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Importance of Weed Control in Chickpea under Rainfed Condition

[1]Abdur Rashid, [1]Rahmat Ullah Khan and [2]Sarfaraz Khan Marwat

[1]Arid Zone Research Institute, Dera Ismail Khan, Pakistan
[2]University WENSAM College, Gomal University, Dera Ismail Khan, Pakistan

Abstract: The study was conducted to examine the response of chickpea to different production inputs including control, insecticides, fertilizer, weed control and inoculation of seed in relation to growth and grain yield at Arid Zone Research Institute (AZRI) Farm, D.I.Khan during 2007-08. All the treatments were arranged in a randomized complete block (RCB) design with three replications. The data revealed that combined application of different inputs increased the number of branches plant^{-1}, number of pods plant^{-1}, 1000 grains weight and grain yield of chickpea compared to control and other treatments. The highest grain yield of 2183 kg ha^{-1} was obtained with full package (FP) showing 59.34% increase over control crop yield. This yield increase remained only 7.52% when weed control was excluded from the full package. The yield (2183 kg ha^{-1}) of full package (T2) was 48.20% more than the yield of 1473 kg ha^{-1} obtained with treatment (T5) including all inputs of full package except weed control. These results suggested that weed control improved the inputs efficiency in increasing chickpea yield under rainfed conditions.

Key words: *Cicer arietinum* L. · Insecticides · Weed control · Inoculum · Grain yield

INTRODUCTION

In Pakistan, growing of legume crops is very important not only for nutritional values but also for improvement of soil fertility due to their capability of atmospheric nitrogen fixation. The rapid growth of population has increased the demand of protein through pulses in cereal-based diets due to high costs of animal proteins and shortage of vegetable oil in the country. In light of increasing demand and potential of pulses, improved package of technology for growing of legume crop is pre-requisite for increasing crop production. Chickpea a major rabi crop among the pulses was grown on an area of 1028.9 thousand hectares with a production of 479.5 thousand tones during 2005-06 [1].

In rainfed areas, important weeds of chickpea are *Medicago ploymorpha L., Anagallis arvensis L., Cypress rotundus, Fumaria indica., Cynodon dactylon., Lathyrus aphaca L., Convolvulus arvensis L. and Carthamus oxycantha*. Weeds being the biggest problem compete with crop for available moisture, nutrients, space and sunlight etc. Thereby, provide opportunities for harboring insects, pests and diseases resulting in yield reduction. Weeds infestations also deteriorate the quality of seed which create storage problem and also effect market rate of the product. Of the total, annual loss 30-50% has been reported due to weeds [2]. Similarly, weeds in rabi pulses caused yield reduction to the extent of 75 percent in chickpea [3-5]. The losses due to weeds on annual basis in wheat amount to more than 28 billion at national level and 2 billion in NWFP [6].

Legumes are most important group of nitrogen fixing plants wherein agronomic practices play considerable role in improving its efficiency of atmospheric nitrogen fixation and grain yield of pulses. Although some of the practices like extensive use of pesticides (herbicides, insecticides and fungicides) retarded plants growth and inhibit nitrogen activity of the legumes. Peters and Zbiba [7] concluded that inhibition of nodulation was caused by herbicidal injury of the plants. Islam and Afandi [8] reported that nodulation was better in hand weeded plots of lentil as compared to the ones treated with tribunil. Manual weeding or hoeing had been an efficient way and common practice to control weeds in grain legumes. In chickpea, one to two manual weedings at 8-9 weeds stage of the crop provided effective weed control to increase the per capita yield [4, 5]. In light of importance of improved package of technology for increased crop production on sustainable basis, this study was designed to evaluate the role of different inputs on the growth and yield of chickpea.

Corresponding Author: Sarfaraz Khan Marwat, University WENSAM College, Gomal University, Dera Ismail Khan, Pakistan

MATERIAL AND METHODS

This experiment was carried out at the Arid Zone Research Farm (AZRI) D.I.Khan during 2007-08 to study the effect of different inputs on the production of chickpea. An improved variety "KK-1" was planted in a plot size of 5x1.80 m with six rows plot^{-1}. The following treatments were arranged in a randomized complete block design (RCB) with three replications.

Treatments	Inputs used
T1:	Control (without inputs)
T2:	Full package including insecticide+fertilizer +weed control+inoculum at recommended rates.
T3:	Full package – insecticide
T4:	Full package – fertilizer
T5:	Full package – weed control
T6:	Full package – inoculum

Before sowing of crop, a composite soil sample 0-30 cm depth was collected and analyzed for determination of soil properties of the experimental field (Table 1).

Crop was sown during October, 2007 in a well-prepared seedbed. The treatments were applied according to the plan of work. The whole quantity of fertilizer (20-50 kg ha^{-1}) and inoculum (2.5 kg ha^{-1}) was applied at the time of land preparation. Weeds were removed manually form the concerned plots only. Insecticide spray was carried out on the appearance of larvae on the crop. All other management practices were kept uniform during the crop-growing season. The agronomic characteristics of the crop were noted by using standard procedure of data recording.

