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Use of pre and post emergent herbicides for better weed control, higher seed yield and economics of chickpea (*Cicer arietinum* L.)

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Abstract
A field experiment was conducted during rabi season, 2022-23 and 2023-24 at Zonal Agricultural Research Station, Kalaburagi, (Karnataka) to assess the 'use of pre and post emergent herbicides for better weed control, higher seed yield and economics of chickpea'. The soil of experimental site was medium black clay in texture having alkaline pH of 8.4, bulk density 1.33 g/cc and with organic carbon content 5.2 g kg^{-1}. The soil was medium in nitrogen (178 kg ha^{-1}), low in phosphorus (22 kg ha^{-1}) and medium in potassium (328 kg ha^{-1}). The results of the experiment revealed that among the herbicides used, application of oxyfluorfen 150 g *fb* quizalofop-p-ethyl @ 100 g a.i. ha^{-1} at 15-20 DAS indicated significantly lower weed density and dry weight of weeds (4.37 & 5.07; 3.70 g & 4.60 g plant^{-1} at 30 and 45 DAS respectively) and recorded significantly higher growth parameters *viz*., plant height (35.21 cm), number of branches (4.68) and dry matter production (17.36 g plant^{-1}), yield parameters *viz*., number of pods plant^{-1} **(**28.01**)** seed weight per plant^{-1} (9.79 g), 100 seed weight (21.19 g plant^{-1}), haulm yield (3271 kg ha^{-1}) and harvest index (35.18%) finally yielding higher seed yield (1775 kg ha^{-1}) over other herbicide treatments. The treatment registered significantly higher weed control efficiency (68.61% & 59.97% at 30 and 45 DAS) and weed index (5.57) along with higher gross returns (₹.91032), net returns (₹.66567), and B:C ratio (3.72). However weedy check recorded significantly higher weed density and weed dry weight but revealed lower growth and yield parameters. Among all the treatments, weed free check recorded significantly lower weed density, weed dry weight and significantly higher growth and yield attributes finally resulting in significantly higher yield (1881 kg ha^{-1}) and economics (₹.96570, ₹.70803 and 3.83 gross returns, net returns and B:C ratio respectively).

Keywords: Herbicide, weed control efficiency, growth, yield, economics, chickpea

1. Introduction

Chickpea (*Cicer arietinum* L.) is one of the most prominent pulse crops not only in India but also in the world. It is called by different synonyms such as gram or bengalgram and is popularly referred to as chana in several places of the country. Chickpea is a cool season long-day legume crop belongs to the family fabaceae and subfamily faboideae. It is valued for its rich nutritive seed with enormous source of protein (23%), carbohydrate (63%), fat (5%), crude fiber (6%), ash (3%) and also rich in calcium, magnesium, iron and niacin (Ratnam *et al*.,2011) [16]. Hence, it is increasingly consumed as a substitute for animal protein. It is predominantly consumed in the form of whole grain or dhal, sprouted grain, green or matured dry seeds and is used in the preparation of variety of snacks, sweets and condiments. Due to its high nutritional value, it has become an integral part of the daily dietary system for over millions of people. In India chickpea is grown on an area of 10.74 m ha, with a production of 13.54 m t and a productivity of 1261 kg ha^{-1} (Anon, 2024) [1]. In Karnataka, chickpea occupies an area of 0.73 million hectares having 0.47 m. tones of production with an average productivity of 689 kg ha^{-1} (Anon., 2024a) [2]. In Karnataka, Kalaburagi occupies the first position with respect to chickpea area (1.24 lakh ha), production (8.63 lakh tonnes) and productivity (733 kg ha^{-1}) (Anon, 2024b) [3] Chickpea is grown during rabi under residual moisture conditions and marginal lands which are low in fertility status and facing various biotic and abiotic stresses.

