18.86ab	4000.0a
Eucalyptus extract	128.0c	56.27	19.25ab	3541.7ab
Isoproturon 500 EW	98.0c	54.50	20.25a	3208.3ab
Hand Weeding	112.3c	54.80	18.57b	3333.3ab
Weedy check	368.3a	55.25	17.28c	2500.0 b
$LSD_{0.05}$	54.4	NS	1.549	1089.8

* Means followed by different letters in the respective column are significantly different at 5 % probability level according to LSD test.

of Ali *et al*. (2003) who reported the maximum biological yield in herbicide treated plots as compared to weedy check.

Conclusion: During winter the unavailability of green fodder in the rainfed area of the province the formers have no option but to feed their animals with green leaves/twigs of chickpea in preparing a nutritious fodder. These are also used as high protein fodder mixed with cereal leaves. Chickpea stover is fed to the cattle/goats as a nutrient-rich supplement to their major cereal fodder in the lean season. Consequently when you cope over the weeds in chickpea field it will produced a huge canopy resulted in high seed and biological yield that will directly benefited the farmers of the areas because they are totally depended on their livestock.

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