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Response of weed management strategies on growth, yield and economics of chickpea (*Cicer arietinum* L.): Yield and yield attributes

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ABSTRACT

A field experiment was conducted during rabi season, 2021-2022 at research block Uttaranchal University, School of Agriculture, field located at Chandanwari, to study the "Response of weed management strategies on growth, yield and economics of chickpea (*Cicer arietinum* L.)". The experiment was carried out in Randomized Block Design with 7 treatments and 3 replications. The results of the experiment showed that various weed control techniques had a substantial impact on how well the chickpea crop performed. Among the all treatments, T5 which is Paddy straw + Pendimethalin (PRE) @1kg a.i/ha + Two hand weeding (45 & 90 DAS) was found to provide the maximum gross return (Rs76890 ha^{-1}) and benefit (31220) followed by T3 which is Paddy straw + 2,4-D (PRE) @1KG a.i/ha + two hand weeding (45DAS & 90 DAS) and T7 which is Weed free. The lowest return was found in T1 which is weedy check (51430). The C:B ratio T5 and T3 (1.68) recorded in two hand weeding in these plot.

Keywords: Chickpea, Weed management, Herbicides, Hand weeding, Yield.

INTRODUCTION

Balanced nutrition has played one of the most crucial roles in maintenance of mental and physical health. It is primarily constituted of vitamins, carbohydrates, proteins as well as several other complex substances in differential amounts. Chickpea has been a cold season rabi legume crop cultivated across the globe as a food crop. M.P., Rajasthan, U.P., Haryana, Maharashtra, and Karnataka are the main states for chickpea production, accounting for 60% of the nation's production and 90% of its area (2005, Ahlawat et al). Weeds are a significant barrier to increasing pulse crop productivity, and the amount of damage they do is dependent on the kind and severity of infestation. Consequently, weeds are suppressed to a suitable degree in order to maximise the production. Chick pea being slow in its growth and short statured plant, is highly susceptible to weed competition. Due to its sluggish early development and small height, chickpea is extremely vulnerable to weed competition, which can result in significant production losses of up to 75% (Chaudhary et al., 2005). The yield reduction depending upon levels of weed competition in gram crop may vary from 30 to 70 percent. Weed emergence with the Rabi sown chickpea crop creates a severe competition unless controlled timely and effectively. Inter-row cultivation is not sufficient and inter-row hand weeding is necessary under most conditions. Therefore, an urgent need is to move from the costly manual weed control to chemical weed control. Adopting efficient weed management techniques will increase the crop's per-unit output. Consequently, a study experiment was carried out to identify the most efficient herbicide for an integrated strategy that can effectively manage these weeds. Plant nutrients can be removed from soil more effectively by weeds than by crops. Due to its early sluggish development and petite stature, the chickpea is especially

sensitive to weed competition, which can reduce production by up to 75%. (Chaudhary et al. 2005). Numerous researchers from around the nation have indicated that pre-emergence applications of pendimethalin at 1.0 kg/ha are effective (Singh and Jain, 2017). An integrated weed management method uses a carefully thought-out sequence of two or more weed control tactics from the five primary categories of preventive, cultural, mechanical, biological, and chemical. According to Waqas et al. (2016), hand weeding followed by the use of pesticides produced the lowest density and biomass of weeds.

MATERIAL AND METHODS

A field experiment was conducted during post rainy season at the research farm of Uttaranchal University, School of Agriculture, field located at Chandanwari, parenatal is the site of experiment during the rabi seasons of 2021-2022 respectively. The climate of Dehradun is humid subtropical. The experiment was laid out in RBD with 3 replication with 7 treatments. The soil of the experimental field was clay loam having organic carbon 0.88%, available nitrogen 255kg ha^{-1}, available phosphorous 25.4 kg $ha^{-1,}$ available potassium 0.0181kg ha^{-1}, EC 0.25 ds/m with pH 8.4. The experiment consisting of seven treatments viz. T1 is weedy check. T2 Paddy straw + Pendimethalin (PRE) @1kg a.i./ha. T3 is Paddy straw + 2,4-D(PRE)@1 kg a.m./a.i. two hand weeding (45 and 90 DAS). T4 is Paddy straw+ Pendimethalin (PRE)@1.0 kg a.i./ha+1hand weeding(45DAS). T5 is Paddy straw+ Pendimethalin (PRE)@1.0 kg a.i./ha + two hand weeding (45 and 90DAS). T6 is Pendimethalin (PRE)@1.0 kg a.i./ha +one hand weeding (45DAS). T7 is Weed free. The experiment was laid out in randomized block design with three replications. Seeds was taken as test variety in this investigation. One hundred seeds were tested before sowing to ascertain the germination ability of Chickpea seeds. Germination test was done using filter paper and Petridis under laboratory conditions. The overall germination percentage was 90%. The variety of chickpea PG 065 was selected. Seeds was sown on last week of November during different seasons by adopting the spacing of 30 x 10 cm. Before sowing, Chickpea being a leguminous crop fulfils the most important a part of its nitrogen requirement through the system of symbiotic N fixation. But, soils with low organic be counted and bad N deliver can also require 20-25 kg in step with hectare of N as starter dose which could meet plant requirement earlier than the formation of nodules.

RESULT AND DISCUSSION

Number of pods per plant

Hand weeding (twice) was shown to produce the most pods per plant, closely followed by Pendimethalin and 2,4-d, which was also highly successful. These were statistically better than the other weed management techniques at the time. It could be because the above treatments had less weeds per unit area, which gave the agricultural plants the ideal environment for healthy growth and development. Balyan and co. (1987). According to Gedia et al. (1989) and Vaishya et al. (1996), an integrated approach to weed management was found to be beneficial for increasing the number of pods per plant.

