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Herbicidal weed management in chickpea (*Cicer arietinum* L.)

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ABSTRACT

The present experiment entitled **"Herbicidal weed management in chickpea (*Cicer arietinum* L.)"** was carried during *Rabi* season of 2025-26 at university of technology Jaipur. The experiment was conducted in Randomized Block Design (RBD), with three replication comprised of ten treatments *viz*. The experiment consisted of ten treatments, namely **T_1:** Imazethapyr @ 50 g/ha applied at 20 DAS, **T_2:** Propaquizafop + Imazethapyr @ 50 g/ha applied at 20 DAS, **T_3:** Sodium acifluorfen + Clodinafop propargyl @ 200 g/ha applied at 20 DAS, **T_4:** Fomesafen + Fluazifop-p-butyl @ 200 g/ha applied at 20 DAS, **T_5:** Bentazon @ 750 g/ha applied at 30 DAS, **T_6:** Pendimethalin + Imazethapyr @ 750 g/ha applied as pre-emergence, **T_7:** Pendimethalin @ 750 g/ha applied as pre-emergence, **T_8:** Sulfentrazone @ 75 g/ha applied as pre-emergence, **T_9:** Weed free, and **T_{10}:** Weedy check. From the findings; it is found that the treatment **T_6:** Pendimethalin + Imazethapyr @ 750 g/ha was found superior over other treatments in terms of growth and yield of Chickpea.

Keywords: Chickpea, Herbicides, Crop growth, Weed control efficiency

INTRODUCTION

For India's large vegetarian population, pulses—dubbed the "Wizard of health"—are the most affordable and abundant source of protein. Protein, fibre, vitamins, and minerals including iron, zinc, and magnesium are all found in pulses. Pulses help lower the risk of a number of chronic diseases and are the second-largest source of dietary protein (27%) after cereals (55%). Pulses not only meet the human population's protein needs but also enhance soil health (Singh et al., 2016). Pigeon pea, chickpea, green gram, black gram, lentil, and pea are mostly farmed as pulse crops in India. After lentils, field peas and lathyrus, chickpeas are a significant Rabi pulse crop.

One of the most significant pulse crops cultivated in tropical and semi-arid regions is chickpeas. Due to its short duration, high tonnage capacity, and exceptional nutrient value as food, feed, and forage, chickpeas (Cicer arietinum L.) have a prominent position among pulses **(Singh et al., 2012).** It is referred to as garbanzo, gram, bengal gram, and chana regionally. Chickpeas are a vital food legume and a great source of animal feed. It is most frequently eaten as dal flour (Besan) or processed whole seed (boiled, fried, roasted, parched, steamed, and sprouted). Green vegetables also include fresh green seeds.

High levels of protein (21.1%), carbs (61.5%), fat (4.5%), minerals, and vitamins are found in chickpeas. Chickpeas also contain iron (7 g), zinc (3 mg/100 g), and phosphorus (340 g) **(Singh et al., 2012).** In the world, it is the third most significant crop following dry peas and beans **(Kaur et al., 2020).** India, Turkey, the Russian Federation, Myanmar, Pakistan, and Ethiopia are the countries where it is mostly farmed. Chickpeas are the most

popular crop among pulses in India, making up 30% of the country's total acreage and 40% of its overall production **(Reddy et al., 2007).**

The cropping history of the field has a significant and direct impact on the number and composition of weeds in the soil. Longer weed competition throughout the winter has a significant impact on pulses and can reduce chickpea yield by up to 75% **(Chaudhary et al., 2005).** When determining when a crop enters its critical period, weed density plays a significant role **(Martin et al., 2001**). Because of its slow growth rate and restricted leaf area development in the early phases of crop growth and development, chickpeas are a poor competitor with weeds.