The overall productivity of chickpea in India is comparatively low as compared to other countries. The lower productivity of chickpea is mainly because of several biotic and abiotic factors. Among the biotic factors, heavy weed infestation is the major factor responsible for poor yield of chickpea. Heavy weed infestation is recognized as a major bottleneck in realizing the potential yield of chickpea. The crop has to compete for light, water, nutrient, and space with weeds during initial growth phases. The report suggested that 30-50% losses in chickpea yield have been estimated due to weed infestation. Weeds pose a serious threat in chickpea and cause up to 50-60 per cent yield losses as indicated by Ratnam *et al*., 2011 [15]. Since the crop is grown in rabi season, if it is infested by a large number of weeds which have quick growth habit the growth and yield will be severely affected. The first 20-30 days after sowing are most critical period of competition between crop and weed for resources (nutrients, moisture, light and space). During this period, as the crop is having slow growth and weeds grow fast. They smother the crop and offer great completion for moisture, nutrients, light and space. They take most of the native and applied nutrients. The problem is further aggravated under the conditions of water stress where, weeds utilize the available moisture in the root zone quickly as they have quick growth habit as established by Kamble *et al*,.2014 [8]. Therefore, research methodologies need to be reoriented to evolve appropriate weed management practices for their better control and improving the productivity of chickpea. Thus, keeping theses points in view, an experiment to study the effect pre and post emergent herbicides on weed control, growth, yield and economics of chickpea was planned and implemented.

2. Materials and Methods

A field experiment was conducted during rabi season, 2022-23 and 2023-24 at Zonal Agricultural Research Station, Kalaburagi (Karnataka) to assess the 'use of pre and post emergent herbicides for better weed control, higher yield and economics of chickpea'. The soil of experimental site was medium black clay in texture having alkaline pH of 8.4, bulk density 1.33 g/cc and with organic carbon content 5.2 g kg^{-1}. The soil was medium in nitrogen (178 kg ha^{-1}), low in phosphorus (22 kg ha^{-1}) and medium in potassium (328 kg ha^{-1}) at the time of initiation of the experiment. The climate of the area was subtropical, received annual average rainfall of 720 mm and mean maximum and minimum temperature were 38.77^{o}C and 17.76^{o}C, respectively. The experiment was laid out in Randomized complete block design (RCBD) with three replications. The experiment consisted of 13 treatments as T1: Oxyfluorfen @ 150 g a.i. ha^{-1} (PRE), T2: Oxyfluorfen @ 250 g a.i. ha^{-1} (PRE), T3: Quizalofop-P-Ethyl @ 100 g a.i. ha^{-1} at 15-20 DAS, T4: Propaquizafop @ 100 g a.i. ha^{-1} at 15-20 DAS, T5: Topromezone @ 20.6 g a.i. ha^{-1} at 14 DAS, T6: Topromezone @ 20.6 g a.i. ha^{-1} at 21 DAS, T7: Topromezone @ 25.7 g a.i. ha^{-1} at 21 DAS, T8: Oxyfluorfen 150 g *fb* Quizalofop-p-ethyl @ 100 g a.i. ha^{-1} at 15-20 DAS, T9: Oxyfluorfen 150 g *fb* Propaquizafop @ 100 ga.i. ha^{-1} at 15-20 DAS, T10: Oxyfluorfen 150 g *fb* Topramezone @ 20.6 g a.i. ha^{-1} at 14-21 DAS, T11: Pendimethalin @ 750 g a.i. ha^{-1}, T12: Weedy check and T13: Weed free check. The sowing of the experiment was done during 2nd fortnight of October in both the years of experimentation. The certified seeds of chickpea variety JG-11 were used for sowing. The recommended dose of fertilizer (25: 50 N:P kg ha^{-1}) was applied at the time of sowing. The crop was sown by hand dibbling and maintaining spacing of 30 cm between rows and 10 cm between plants. A knapsack sprayer fitted with flat fan nozzle was used to apply the pre-emergent weedicide on the first day after sowing and post-emergent weedicide was sprayed as per the treatment with a spray volume of 750 l ha^{-1}. In different plots weed management operation was done as per the treatments. Observations on weed population were recorded at 30 and 45 DAS. Weeds were counted randomly at selected places in each plot using 0.5 × 0.5 m quadrant (0.25 m^{2}). Weed count was expressed as number per m^{-2} and subjected to square-root transformation $(x+0.5)^{1/2}$ to normalize their distribution. Total weed density was obtained by adding all the grasses, sedges and broad leaf weeds. The weeds removed from the selected areas were dried at 70^{o} C for 72 hours to obtain constant weight and the dry weight was expressed in g m^{-2}. Weed control efficiency (WCE) was calculated by using suitable formula given by Lal *et al.*, 1990 [13].

