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Effect of integrated weed management practices on growth and yield of Kabuli chickpea

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Abstract

A field experiment was conducted during *rabi* of 2022-2023 at Agricultural college farm, Bapatla, Andhra Pradesh to study the effect of various herbicides on growth and yield of chickpea. The experiment consisted of eleven treatments which was laid out in randomized block design with three replications. Plant height, drymatter production, number of pods plant⁻¹ and seed yield were found superior with hand weeding at 15 DAS and 30 DAS and butachlor @ 1.5 kg a.i. ha⁻¹ as PE *fb* hand weeding at 30 DAS. Among the herbicide combinations studied, butachlor @ 1.5 kg a.i. ha⁻¹ as PE *fb* sodium acifluorfen @ 160 g + clodinafop propargyl @ 80 g a.i. ha⁻¹ as PoE at 30 DAS recorded higher plant height, drymatter production, number of pods plant⁻¹ and seed yield which was comparable with butachlor @ 1.5 kg a.i. ha⁻¹ as PE *fb* fomesafen @ 110 g + fluazifop-p-butyl @ 110 g a.i. ha⁻¹ as PoE at 30 DAS.

Keywords: Chickpea, herbicide, drymatter, yield

Introduction

Chickpea is one of the most important *rabi* pulse crop of India. It is very good source of carbohydrates and proteins which contains 18-22% protein, 61-62% carbohydrates, 4.5% fat with a calorific value of 396 kcal 100 gm⁻¹. Chickpea (*Cicer arietinum* L.) is the second most cultivated and most consumed grain legume after beans worldwide (FAOSTAT, 2021). It is grown in an area of 10 million hectares with a production of 11.91 million tonnes and a productivity of 1192 kg ha⁻¹ in India. In Andhra Pradesh, it is cultivated in an area of 0.47 million hectares with a production of 0.53 million tonnes and a productivity of 1136 kg ha⁻¹ (Agricultural statistics at a glance - 2022)^[1]. The productivity of chickpea is comparatively very low. This may be due to various biotic and abiotic factors. Poor weed management is one of the most limiting factors in chickpea. Chickpea, which is slow in early growth and being a short stature plant, it is highly susceptible to weed competition and often considerable losses may occur if weeds left uncontrolled. Chaudhary *et al.* (2005)^[2] reported 75% of yield reduction in chickpea due to serious competition with weeds. To manage these weeds generally hand weeding is followed, due to increase in labour costs it is not economically viable and there is need for prioritizing other options like intercultivation and herbicides. As a response to this several integrated weed management practices and herbicides were tested for weed control in chickpea.

Materials and Methods

A field experiment was conducted during *rabi* of 2022-2023 at Agricultural college farm, Bapatla, Acharya N.G. Ranga Agricultural University, Andhra Pradesh. The soil was clay in texture with neutral pH, having low organic carbon 0.36%, available nitrogen 160 kg /ha and medium available phosphorus 26.4 kg /ha, medium available potassium 320 kg/ha. The experiment consists of 11 treatments viz., T₁: Weedy check, T₂: Hand weeding at 15 DAS and 30 DAS, T₃: Butachlor @ 1.5 kg a.i. /ha as PE, T₄: Butachlor @ 1.5 kg a.i. /ha as PE *fb* Sodium Acifluorfen @ 160 g + Clodinafop Propargyl @ 80 g a.i. /ha as PoE at 30 DAS, T₅: Butachlor @ 1.5 kg a.i. /ha as PE *fb* Fomesafen @ 110 g + Fluazifop-p-butyl @ 110 g a.i. /ha as PoE at 30 DAS, T₆: Butachlor @ 1.5 kg a.i. /ha as PE *fb* Topramezone @ 25 g a.i. /ha as PoE at 30 DAS, T₇: Butachlor @ 1.5 kg a.i. /ha as PE *fb* Quizalofop ethyl @ 50 g a.i. /ha as PoE at 30 DAS, T₈: Butachlor @ 1.5 kg a.i. /ha as PE *fb* Hand weeding at 30 DAS, T₉: Butachlor @ 1.5 kg a.i. /ha as PE *fb* Intercultivation at 30

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DAS, T₁₀: Intercultivation at 15 DAS and 30 DAS, T₁₁: Hand weeding at 15 DAS *fb* Intercultivation at 30 DAS. The experiment was laid out in randomized block design with three replications. Chickpea, NBeg-149 variety was sown on fully prepared experimental field with a spacing of 45 cm × 10 cm. Before sowing, entire dose of nitrogen (20 kg /ha) and phosphorus (50 kg /ha) and potassium (40 kg /ha) was applied as basal. Application of both pre emergence and post emergence herbicides was done as per the respective treatments.