MATERIALS AND METHODS

The present experiment entitled **"Herbicidal weed management in chickpea (*Cicer arietinum* L.)"** was carried during *Rabi* season of 2025-26 at university of technology Jaipur in the year 2025-26 in Randomized Block Design (RBD) with 10 treatments. The experiment consisted of ten treatments, namely **T_1:** Imazethapyr @ 50 g/ha applied at 20 DAS, **T_2:** Propaquizafop + Imazethapyr @ 50 g/ha applied at 20 DAS, **T_3:** Sodium acifluorfen + Clodinafop propargyl @ 200 g/ha applied at 20 DAS, **T_4:** Fomesafen + Fluazifop-p-butyl @ 200 g/ha applied at 20 DAS, **T_5:** Bentazon @ 750 g/ha applied at 30 DAS, **T_6:** Pendimethalin + Imazethapyr @ 750 g/ha applied as pre-emergence, **T_7:** Pendimethalin @ 750 g/ha applied as pre-emergence, **T_8:** Sulfentrazone @ 75 g/ha applied as pre-emergence, **T_9:** Weed free, and **T_{10}:** Weedy check. From the findings; it is found that the treatment **T_6:** Pendimethalin + Imazethapyr @ 750 g/ha was found superior over other treatments in terms of growth and yield of Chickpea.

The Jaipur is situated at 26.6970^0 North latitude and 75.8723^0 east longitude and an altitude of 427 meters above mean sea level in Jaipur district of Rajasthan. It falls under Agro-climatic zone IIIA (Semi-Arid Eastern Plain) of the state.

RESULTS AND DISCUSSION

Statistical data total density of weeds, total dry matter accumulation, Weed control efficiency weed index, plant population,/M^2 plant height(cm) number of branches per plant dry matter accumulation, pods per plant, seed per pod, length of pods, test weight, seed yield per plant, seed yield, stover yield, biomasss yield, harvest index of Chickpea are presented in table 1 & table 2.

At 90 DAS, minimum total weed density was recorded under weed free conditions. Application of pendimethalin+imazethapyr @ 750 g/ha as PE significantly reduced weed density by 2.04/m2 over pendimethalin @ 750 g/ha as PE (2.54/m2). It was at par with imazethapyr @ 50 g/ha (1.95/m2). At harvest, the highest total weed density was recorded under weedy check situations. Among herbicidal treatments, maximum total weed density was recorded with the application of sodium acifluorfen+clodinafop propargyl @ 200 g/ha at 20 DAS (6.03/m2) and it was on par with propaquizafop + imazethapyr @ 50 g/ha at 20 DAS (5.82/m2). Pendimethalin+imazethapyr @ 750 g/ha as PE significantly reduced total weed density by 2.11/m2 and it was at par with imazethapyr @ 50 g/ha at 20 DAS and pendimethalin @ 750 g/ha as PE. The respective values with imazethapyr @ 50 g/ha at 20 DAS and pendimethalin @ 750 g/ha as PE were 2.12 and 2.53/m2.

At 90 DAS, minimum weed dry matter was observed under weed free condition. Application of pendimethalin+imazethapyr @ 750 g/ha as PE gave weed dry matter of 1.79 g/m^2 and it was at par with imazethapyr @ 50 g/ha applied as early post emergence (2.01 g/m^2). At harvest, the data revealed that weed dry weight was suppressed to a minimum extent of 2.04 g/m^2 with the application of pendimethalin+imazethapyr @ 750 g/ha as PE. This treatment reduced the weed dry matter by 70 per cent compared to weedy check.

A perusal of the data revealed that among herbicidal treatments, highest weed control efficiency was achieved by pendimethalin+imazethapyr @ 750 g/ha as PE (91.92% at harvest) closely followed by application of imazethapyr @ 50 g/ha as 20 DAS (88.39%). Contrary to it, the lowest weed control efficiency was recorded at harvest was under sodiumacifluorfen+clodinafop propargyl @ 200 g/ha at 20 DAS (66.42%).

It is evident from the presented data that the highest weed index was recorded under weedy check plots (68.85%). All the herbicidal treatments reduced the WI compared to weedy check plot. The lowest WI (1.15%) was recorded by application pendimethalin+imazethapyr @ 750 g/ha as PE whereas the second lowest WI (17.21%) was recorded with the application of imazethapyr @ 50 g/ha as 20 DAS.

All the weed control treatments significantly reduced the plant mortality as compared to weedy check. Significantly higher number of plants survived under weed free treatment and was found statistically at par in all the weed control treatments except sodium acifluorfen+clodinafop propargyl @ 200 g/ha at 20 DAS. The plant stand with this treatment was reduced significantly by 10.03% compared to weed free check.