Table 1: Physico- chemical properties of the soil used

	Parameter	Value
Chemical properties	pH.	8.2
	E Ce (dSm^{-1})	2.79
	Organic matter (%)	0.76
	Available P (mg kg^{-1})	6.89
	Available K (mg kg^{-1})	112
Physical properties	Clay (%)	52.50
	Sill (%)	38.00
	Sand (%)	9.50
	Texture	Clay

The crop samples were harvested at physiological maturity and sun dried samples were threshed manually to collect yield data of the individual treatment. The data collected was analyzed statistically by using the analysis of variance technique and Duncan`s multiple range test (DMRT) at 5% level of probability was applied to compare the treatment means [9].

RESULTS AND DISCUSSION

The data presented in Table 2 indicated that the different production inputs had no significant effect on the plant height of chickpea. The plant height was linearly increased from 56 cm to 58.4 cm with different inputs compared to minimum plant height (56 cm) in control treatment. The maximum plant height (58.4 cm) was recorded in the treatment of full package (T2) showing positive effect on the vegetative growth of chickpea, which ultimately increased the plant height. The days taken to maturity by different treatments under study were also statistically at par. This non-significant effect on the days taken to maturity might be attributed to genetic characteristic of the cultivar.

Number of branches plant^{-1} (Table 2) were significantly affected by the different treatments. The maximum number of branches plant^{-1} (3.10) were recorded in the treatment of full package (T2) followed by T3 with 2.96 branches plant^{-1}with non-significant difference to each other. All other treatments produced the lowest number of branches palnt^{-1} which showed that any of the input among fertilizer, weed control and inoculum when not applied significantly affected the plant growth resulting decreased number of branches plant^{-1} of chickpea. The number of pods plant^{-1} were significantly affected by different production inputs. Full package (T2) of inputs produced the highest number of pods plant^{-1} (48) followed by T3 with 46.40 pods plant^{-1} showing non-significant difference to each other. The lowest number of pods plant^{-1}(28.07) were produced in control treatment showing 71 % decrease than full package pods plant^{-1}. These results are in line with the findings of Ashraf [10] and Mehboob *et al.* [11] whom reported similar increase in number of pods plant^{-1} with seed inoculum + NP fertilizer levels. 1000 grains weight of chickpea were also affected by the different production inputs. The maximum thousand grains weight of 205.7 g was recorded in the treatment of full package (T2) showing significant increase than all other treatments under study. These results suggested that combined application of the different inputs in full package provide favorable soil

Table 2: Yield components and grain yield of chickpea as affected by different production inputs during 2007-08

Treatments	Plant height (cm)	Days to maturity	No. of branches plant^{-1}	No. of pods plant^{-1}	1000 grains weight (g)	Grain Yield (kg ha^{-1})	% increase over control
T1=Control	56.0	157	2.30 c	28.07 f	202.6 cd	1370 c	-
T2=Full package (FP)	58.4	157	3.10 a	48.00 a	205.7 a	2183 a	59.34
T3=FP-Insecticide	57.5	158	2.96 ab	46.40 ab	204.3 b	2089 ab (4.49)	52.04
T4=FP- Fertilizer	56.2	157	2.86 bc	43.17 bc	203.5 bc	1961 b (11.32)	43.13
T5=FP-Weed control	57.6	157	2.53 d	24.63 e	201.1 d	1473 c (48.20)	7.51
T6=FP-Inoculum	57.4	157	2.73 c	39.30 d	203.1 bc	1911 b (14.23)	39.48
LSD (0.05)	NS	NS	0.13	3.27	1.14	205	-

N.S: Non-significant. * Means followed by same letter do not differ significantly at 5% level of probability

environment and better nutrients supply, which ultimately improve the seed size of the crop. These results are in harmony with the findings of Provorov *et al.* [12] and Mehboob *et al.* [11] .

The data (Table 2) pertaining to grain yield of chickpea showed that the production inputs had significantly affected the grain yield. The yield had significantly increased with all the treatments compared to control except T5 where weeds were not eradicated. The grain yield ranged from 1370 to 2183 kg ha^{-1} revealed that the highest yield of 2183 kg ha^{-1} was obtained with full package (T2) of inputs followed by 2089 kg ha^{-1} grain yield with treatment (T3) including all inputs except insecticide application. The non-significant difference between these treatments suggested that either the intensity of insects was not so sever or the insects were effectively controlled by the insecticide spray. The yield obtained with treatment T4 and T6 was also significantly higher than control crop (T1) but the treatment including all inputs except weed control (T5) was statistically at par with treatment (T1) without inputs. In terms of percentage, the yield increase was 7.52 to 59.34% with different production inputs wherein the lowest increase (7.52%) was observed with T5 where weeds were not removed from the plot. Figures in parenthesis showed that weeds alone reduced the yield by 48.20% compared to decrease of 4.49, 11.32 and 14.23 % with insecticide, fertilizer and inoculum, respectively than yield obtained with full package. These results are in line with findings of Balyan and Bhan [5] and Mehboob *et al.* [11]. Thus, it can be concluded that only nutrients supply and plant protection measures are not enough to get higher yield unless weeds are not controlled under rainfed condition. These results suggested that a large potential yield gap and the significant contribution of individual test factor are not likely to provide sufficient incentives unless the improved package is not adopted. All the inputs proved to be more effective, especially when used in combination in improving chickpea production under rainfed condition.

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