Results and Discussion

The predominant weed species observed in the experimental plot were grasses like *Cynodon dactylon*, *Dinebra retroflexa*, *Dactylactenium aegyptium*, *Chloris barbata*; sedge like *Cyperus rotundus* and broad leaved weeds like *Trichodesma indica*, *Cleome viscosa*, *Digera arvensis*, *Phyllanthus niruri*, *Parthenium hysterophorus*, *Euphorbia hirta*, *Chrozophora rottleri* and *Physalis minima*.

Higher plant height, drymatter production were found with hand weeding at 15 DAS and 30 DAS which was on par with butachlor @ 1.5 kg a.i. ha⁻¹ as PE *fb* hand weeding at 30 DAS. Among herbicide combinations, butachlor @ 1.5 kg a.i. ha⁻¹ as PE *fb* sodium acifluorfen @ 160 g + clodinafop propargyl @ 80 g a.i. ha⁻¹ as PoE at 30 DAS recorded higher plant height, and drymatter production which was comparable with butachlor @ 1.5 kg a.i. ha⁻¹ as PE *fb* fomesafen @ 110 g + fluazifop-p-butyl @ 110 g a.i. ha⁻¹ as PoE at 30 DAS. Higher drymatter production in chickpea with hand weeding at 15 DAS and 30 DAS may be attributed to reduced competition for growth resources, which facilitated a favorable environment for improved crop growth and higher accumulation of dry matter. These reports were in accordance with Balwan *et al.* (2016) [6].

The higher number of pods plant⁻¹, seed yield and haulm yield

were recorded with hand weeding at 15 DAS and 30 DAS and it was on par with butachlor @ 1.5 kg a.i. /ha as PE *fb* hand weeding at 30 DAS. This might be due to reduced crop weed competition during their critical period which favoured better environment for crop growth and development. These results are in agreement with the findings of Chaudhary *et al.* (2005) [2]. Among the herbicide combinations studied, higher number of pods plant⁻¹, seed yield and haulm yield were recorded with the application of butachlor @ 1.5 kg a.i. /ha as PE *fb* sodium acifluorfen @ 160 g + clodinafop propargyl @ 80 g a.i. /ha as PoE at 30 DAS which was on par with butachlor @ 1.5 kg a.i. /ha as PE *fb* fomesafen @ 110 g + fluazifop-p-butyl @ 110 g a.i. /ha as PoE at 30 DAS. The decrement in yields of the herbicide combinations was due to the phytotoxicity of the herbicides on the chickpea crop.

Phytotoxicity

Symptoms like chlorosis and slight stunting was observed in the treatment butachlor @ 1.5 kg a.i. /ha as PE *fb* sodium acifluorfen @ 160 g + clodinafop propargyl @ 80 g a.i. /ha as PoE at 30 DAS after spraying of post emergence herbicide. The crop regained its satisfactory growth within 7-14 days after spraying of post emergence herbicide. Similar observations were reported by Nath *et al.* (2018) [4] and Manasa *et al.* (2022) [3].

Symptoms like discoloration of leaves, stunted growth and slight injury was observed in the treatment butachlor @ 1.5 kg a.i. /ha as PE *fb* fomesafen @ 110 g + fluazifop-p-butyl @ 110 g a.i. /ha as PoE at 30 DAS. However, the crop regained its normal growth within 14-21 days after spraying of post emergence herbicide. In case of butachlor @ 1.5 kg a.i. /ha as PE *fb* topramezone @ 25 g a.i./ha as PoE at 30 DAS treatment, severe injury of the crop was seen and the crop recovered 21 days after spraying of post emergence herbicide. These observations were in accordance with the sanketh *et al.* (2021) [5].