$$\text{WCE (100)} = \frac{\text{WCC - WCT}}{\text{WCC}} \text{ X 100}$$

Where,
WCC = Dry weight of weeds in unweeded control plot (g)
WCT = Dry weight of weeds in treated plot (g)

Weed index represents actual measure of weeds present and was calculated by following suitable formula (Lal *et al.*, 1990) [13].

$$\text{WI} = \frac{\text{X - Y}}{\text{X}} \text{ X 100}$$

Where,
X = Seed yield in weed free check plot (kg ha^{-1})
Y= Seed yield in treated plot (kg ha^{-1})

Suitable plant protection measures were followed during the cropping season. Five plants were randomly selected in each net plot area for taking observations on growth and yield and quality attributing parameters as per the schedule. The crop in each net plot was harvested separately as per treatment and the values were converted into hectare basis and expressed in kilograms per hectare. The data recorded during the investigation were compiled and analyzed for statistical significance as per the analysis of variance for the split plot design. Fisher's method of analysis of variance (ANOVA) adopted for the purpose. Standard error of mean and coefficient of variability have been worked out for a set of observations under each character at P=0.05 to interpret the significance as given by Panse VG and Sukhatme, 1978 [14].

3. Results and Discussion

Weed flora observed

Many different types of weeds were observed in the experimental plot of chickpea. The most important grassy weeds observed in the experimental plot were *Cynodon dactylon*, *Panicum repens*, *Dactyloctenium aegyptium*, *Digitaria marginata* and *Erogrostis gangetica*. While common broad-leaved weeds observed were *Commelina benghalensis*, *Phyllanthus niruri*, *Tribulus terrestris*, *Abutilon indicum*, *Euphorbia hirta*, *Trichodesma* spp., *Portulaca oleracea*, *Tridax procumbens*, *Amaranthus viridis*, *Digeria arvensis* and *Leucus aspera* and the common sedge observed was *Cyperus* rotundus (Kalyani and Srinivasulu, 2011) [7, 12]

Effect on weed density weed dry weight

The weed density and weed dry weight in all the treatments at 30 and 45 DAS were significantly reduced with the use of weedicide compared to weedy check (Table 1 & 2). Among the herbicide treatments, the pooled data indicated that significantly lower weed density (4.37 and 5.07 at 30 and 45 DAS respectively) was recorded with use of oxyfluorfen 150 g *fb* quizalofop-p-ethyl @ 100 g a.i. ha^{-1} at 15-20 DAS and weed dry weight also followed the similar trend (3.70 and 4.60 g m^{-2} at 30 and 45 DAS respectively). these results are in conformity with findings of Kumar *et al*, 2014 [11]. This was mainly due to combination of both pre and post emergent herbicide which were efficient in killing the most of the weeds compared to other treatments. Oxyflorofen primarily acts by inhibiting the enzyme protoporphyrinogen oxidase (PPO), which is crucial for chlorophyll synthesis. This inhibition causes a buildup of toxic prophyrins, damaging cell membranes and leading to rapid desiccation and death of weeds. Quizalofop-P-ethyl's acts by inhibiting the Acetyl-CoA carboxylase (ACCase) enzyme, which is crucial for lipid and fatty acid synthesis (Kachhadiya *et al*, 2009) [6]. Among all the treatments, weedy check recorded significantly higher weed density (7.44 and 8.18 at 30 and 45 DAS respectively) and weed dry weight (6.53 and 7.47 g m^{-2} at 30 and 45 DAS respectively) due to presence of more number of weeds. Whereas, weed free check recorded significantly lower weed density (2.62 and 2.97) and weed dry weight (2.21 and 2.90 g m^{-2}) when compared to all other treatments. This was mainly due to less density of weeds contributing less dry weight in weed free check. Similar results are obtained by Lal, 1990 [13].

