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Influence of cultivars and post-emergence herbicides on growth and yield of chickpea

K Surendra Kumar, M Sunil Kumar, K Anny Mrudhula and T V Sridhar
Department of Agronomy, Acharya N G Ranga Agricultural University,
Agricultural College, Bapatla - 522101, Andhra Pradesh, India

ABSTRACT

A field experiment was conducted at Regional Agricultural Research Station, Lam Farm , Guntur campus of Acharya N.G. Ranga Agricultural University, Andhra Pradesh, India on clay soils to study the "Influence of cultivars and post emergence herbicides on growth and yield of chickpea" during *rabi* 2024-25.The experiment was laid out in a split plot design, replicated thrice with four chickpea cultivars as main plots and five post-emergence herbicides as subplots. The main plot treatments consisted of (M_1) NBeG-452, (M_2)JG-11,(M_3) Jaki-9218,(M_4)KAK-2.The subplot treatments consisted of (S_1)Topramezone@15 g ha^{-1} at 25 DAS, (S_2) Imazethapyr@40 g ha^{-1} at 25 DAS (S_3)Sodium Acifluorfen + Clodinafop propargyl@122.5 g ha^{1}(RM) at 25 DAS,(S_4)Fomesafen + Fluazifop-p-butyl@40 g ha^{-1}(RM) at 25 DAS,(S_5) Unweeded check. All the post-emergence herbicides were applied at 25 DAS. Among different post emergence herbicides Topramezone@15 g ha^{-1} at 25DAS registered significantly higher crop growth parameters and yield attributing characters that resulted in higher yield of chickpea.

Keywords: *Chickpea, Post-emergence herbicides and Seed yield*

Chickpea (*Cicer arietinum* L.), a globally significant food legume and a key pulse crop in India, faces substantial yield constraints due to weed infestation. Its short stature and slow initial growth make it highly susceptible to weed competition, resulting in yield losses ranging from 40–75% (Ratnam *et al*., 2011; chitale *et al*., 2024). Traditional weed management practices, such as pre-emergence herbicide application and manual weeding, are often employed (Kashyap *et al*., 2022) however, rising labor costs and labor shortages render manual weeding economically unviable. Moreover, pre-emergence herbicides fail to control late-emerging weeds effectively. While post-emergence herbicides like quizalofop-ethyl and propaquizafop are recommended for grass weed control, selective post-emergence herbicides for broadleaf weeds, which pose significant challenges in chickpea fields, remain limited due to concerns over crop phytotoxicity. Farmers urgently demand broad-spectrum post-emergence herbicides that are both effective and economical. To address these challenges, this study evaluates the efficacy of various post-emergence broad-spectrum herbicides on weed control, crop growth, yield, and economic outcomes in chickpea cultivation.

MATERIAL AND METHODS

The present experiment "Response of chickpea cultivars to different post-emergence herbicides" was conducted during 2024-25 in black clay soils of Regional Regional Agricultural Research Station, Lam, Guntur campus of Acharya N.G. Ranga Agricultural University, Andhra Pradesh.

The experiment was laid out in a split plot design, replicated thrice with four chickpea cultivars as main plots and five post emergence herbicides as subplots. The main plot treatments consisted of (M_1) NBeG-452, (M_2)JG-11, (M_3) Jaki-9218, (M_4) KAK-2.The subplot treatments consisted of (S_1)Topramezone@15 g ha^{-1} at 25 DAS,(S_2) Imazethapyr@40 g ha^{-1} at 25 DAS (S_3)Sodium Acifluorfen + Clodinafop propargyl@122.5 g ha^{-1} (RM) at 25 DAS,(S_4)Fomesafen + Fluazifop-p-butyl@40 g ha^{-1}(RM) at 25 DAS,(S_5) Unweeded check.

The data on growth at regular intervals and yield attributes at the time of harvest were recorded.

The seed yield was measured as total yield per plot and transformed to kg ha^{-1}. The data analyzed statistically as per the method suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Growth and Yield attributes

Plant height

The data in (Table1) shows Plant height recorded at harvest were statistically analysed for different chickpea cultivars and post-emergence herbicides. Plant height was significantly influenced by chickpea cultivars and post-emergence herbicides.

