Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2021; 10(1): 1714-1716
Received: 20-11-2020
Accepted: 22-12-2020

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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, 2019-20 at research block of S.G.R.R. University, Dehradun, Uttarakhand 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 8 treatments and 3 replications. The investigation revealed that the performance of Chickpea crop was significantly influenced by various strategies of weed management. Among all the treatments, Treatment T6 (Pendimethalin @ 0.75 kg a.i./ha + hand weeding at 25, 45 and 60 days after sowing) was found best in the weed management of chickpea. Treatment T1 (weedy check) came out to be the lowest performed treatment in compared to others.

Keywords: Chickpea, weed management, herbicides

Introduction
Pulses play an important role in Indian agriculture for sustainable production, improvement in soil health and environment safety. India is the largest producer and also consumer of pulses in the world and found that it is a cheaper source of protein to overcome malnutrition among human beings. Pulses contain high percentage of quality protein nearly three times as much as cereals. One of the major constraints to increase in yield of pulse crop is the presence of weeds and the magnitude of losses by them depends on the type and intensity of infestation. Therefore, weeds are controlled to a desirable extent so that the yield can be increased. Chick pea being slow in its growth and short statured plant, is highly susceptible to weed competition. 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 mechanical weed control to chemical weed control.
Earlier studies have shown that legume crop productivity can be enhanced and sustained under proper weed management. Therefore, a study was envisaged to find out the effect of different weed management strategies on growth and yield of chickpea for sustainable production.

Materials and Methods
A field experiment was conducted during 2019-2020 at the research block of School of Agricultural sciences, S.G.R.R.U, Dehradun (Uttrakhand) India. The climate of Dehradun is humid subtropical. It was recorded that Dehradun received 1734.1 mm rainfall from the month of July to October in 2019. The soil of the experimental site was clayey in texture, low in available nitrogen, medium in available phosphorus and Potassium contents with neutral in reaction and normal in electrical conductivity. The maximum and minimum temperature recorded during the growing sea-son i.e., from October 2019 to March 2020 was 30 °C and 10 °C respectively. The experiment was laid out in RBD with 3 replications and 8 treatments.
The crop chickpea variety Desk (Avrodhi) was sown on 26/10/2019 with a spacing of 30 cm x 25 cm. Seeds were sown by hand maintaining a definite quantity measured for each plot on the basis of recommended seed rate (100 kg/ha). Seed were treated with rhizobium @ 3g per kg of seed before sowing against fungal diseases. One pre-sowing irrigation was given at the time of land preparation to provide sufficient moisture for good germination and crop emergence and second light irrigation was provided at 30 DAS, After this mainly rainwater was observed as mode of irrigation. As per treatment, hand weeding was done at 25, 45 and 60 DAS with the help of khurpi. Herbicide pendimethalin was applied before sowing @ 0.75 kg a.i./ha. Pendimethalin was sprayed with the help of high volume sprayer as pre-emergence treatment.

Results and Discussion

Number of pods per plant

The mean number of pods per plant is affected by different treatments. The statistical analysis had shown that pods per plant were significantly affected due to different treatments. Treatment T8 produced maximum pods per plant i.e. 53.22.The lowest number of pods per plant i.e. 29.4 was recorded in treatment T1 shown in Table.1. These findings are in line of those reported by Singh *et al*. (2003) [8] and Chaudhary *et al*. (2005) [5].

Number of seeds per pod

Treatment T8 produced maximum number of seeds per pods i.e, 1.95 g which was statistically superior to all the remaining treatments. The lowest number of seeds per pod was recorded in treatment T1 Shown in (Table.1). Similar observation was earlier reported by Pandit *et al*. (2017).

Weight of seeds per plant

Treatment T8 produced maximum grain yield, which was significantly more than all the remaining treatments. The mean of grain yield per plant was calculated from the yield as recorded after harvest of the crop from five selected tagged plants of each plot. It was statistically analyzed and results were tabulated. The grain yield per plant varied from 15-50g in treatment T8 to 5.99g in treatment T1 (weedy check) shown in (Table.1). Similar findings were reported by Ratnam and Reddy (2011) and Pedde *et al*. (2013) [15].

Grain yield

The results presented in (Table.1) indicated that grain yield (8.17 q/ha) was recorded significantly maximum under Treatment T8, whereas the minimum grain yield i.e. (4.60 q/ha) was recorded under Treatment T1. Similar observation was earlier reported by Raghavendra KS and RC Gundappagol (2017) [16].

Straw yield

From (Table.1) it was also observed under different treatments of weed management on chickpea, straw yield was significantly maximum under Treatment T8, whereas the minimum grain yield was recorded under Treatment T1, The maximum straw yield per ha was (15.55q) whereas the minimum grain yield per ha was (9.21 q). The results matches the findings of Goud *et al.* (2013).

Harvest index

There was a marked influence of different treatments on the harvest index presented in (Table.1). The maximum harvest index (59.8 %) was ob- served under Treatment T8. Whereas the minimum harvest index (39.40 %) was observed under Treatment T1. Similar findings were reported by Sharma *et al.* 2007; Yadav and Tripathi, 2013 [2, 4].

Table 1: Yield attributing parameters of chickpea as influenced by treatments during rabi season 2019-2020

Symbols	Treatments	No. of pod/plant	No. of seed/pod	Weight of seed/plant	Grain yield (q/ha)	Straw yield (q/ha)	Harvest Index (%)
T1	Weedy check	29.40	0.60	5.99	3.50	4.60	39.40
T2	Hand weeding + hand hoeing at 25, 45 and 60 DAS	40.30	1.75	20.04	5.65	12.27	49.93
T3	Plastic mulch	36.50	1.60	9.20	5.53	10.52	45.65
T4	Pendimethalin @ 0.75 kg a.i./ha	37.40	1.62	10.20	6.24	11.21	41.89
T5	Isoproturon @ 0.75 kg a.i./ha	34.40	1.40	9.21	4.60	12.82	39.40
T6	Pendimethalin @ 0.75 kg a.i./ha + Hand weeding at 25, 45 and 60 DAS	45.60	1.90	25.50	6.50	13.45	54.50
T7	Isoproturon @ 0.75 kg a.i/ha + Hand weeding at 25, 45 and 60 DAS	35.40	1.30	12.50	4.25	9.55	43.20
T8	Weed free	5322	195	28.80	8.17	15.55	59.80
S.E. (m) ±		5.004	2.010	1.42	3.10	4.28	6.39
C.D. at 5%		8.15	2.020	1.68	5.29	7.60	11.99

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