At 90 DAS, the crop maintained weed free produced the highest plant height of 43.33 cm and the second highest plant height was recorded with application of pendimethalin+imazethapyr @ 750 g/ha (38.33 cm). These treatments enhanced the plant height by 9.66 and 4.66 cm compared to weedy check plot. The data revealed that plant height of chickpea crop recorded at harvest was significantly reduced under weedy check condition compared to different herbicidal treatments. The minimum plant height was recorded under weedy check treatment (36 cm) whereas weed free condition and pendimethalin+imazethapyr @ 750 g/ha recorded significantly higher plant height of (46.33 and 45.00 cm), respectively.

At 90 DAS, the results revealed that highest branches/plant were recorded under weed free condition. Among herbicidal treatments, pre-emergence application of pendimethalin+imazethapyr@ 750 g/ha produced highest no. of branches/plant (7.67/plant) and it was at par with imazethapyr @ 50 g/h (7.33/plant) and pendimethalin @ 750 g/ha (7.33/plant). At harvest, crop maintained weed free throughout its pendency, produced highest branches/plant however, it was at par with herbicidal applications of pendimethalin+imazethapyr @ 750 g/ha as PE (7.83), imazethapyr @ 50 g/ha (7.50) and pendimethalin @ 750 g/ha (7.67).

At 90 DAS, perusal of data explicate that the highest crop dry matter production was recorded with the application of pendimethalin+imazethapyr @ 750 g/ha as PE (320 g/m^2) and it was significantly higher over imazethapyr @ 50 g/ha by 48.83 per cent. The respective value over pendimethalin @ 750 g/ha was 54.8 per cent. The weedy check plots produced lowest dry matter (81.67 g/m^2) at this growth stage.

The data showed that all the herbicidal weed management treatments had significant positive effect on number of pods/plant. The highest number of pods/plant were recorded with application of pendimethalin+imazethapyr@ 750 g/ha as PE (74.33) however, it was at par with weed free conditions, pendimethalin @ 750 g/ha and imazethapyr @ 50 g/ha where the respective values were 73.00, 69.00 and 66.33, respectively. Weedy check plots produced minimum pods/plant (38.00).

Data presented in Table 1.2 shows that length of pod in chickpea are not significantly affected by any of the treatments in the tested year.

The data on seeds/pod are presented in Table 1.2. The results revealed that compared to weedy check plots, all herbicidal weed management treatments had positive effect on seeds/pod. The maximum seeds/pod was recorded with the application of pendimethalin+imazethapyr @ 750 g/ha as PE

(2.03) however, it was at par with all herbicidal treatments except fomesafen+fluazifop-p-butyl @ 200 g/ha (1.50) and propaquizafop+imazethapyr @ 50 g/ha (1.30).

The data pertaining to 100-seed weight were significantly varied due to different weed management treatments as presented in Table 4.9. The data indicate that pendimethalin+imazethapyr @ 750 g/ha recorded 100-seed weight (16.83 g) at par with weed free conditions (16.89 g). Application of pendimethalin+imazethapyr @ 750 g/ha and imazethapyr @ 50 g/ha also produced dry matter at par with each other but both these treatments were significant superior over rest of the treatments.

The data presented in Table 1.2 revealed that highest seed yield/plant was recorded under weed free conditions (6.24 g) and it was at par with the application pendimethalin+imazethapyr @ 750 g/ha as PE (6.20 g) and imazethapyr @ 50 g/ha (5.30 g). Amongst herbicidal treatments, lowest seed yield/plant was recorded with fomesafen+fluazifop-p-butyl @ 200 g/ha at 20 DAS (2.98 g) and it was at par with sodium acifluorfen+clodinafop propargyl @ 200 g/ha, propaquizafop+imazethapyr @ 50 g/ha where the values of seed yield/plant were 3.59 and 3.58 g, respectively.