Plant height at harvest was significantly influenced with chickpea cultivars and post-emergence herbicides. At harvest KAK-2 variety(M_4). Recorded significantly higher plant height and it was found to be on par with NBeG-452 variety (M_1). Significantly the lower plant height was recorded with JG-11 variety(M_2).

Among the post-emergence herbicides significantly higher plant height at harvest was recorded with the application of topramezone @ 15g ha^{-1}(S_1). which was on par with Sodium Acifluorfen + Clodinafop propargyl @ 122.5 g ha^{-1}(S_3) and these two treatments recorded higher plant height over Imazethapyr @ 40 g ha^{1}(S_2). and Fomesafen + Fluazifop-p-butyal @ 40 g ha^{1} (S_4) whereas significantly lowest plant height was recorded in unweeded check. The higher plant height at harvest with Topramezone @ 15 g ha^{-1} (S_1) comparable to Sodium Acifluorfen + Clodinafop Propargyl @ 122.5 g ha^{-1}, (S_3). can be attributed to their effective weed control, which minimized competition for essential resources like light, nutrients and water, promoting optimal chickpea growth. This recovery facilitated enhanced vegetative growth, as evidenced by increased plant height compared to other treatments. These results underscore the role of these post-emergence herbicides in fostering robust crop

Table 1. Growth, yield parameters and yield in chickpea as affected by chickpea cultivars and post-emergence herbicides

Treatments	Plant height(cm) at harvest	No of branches $plant^{-1}$	Yield (kg ha-1)
Chickpea cultivars			
M1:NBeG-452	51.00	25.10	1813
M2:JG-11	47.60	22.70	1478
M3:Jaki-9218	49.40	23.90	1693
M4:KAK-2	53.50	20.90	1374
S.Em (±)	1.13	0.55	42.3
CD (P=0.05%)	3.90	1.90	146
CV (%)	8.70	9.10	10
Post emergence herbicides			
S1:Topramezone@15g ha 1 at 25 DAS	57.40	79.10	2010
S2:Imazethapyr@40 g ha-1 at 25 DAS	52.00	56.50	1587
S3: Sodium acifluorfen +Clodinafop propargyl@122.5 g ha-1 (RM) at 25 DAS	54.80	74.70	1823
S4:Fomesafen+Fluazifop-p-butyl@40 g ha-1 (RM)at 25 DAS	46.60	50.90	1423
S5: Un weeded check	41.10	46.80	1105
S.Em(±)	1.35	2.08	42.2
CD (P=0.05%)	3.90	6.00	122
CV (%)	9.30	11.70	9
Interaction			
Mx S	NS	NS	NS
Sx M	NS	NS	NS

development by reducing weed interference in chickpea cultivation.

There is no significant interaction effect among the chickpea cultivars and post- emergence herbicides on plant height at harvest. These findings are in agreement with the earlier reports of Chitale *et al*. (2024) and Sanketh *et al*. (2021)

No of branches per plant

Data pertaining to number of branches plant^{-1} in chickpea presented in Table 1 revealed that the chickpea cultivars and post-emergence herbicides could significantly influence the number of branches, but interaction was non-significant.

Significantly the higher number of branches per plant were recorded with NBeG-452 (25.1) (M_1) which was on par with Jaki-9218 (23.9) (M_3) and showed significant effect with JG-11 (22.7) (M_2) and KAK-2 (20.9) (M_4). The higher number of branches per plant in NBeG-452 (M_1) and Jaki-9218 (M_3) due to their superior genetic potential, vigorous early growth and efficient assimilate partitioning towards axillary bud development. These varieties are known for their prolific branching habit, contributing to better canopy structure and productivity. In contrast, KAK-2 (M_4) and JG-11 (M_4) exhibited fewer branches due to their comparatively determinate or less-branching growth habit.