Effect on weed control efficiency and weed index

Among the herbicide treatments, the pooled data (Table 3) indicated that application of oxyfluorfen 150 g *fb* quizalofop-p-ethyl @ 100 g a.i. ha^{-1} at 15-20 DAS recorded significantly higher weed control efficiency (68.61% and 59.97% at 30 and 45 DAS respectively) compared to other treatments. This was mainly due to efficient killing of weeds due to combination of pre and post emergent herbicides. Among the herbicides, lower weed control efficiency (48.49% and 40.83% at 30 and 45 DAS respectively) was observed with the use of oxyfluorfen @ 150 g a.i. ha^{-1} as pre emergent spray (48.49% and 40.83% at 30 and 45DAS respectively). similar observations are made by Buttar, *et al*., 2008 [4]. With regard to weed index, application of oxyfluorfen 150 g *fb* quizalofop-p-ethyl @ 100 g a.i. ha^{-1} at 15-20 DAS recorded significantly lower weed index (5.57) owing to effective death of weeds by the herbicides as compared to other herbicidal treatments whereas, weedy check recorded significantly higher weed index (22.84) due to more number of weeds compared to all other treatments. Similar results are obtained by Poonia TC and Pithia (2013) [15] and Sanket *et al*., 2021 [18].

Effect on growth parameters

Growth of the plant was severely affected due to the presence of weeds as they competed with crop for growth resources. It is clear from the pooled data (Table 4) that among all the treatments, significantly lower plant height, number of branches and dry matter production were obtained with weedy check (28 cm, 3.05 and 8.98 g $plant^{-1}$ respectively). This was mainly due to the presence of more number of weeds in the treatment and the intense competition by the weeds for the growth resources which they utilized and suppressed the crop. Whereas, weed free check recorded significantly higher values (37.67, 5.34 and 19.88 gm^{-2}cm plant height, number of branches and dry matter production respectively) due to less competition by the weeds in the treatment (Sanket *et al*., 2021) [18]. Among the herbicides, application of oxyfluorfen 150 g *fb* quizalofop-p-ethyl @ 100 g a.i. ha^{-1} at 15-20 DAS recorded significantly higher plant height, number of branches and dry matter production per plant (35.21, 4.68 and 17.36 g respectively) as the combination of pre and post emergent herbicide was more effective in controlling the weeds there by avoiding the competition by the weeds in the treatment as compared to other herbicidal treatments. Similar results are obtained by Dubey *et al*., 2018 [5] and Rupareliya *et al*., 2017 [17].

Effect on yield and yield parameters

Different treatments had significant effect on yield and yield parameters of chickpea (Table 5 & 6). The pooled data indicated that, weedy check recorded significantly lower seed yield (1448 kg ha^{-1}) compared to all the treatments that was due to production of significantly lower number of pods per plant, seed weight per plant, 100 seed weight, haulm yield and harvest index (18, 5.85, 17.98, 2891 kg ha^{-1} and 32.85% respectively) compared to all the treatments. The high density of weeds caused stiff competition with crop for growth resources leading to poor growth and consequently lesser yield in this treatment. These results confirm the findings of Srikanth *et al*., 2021 [19]. Whereas, weed free check recorded significantly higher seed yield (1881 kg ha^{-1}) compared to all other treatments. This was mainly due to production of significantly higher yield attributes such as number of pods $plant^{-1}$, seed weight per $plant^{-1}$, 100 seed weight, haulm yield and harvest index (31.02, 10.66 g, 21.49 g, 3417 kg ha^{-1} and 35.50 respectively) as there was less competition by weeds with crop (Khope *et al*., 2011) [10]. Among the herbicide treatments, application of oxyfluorfen 150 g *fb* quizalofop-p-ethyl @ 100 g a.i. ha^{-1} at 15-20 DAS recorded significantly higher number of pods $plant^{-1}$, seed weight per $plant^{-1}$, 100 seed weight, haulm yield and harvest index (28.01, 9.79 g, 21.19 g, 3271 kg ha^{-1}, 35.18% respectively). The application of herbicide provided best weed free condition in this treatment leading to better growth and yield parameters. These findings are in conformity with Yadav *et al*., 2019 [20]. All these parameters contributed for the production of significantly higher seed yield (1775 kg ha^{-1}) over other herbicide treatments.

Effect on economics

The economics of chickpea cultivation was significantly influenced by different weed management treatments. The pooled data (Table 7) indicated that weed free check recorded significantly higher gross returns, net returns and B:C ratio (₹. 96570, ₹. 70803 and 3.83 respectively) compared to all the treatments owing to higher yield in that treatment because of lesser weed competition. Whereas, weedy check recorded significantly lower gross returns, net returns and B:C ratio (₹. 74194, ₹. 52405 and 3.83 respectively) due to poor yield that was caused by heavy weed infestation leading to poor growth and yield parameters. Among the herbicide treatments, application of oxyfluorfen 150 g *fb* quizalofop-p-ethyl @ 100 g a.i. ha^{-1} at 15-20 DAS recorded significantly higher gross returns, net returns and B:C ratio (₹.91032, ₹. 66567 and 3.72 respectively) compared to other herbicide treatments, as the combination of pre and post emergent herbicide that eliminated majority of the weeds and created good condition for plant growth leading to higher yield. This coupled with higher market price lead to significantly higher gross and net returns and hence better B:C ratio in the treatment. Similar results are noticed by Kashyap *et al*., 2022 [9].