It is quite evident from the data that significantly higher grain yield (2033 kg/ha) was recorded under weed free conditions and it was at par with application of pendimethalin+imazethapyr @ 750 g/ha as PE (2010 kg/ha). Both these treatments significantly improved the seed yield by 27.06 and 25.6 per cent, respectively over pendimethalin @ 750 g/ha as PE which produced 1600 kg seed yield/ha. Application of imazethapyr @ 50 g/ha produced seed yield at par with pendimethalin @ 750 g/ha, however it was significantly higher over weedy check by 165.8 per cent. Similarly, bentazon @ 750 g/ha at 30 DAS produced seed yield of 1400 kg/ha which was at par with pendimethalin @ 750 g/ha but significantly superior over weedy check by 121 per cent.

Data revealed that compared to weedy check, all herbicidal treatments had positive effect on stover yield. The highest stover yield was obtained from the crop kept under weed free conditions (3283 kg/ha) and it was on par with application of pendimethalin+imazethapyr @ 750 g/ha as PE, pendimethalin @ 750 g/ha as PE and imazethapyr @ 50 g/ha at 20 DAS where the stover yield of 3267, 2950 and 2883 kg/ha were recorded, respectively. Application of pendimethalin+imazethapyr @ 750 g/ha as PE, pendimethalin @ 750 g/ha as PE and imazethapyr @ 50 g/ha at 20 DAS significantly improved the stover yield by 161.4, 136 and 130.6 per cent over weedy check, respectively. Similarly, application of bentazon @ 750 g/ha, sulfentrazone @ 75 g/ha and propaquizafop+imazethapyr @ 50 g/ha produced stover yield on par with each other but significantly superior over weedy check by 114.6, 101.4 and 98.6 per cent, respectively. The lowest stover yield was recorded in weedy check plots (1250 kg/ha).

The data presented in Table 1.2 revealed that the highest biomass yield was recorded under weed free condition (5316 kg/ha) and it was on par with the application of pendimethalin+imazethapyr @ 750 g/ha as PE (5277 kg/ha). Both these treatments significantly improved biomass yield by 16.8 and 15.97 per cent, respectively over pendimethalin @ 750 g/ha which produced 4550 kg biomass yield/ha.

Application of imazethapyr @ 50 g/ha, pendimethalin @ 750 g/ha, bentazon @ 750 g/ha and sulfentrazone @ 75 g/ha produced biomass yield on par with each other but significantly superior over weedy check by 142.4, 141.6, 116.8 and 106.2 per cent, respectively.

The data related to harvest index as influenced by different weed management treatments have been presented in Table 1.2. Harvest index indicate reproductive efficiency of different treatments as compared to weed free situation.

It is evident from the presented data that the highest harvest index was recorded in weed free conditions (38.24%). Amongst the herbicidal treatments, the highest harvest index was recorded with the application of pendimethalin+imazethapyr @ 750 g/ha as PE (38.08%), second highest being with the application of imazethapyr @ 50 g/ha at 20 DAS (36.85%). The harvest index recorded at imazethapyr @ 50 g/ha at 20 DAS was (36.85%). The lowest harvest index was recorded with application of fomesafen+fluazifop-p-butyl @ 200 g/ha (29.61%) closely followed by sodium acifluorfen+clodinafop propargyl @ 200 g/ha (30.28%)

Conclusion

On the basis of one season findings of the present investigation entitled **"Herbicidal weed management in chickpea (*Cicer arietinum* L.)"**, it can be concluded that under the soil and agro-climatic conditions of Jaipur, herbicidal weed management in chickpea pre-emergence application of pendimethalin+imazethapyr @ 750 g/ha was found most effective for management of weeds for obtaining higher production from the crop. This treatment recorded seed yield 2015 kg/ha with net return of 73,253/ha and B:C ratio 3.71. A

Application of imazethapyr @ 50 g/ha at 20 DAS is next best alternative herbicidal management practice which provided seed yield 1683 kg/ha.

Table 1.1 Total density of weeds, total dry matter accumulation, Weed control efficiency weed index, plant population,/M^2 plant height(cm) number of branches per plant dry matter accumulation.