Number seeds per pod

The data of number of seeds per pod recorded and presented in table accurately. It is noticeable from the table that the maximum seeds per pod were recorded where, hand weeding twice was practiced and the minimum in unweeded plots. Combination of both chemical i.e., pendimethalin and 2,4-D proved with superiority in increasing the number of the seeds per pod. The superior treatment which maximum seeds per pod was, Paddy straw + Pendimethalin (PRE) @1kg a.i./ha + Two hand weeding (45 & 90 DAS) followed by Paddy straw + 2,4-D (PRE)@ 1kg a.i./ha + two hand weeding (45 DAS & 90 DAS) than unweeded plots in the field.

Grain yield

The grain yield as determined by various weed control measures are presented in table. Each plot has been showing various effect on grain yield in the field with controlling weeds measures. The effective treatment shows effective result on grain yield with number of grains. In all treatments the best treatment was the paddy straw+ pendimethalin (PRE)@ 1 kg a.i./ha + two hand weeding (45 & 90 DAS) and Paddy straw + 2,4-D (PRE)@ 1kg a.i./ha + two hand weeding (45 DAS & 90 DAS) with grain yield (14.78 & 13.90) followed by weed free plot. During the investigation we observed that effect of pre-emergence with two hand weeding helps to increased grain yield than unweeded plots. The various chemicals tested increased the grain yield significantly over the unweeded plots. The minimum (8.76) grain yield was recorded where, weedy check. Weed compete with main plant for space, light, nutrients and water when growth of grain yields proper time because of many reasons for yield losses and low productivity.

Straw yield

The straw yield as determined by various weed control treatments are presented in table. Observed from the table that the weed control measures during experiment having variations in the field. The maximum grain yield (30.75 & 28.48 Q/ha) were recorded where hand weeding (twice) was practiced which was followed by pendimethalin and 2,4-D and the minimum (20.02 Q/ha) under unweeded plots respectively. The various herbicides tested during the investigation increased the straw yield significantly over unweeded plot. These herbicides remained at par among themselves in increasing the straw yield herbicides assisted with hand weeding proved more influential in increasing the straw yield as compare to their individual effects.

Harvest index

The data determine to harvest index presented in the table. The investigation could not reach to the level of significance in affecting the harvest index parameter in the field.

TABLE: Yield attributes parameters of chickpea as influenced by treatments during rabi sesean 2021-2022.

Symbols	Treatment	No. of seeds/plant	No. Of seed/pod	Grain yield(Q/ha)	Straw yield(g/ha)	Harvest Index (%)
T1	Weedy check	35.08	1.04	8.76	20.02	28.43
T2	Paddy straw + Pendimethalin (PRE) @1kg a.i./ha	45.87	1.09	10.30	24.74	29.39
T3	Paddy straw + 2,4-D(PRE)@1 kg a.i./ha + two hand weeding (45DAS &90DAS)	55.70	1.12	13.90	28.48	32.89
T4	Paddy straw + Pendimethalin (PRE)@1kg a.i./ha + one hand weeding(45DAS)	52.68	1.06	11.54	25.54	31.12
T5	Paddy straw + Pendimethalin (PRE)@1kg a.i./ha + Two hand weeding(45&90DAS)	56.32	1.15	14.78	30.75	32.70
T6	Pendimethalin (PRE)@1kg a.i./ha + one hand weeding(45DAS)	54.20	1.09	12.67	24.65	31.94
T7	Weed free	57.50	1.22	17.18	31.43	33.81
	SEM± CD at 5%	1.60 3.08	0.020 0.06	0.35 1.02	1.08 2.04	1.10 N.S.

Economics: In calculating the economics, the existing price of herbicides, labours, fertilisers, seeds and finally the produce was taken into consideration. Higher gross return was recorded in two hand weedings 45 and 90 days after sowing (Rs. 76890 ha^{-1}). Among the herbicidal treatments, application of Paddy straw + Pendimethalin (PRE) @1kg a.i./ha + Two hand weeding (45 DAS & 90 DAS) (Rs. 76890 ha^{-1}) and Paddy straw + 2,4-D (PRE)@1 kg a.i./ha + two hand weeding (45 DAS & 90 DAS) (Rs. 73300 ha^{-1}) recorded notably higher gross returns. The higher gross returns were mainly attributed by higher seed yield, obtained due to higher weed control efficiency. The lower gross returns were recorded with weedy check, which was mostly brought about by the lower seed yield gained as a result of unchecked weed development throughout crop growth. This was mainly due to higher gross returns along with lesser cost of cultivation, particularly less weed management cost.

TABLE: Yield and economics of chickpea as influenced by different pre and post emergence herbicides

Symbol	Treatments	Gross return	B:C ratio
T1	Weedy check	51430	1.48
T2	Paddy straw + Pendimethalin (PRE) @1kg a.i./ha	62500	1.56
T3	Paddy straw + 2,4-D(PRE)@1 kg a.i./ha + two hand weeding (45DAS &90DAS)	68480	1.68
T4	Paddy straw+ Pendimethalin (PRE)@1kg a.i./ha + one hand weeding(45DAS)	73300	1.73
T5	Paddy straw + Pendimethalin (PRE)@1kg a.i./ha + Two hand weeding(45&90DAS)	76890	1.68
T6	Pendimethalin (PRE)@1kg a.i./ha + one hand weeding(45DAS)	60200	1.55
T7	Weed free	70680	1.74

CONCLUSION

According to inferences made from the production of gram in Dehradun, using pendimethalin and 2,4-D with twice-daily hand weeding can provide the greatest economically viable yield of gram crop and proved to be the most effective weed control strategy, achieving the highest net return and cost-benefit ratio. Therefore, it is safe to suggest this approach of weed management to farmers in order to maximize both the continued production of gram and the largest net return from it.

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