Table 1: Weed density in chickpea as influenced by different weed management treatments at 30 and 45 DAS

Treatments	Weed density / m^2 at 30 DAS			Weed density / m^2 at 45 DAS		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
T1: Oxyfluorfen @ 150 g a.i./ha (PRE)	5.77 (32.80)	5.44 (29.11)	5.61 (30.96)	6.13 (37.06)	6.33 (39.59)	6.23 (38.33)
T2: Oxyfluorfen @ 250 g a.i./ha (PRE)	5.43 (29.03)	5.23 (26.89)	5.33 (27.96)	5.76 (32.81)	6.09 (36.57)	5.93 (34.69)
T3: Quizalofop-P-Ethyl @ 100 ga.i./ha at 15-20 DAS	4.57 (20.52)	4.73 (21.85)	4.65 (21.19)	4.89 (23.58)	5.50 (29.72)	5.20 (26.65)
T4: Propaquizafop @ 100 g a.i./ha at 15-20 DAS	5.24 (26.97)	5.02 (24.76)	5.13 (25.87)	5.56 (30.47)	5.84 (33.67)	5.70 (32.07)
T5: Topromezone @ 20.6 g a.i./ha at 14 DAS	5.26 (27.23)	5.12 (25.78)	5.19 (26.51)	5.59 (30.76)	5.96 (35.06)	5.77 (32.91)
T6: Topromezone @ 20.6 g a.i./ha at 21 DAS	5.29 (27.54)	4.99 (24.43)	5.14 (25.99)	5.62 (31.12)	5.81 (33.22)	5.71 (32.17)
T7: Topromezone @ 25.7 g a.i./ha at 21 DAS	5.30 (27.58)	5.05 (25.00)	5.18 (26.29)	5.63 (31.17)	5.87 (34.00)	5.75 (32.58)
T8: Oxyfluorfen 150 g *fb* Quizalofop-p-ethyl @ 100 g a.i./ha at 15-20 DAS	4.44 (19.23)	4.30 (18.03)	4.37 (18.63)	5.15 (26.12)	4.99 (24.53)	5.07 (25.33)
T9: Oxyfluorfen 150 g *fb* Propaquizafop @ 100 ga.i./ha at 15-20 DAS	5.17 (26.30)	4.93 (23.82)	5.05 (25.06)	5.49 (29.72)	5.74 (32.40)	5.62 (31.06)
T10: Oxyfluorfen 150 g *fbTopramezone* @ 20.6 g a.i./ha at 14-21 DAS	5.24 (26.96)	4.99 (24.43)	5.12 (25.70)	5.56 (30.46)	5.81 (33.23)	5.68 (31.85)
T11: Pendimethalin @ 1000 g a.i./ha	5.26 (27.34)	5.13 (25.86)	5.20 (26.60)	5.68 (31.89)	6.29 (39.18)	5.99 (35.54)
T12: Weedy check	7.70 (58.91)	7.17 (51.03)	7.44 (54.97)	8.00 (63.56)	8.36 (69.40)	8.18 (66.48)
T13: Weed free check	2.82 (7.52)	2.42 (5.42)	2.62 (6.47)	3.15 (9.50)	2.79 (7.38)	2.97 (8.44)
S. Em±	5.77 (32.80)	5.44 (29.11)	5.61 (30.96)	6.13 (37.06)	6.33 (39.59)	6.23 (38.33)
CD at 5%	5.43 (29.03)	5.23 (26.89)	5.33 (27.96)	5.76 (32.81)	6.09 (36.57)	5.93 (34.69)

Table 2: Weed dry weight in chickpea as influenced by different weed management treatments at 30 and 45 DAS