Treatments	Total density of weeds		Total dry matter of weeds		Weed control efficiency		weed index	Plant population/m^2	Plant height (cm)		Number of branches/plant	dry matter
	90 DAS	At Harvest	90 DAS	At Harvest	90 DAS	At Harvest	%	Final	90 DAS	At Harvest	At Harvest	At Harvest
t_0	1.95 (3.33)	2.12 (4.00)	2.01 (3.58)	2.41 (5.32)	91.22	88.39	17.21	31.75	36.67	40.00	7.50	443.33
t_1	5.46 (29.33)	5.82 (33.33)	3.87 (14.50)	3.88 (14.56)	64.49	68.26	45.08	31.20	34.33	39.33	6.17	356.67
t_2	5.67 (31.67)	6.03 (35.88)	3.96 (15.17)	3.99 (15.40)	62.86	66.42	48.36	29.33	35.00	38.00	5.47	350.00
t_3	4.91 (23.67)	5.30 (27.58)	3.66 (12.92)	3.83 (14.17)	68.37	69.11	54.10	31.33	34.00	38.33	5.50	308.33
t_4	4.13 (16.67)	4.33 (18.33)	3.53 (12.00)	3.65 (12.83)	70.61	72.02	31.15	33.10	35.00	40.00	6.50	398.33
t_5	2.04 (3.67)	2.11 (4.00)	1.79 (2.72)	2.04 (3.71)	93.35	91.92	1.15	32.42	38.33	45.00	7.83	516.67
t_6	2.53 (6.00)	2.53 (6.00)	2.06 (3.75)	2.71 (6.89)	90.82	84.98	21.31	32.13	36.67	40.00	7.67	446.67
t_7	5.34 (28.00)	5.48 (29.53)	3.60 (12.50)	3.70 (13.17)	69.39	71.29	32.79	32.17	36.00	40.00	6.67	388.33
t_8	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	100.00	100.00	-	32.60	43.33	46.33	8.08	536.67
t_9	12.52 (156.33)	12.60 (158.33)	6.43 (40.83)	6.80 (45.87)	-	-	68.85	25.67	33.67	36.00	5.08	198.33
S Em+-	0.13	.14	0.089	.099				0.63	1.52	1.91	0.33	23.63
C.D.(P=(0.05)	.40	.40	.27	.90				1.88	4.52	5.70	1.00	70.23

Table 1.2 Pods per plant, seed per pod, length of pods, test weight, seed yield per plant, seed yield, stover yield, biomasss yield, harvest index.

Treatments	Pods/plant	Seeds/pod	Length of pod	100 - seed weight	Seed yield/plant	Seed yield	Stover yield	Biomass yield	Harvest index
	(No.)	(No.)	(cm)	(g)	(g)	(kg/ha)	(kg/ha)	(kg/ha)	index (%)
t_0	66.33	1.92	2.37	15.80	5.30	1683	2883	4566	36.85
t_1	59.33	1.30	2.34	12.40	3.58	1117	2483	3600	31.02
t_2	52.00	1.67	2.33	12.33	3.59	1050	2417	3467	30.28
t_3	48.33	1.50	2.24	11.97	2.98	933	2217	3150	29.61
t_4	64.33	1.80	2.34	14.43	4.23	1400	2683	4083	34.28
t_5	74.33	2.03	2.66	16.83	6.20	2010	3267	5277	38.08
t_6	69.00	1.85	2.57	15.73	4.99	1600	2950	4550	35.16
t_7	63.33	1.73	2.50	14.50	4.25	1367	2517	3884	35.19
t_8	73.00	2.08	2.67	16.89	6.24	2033	3283	5316	38.24
t_9	38.00	1.12	2.22	11.00	2.47	633	1250	1883	33.62
S Em±	3.17	0.13	0.11	0.34	0.33	98.36	156.92	245.02	0.85
CD (P=0.05)	9.43	0.41	NS	1.04	1	292.25	466.26	728.00	2.55

CONCLUSION

On the basis of one season findings of the present investigation entitled **"Herbicidal weed management in chickpea (*Cicer arietinum* L.)"**, it can be concluded that herbicidal weed management in chickpea pre-emergence application of pendimethalin+imazethapyr @ 750 g/ha was found most effective for management of weeds for obtaining higher production from the crop. This treatment recorded seed yield 2010 kg/ha with net return of ` 73,251/ha and B:C ratio 3.71.

Application of imazethapyr @ 50 g/ha at 20 DAS is next best alternative herbicidal management practice which provided seed yield 1683 kg/h.

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