Table 1: Effect of integrated weed management practices on growth and yield of kabuli chickpea

Treatment	Plant height (cm)	Drymatter production (g/m ²)	Pods /Plant	Seed yield (kg/ha)	Haulm yield (kg /ha)
T ₁ : Weedy check	25.20	128.33	6.3	393	699
T ₂ : Hand weeding at 15 DAS and 30 DAS	47.87	486.67	26.4	1766	2520
T ₃ : Butachlor @ 1.5 kg a.i. /ha as PE	30.27	183.33	9.7	620	1051
T ₄ : Butachlor @ 1.5 kg a.i. /ha as PE <i>fb</i> Sodium Acifluorfen @ 160 g + Clodinafop Propargyl @ 80 g a.i. /ha as PoE at 30 DAS	42.13	326.67	18.2	1160	1720
T ₅ : Butachlor @ 1.5 kg a.i. /ha as PE <i>fb</i> Fomesafen @ 110 g + Fluazifop-p- butyl @ 110 g a.i. /ha as PoE at 30 DAS	41.07	316.33	17.9	1135	1687
T ₆ : Butachlor @ 1.5 kg a.i. /ha as PE <i>fb</i> Topramezone @ 25 g a.i. /ha as PoE at 30 DAS	31.33	200.00	11.3	657	1060
T ₇ : Butachlor @ 1.5 kg a.i. /ha as PE <i>fb</i> Quizalofop ethyl @ 50 g a.i. /ha as PoE at 30 DAS	36.40	252.00	14.5	897	1372
T ₈ : Butachlor @ 1.5 kg a.i. /ha as PE <i>fb</i> Hand weeding at 30 DAS	47.07	452.00	25.8	1740	2490
T ₉ : Butachlor @ 1.5 kg a.i. /ha as PE <i>fb</i> Intercultivation at 30 DAS	45.67	393.33	21.9	1440	2105
T ₁₀ : Intercultivation at 15 DAS and 30 DAS	43.13	343.33	18.4	1193	1752
T ₁₁ : Hand weeding at 15 DAS <i>fb</i> Intercultivation at 30 DAS	46.13	404.33	22.5	1517	2209
SEm(±)	1.57	12.10	1.1	76	105
LSD (P=0.05)	4.64	35.69	3.2	225	311
C.V (%)	6.87	6.61	10.7	12	11

Table 2: Phytotoxic effect of different herbicides on kabuli chickpea

Treatment	7 DAS	14 DAS	21 DAS
T ₁ : Weedy check	-	-	-
T ₂ : Hand weeding at 15 DAS and 30 DAS	-	-	-
T ₃ : Butachlor @ 1.5 kg a.i. /ha as PE	-	-	-
T ₄ : Butachlor @ 1.5 kg a.i. /ha as PE <i>fb</i> Sodium Acifluorfen @ 160 g + Clodinafop Propargyl @ 80 g a.i. /ha as PoE at 30 DAS	1	0	0
T ₅ : Butachlor @ 1.5 kg a.i. /ha as PE <i>fb</i> Fomesafen @ 110 g + Fluazifop-p- butyl @ 110 g a.i. /ha as PoE at 30 DAS	1	2	0
T ₆ : Butachlor @ 1.5 kg a.i. /ha as PE <i>fb</i> Topramezone @ 25 g a.i. /ha as PoE at 30 DAS	1	5	5
T ₇ : Butachlor @ 1.5 kg a.i. /ha as PE <i>fb</i> Quizalofop ethyl @ 50 g a.i. /ha as PoE at 30 DAS	0	0	0
T ₈ : Butachlor @ 1.5 kg a.i. /ha as PE <i>fb</i> Hand weeding at 30 DAS	-	-	-
T ₉ : Butachlor @ 1.5 kg a.i. /ha as PE <i>fb</i> Intercultivation at 30 DAS	-	-	-
T ₁₀ : Intercultivation at 15 DAS and 30 DAS	-	-	-
T ₁₁ : Hand weeding at 15 DAS <i>fb</i> Intercultivation at 30 DAS	-	-	-

Rating: Note: DAS – Days after spraying of post emergence herbicides

0 – No injury, normal

1. – Slight stunting, injury or discolour

2 – Some stand loss, stunting / discolour

5 - Injury more persistent, recovery doubtful

Conclusion

Based on the results obtained from the experiment, better growth and yield were observed in hand weeding at 15 DAS and 30 DAS and it was on par with butachlor @ 1.5 kg a.i. /ha as PE *fb* hand weeding at 30 DAS. Among the various herbicide combinations studied, butachlor @ 1.5 kg a.i. /ha as PE *fb* sodium acifluorfen @ 160 g + clodinafop propargyl @ 80 g a.i. /ha as PoE at 30 DAS was found to be effective.

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