Among the post-emergence herbicides applied at 25 DAS, significantly highest number of branches per plant were recorded with Topramezone 15 g ha^{-1} (16.6) (S_1) followed by the application of Sodium Acifluorfen + Clodinafop Propargyl 122.5 g ha^{-1}(S_3) (14.3) and these two treatments are having more number of branches than Imazethapyr @40 g ha^{1} (S_2) and Fomesafen+ Fluazifop-p-butyl (S_4) as these herbicides are having higher values of weed density and dry weight. Significantly lowest number of branches plant^{-1} were reported under unweeded check (6.0) (S_5). Significantly higher number of branches plant^{1} with Topramezone 15 g ha^{-1} (S_1) and Sodium Acifluorfen + Clodinafop Propargyl 122.5 g ha^{-1} (S_3) is due to their effective post-emergence weed control, which reduces crop–weed competition for light, nutrients and moisture, thereby promoting better axillary bud development and branching. In contrast, the unweeded check faced intense competition, which suppressed growth and branching due to resource limitation. Similar findings were reported by Chitale *et al*. (2024), who documented improved crop architecture under effective weed management regimes. The interaction effect was found to be non-significant among the chickpea cultivars and post-emergence herbicides.

Seed yield

On appraisal of data pertaining seed yield was presented in Table 1 revealed that chickpea cultivars and post emergence herbicides has significant effect but their interaction was not effective.

The data reveals that, NBeG-452 variety(1813kg ha^{-1}) (M_1) recorded significantly the higher seed yield which was on par with Jaki-9218 variety (1693 kgha^{-1}) (M_3) and these two cultivars are having higher seed yield over JG-11(M_2), while significantly lower seed yield was recorded with KAK-2 variety (1374 kg ha^{-1}) (M_4). Experimental data reveals that various post-emergence herbicides application had a significant impact on seed yield. Significantly maximum seed yield was recorded with the application of Topramezone 15 g ha^{-1} at 25 DAS (2010 kg ha^{-1}) (S_1) which was found to be on par with Sodium Acifluorfen + Clodinafop Propargyl 122.5 g ha^{-1} at (1823) (S_3) and superior to Imazethapyr (S_2) and Fomesafen + Fluazifop-p-butyl (S_4). The higher seed yield with the post-emergence application of Topramezone due to increasing number of branches palnt^{1}, no of pods plant^{-1}.

The superior seed yields in cultivars NBeG-452 and Jaki-9218 may be attributed to their enhanced morphological traits, such as higher number of branches and pods per plant, which translated into better sink capacity and reproductive success. These genotypes likely utilized available resources more efficiently under weed-free conditions. Topramezone and Sodium Acifluorfen + Clodinafop Propargyl outperformed other herbicide treatments due to their effective weed control, which minimized competition and enhanced resource availability for chickpea plants. The unweeded check recorded the lowest seed yield due to severe competition from weeds.

The yield improvement under these treatments is mainly due to effective weed control, leading to reduced competition and better resource availability. Meanwhile, the weedy check plots recorded the lowest yield due to continuous crop-weed competition. These results highlight the importance of appropriate herbicide selection and varietal choice for

achieving optimum yield in chickpea under post-emergence weed management systems. The superior performance of Topramezone may be attributed to enhanced weed suppression, leading to increased number of branches and seed yield (Nath *et al*., 2021 ; Sethi *et al*., 2021). These results are in accordance with Gairola *et al*. (2024) who also reported significant gains in chickpea productivity following effective post-emergent weed management.

There is no significant interaction among the chickpea cultivars and post- emergence herbicides on seed yield.

CONCLUSION

· Among the chickpea cultivars NBeG-452 recorded higher plant height,No.of branches and significantly higher seed yield and it is on par with Jaki-9218 and significantly lower plant height, No. of branches plant^{-1} and seed yield was recorded in KAK-2.

· Among the post-emergence herbicides Topramezone@15 g ha^{-1}(S_1) registered lower weed density and dry weight comparable with Sodium Acifluorfen + Clodinafop propargyl@122.5g ha^{-1}(S_3) and resulted in improved crop growth parameters,seed yield.

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