Treatments	Weed dry weight / g m^2 at 30 DAS			Weed dry weight / g m^2 at 45 DAS		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
T1: Oxyfluorfen @ 150 g a.i./ha (PRE)	4.97 (24.27)	4.34 (18.34)	4.66 (21.31)	5.52 (30.02)	5.64 (31.32)	5.58 (30.67)
T2: Oxyfluorfen @ 250 g a.i./ha (PRE)	4.68 (21.48)	4.17 (16.94)	4.43 (19.21)	5.20 (26.57)	5.45 (29.23)	5.32 (27.90)
T3: Quizalofop-P-Ethyl @ 100 ga.i./ha at 15-20 DAS	4.22 (17.41)	3.78 (13.76)	4.00 (15.59)	4.68 (21.53)	5.00 (24.50)	4.84 (23.02)
T4: Propaquizafop @ 100 g a.i./ha at 15-20 DAS	4.52 (19.95)	4.01 (15.60)	4.27 (17.78)	5.02 (24.68)	5.26 (27.24)	5.14 (25.96)
T5: Topromezone @ 20.6 g a.i./ha at 14 DAS	4.54 (20.15)	4.09 (16.24)	4.32 (18.20)	5.04 (24.92)	5.36 (28.19)	5.20 (26.56)
T6: Topromezone @ 20.6 g a.i./ha at 21 DAS	4.57 (20.38)	3.99 (15.39)	4.28 (17.89)	5.07 (25.21)	5.24 (26.93)	5.15 (26.07)
T7: Topromezone @ 25.7 g a.i./ha at 21 DAS	4.57 (20.41)	4.03 (15.750)	4.30 (18.08)	5.07 (25.25)	5.29 (27.46)	5.18 (26.35)
T8: Oxyfluorfen 150 g *fb* Quizalofop-p-ethyl @ 100 g a.i./ha at 15-20 DAS	4.11 (16.45)	3.29 (10.36)	3.70 (13.41)	4.56 (20.35)	4.63 (20.92)	4.60 (20.64)
T9: Oxyfluorfen 150 g *fb* Propaquizafop @ 100 g a.i./ha at 15-20 DAS	4.47 (19.46)	3.94 (15.01)	4.21 (17.24)	4.95 (24.07)	5.18 (26.35)	5.07 (25.21)
T10: Oxyfluorfen 150 g *fb*Topramezone @ 20.6 g a.i./ha at 14-21 DAS	4.52 (19.95)	3.99 (15.39)	4.26 (17.67)	5.02 (24.68)	5.23 (26.93)	5.13 (25.80)
T11: Pendimethalin @ 1000 g a.i./ha	4.54 (20.23)	4.09 (16.29)	4.32 (18.26)	5.04 (25.02)	5.36 (28.27)	5.20 (26.65)
T12: Weedy check	7.35 (53.59)	5.71 (32.15)	6.53 (42.87)	7.70 (58.92)	7.24 (51.88)	7.47 (55.40)
T13: Weed free check	2.45 (5.57)	1.97 (3.42)	2.21 (4.50)	2.71 (6.89)	3.09 (9.09)	2.90 (7.99)
S. Em±	0.14	0.10	0.12	0.16	0.12	0.14
CD at 5%	0.41	0.31	0.36	0.46	0.34	0.40

Table 3: Weed control efficiency and weed index in chickpea as influenced by different weed management treatments

Treatments	Weed control efficiency at 30 DAS (%)			Weed control efficiency at 45 DAS (%)			Weed index		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
T1: Oxyfluorfen @ 150 g a.i./ha (PRE)	54.35	42.63	48.49	43.72	37.93	40.83	11.16	17.56	14.36
T2: Oxyfluorfen @ 250 g a.i./ha (PRE)	59.97	47.02	53.50	50.76	42.00	46.38	13.00	21.17	17.09
T3: Quizalofop-P-Ethyl @ 100 ga.i./ha at 15-20 DAS	67.27	56.97	62.12	59.65	50.68	55.17	5.75	8.68	7.22
T4: Propaquizafop @ 100 g a.i./ha at 15-20 DAS	62.56	51.54	57.05	53.86	45.89	49.88	10.04	17.54	13.79
T5: Topromezone @ 20.6 g a.i./ha at 14 DAS	62.16	49.17	55.67	53.38	43.90	48.64	9.33	16.83	13.08
T6: Topromezone @ 20.6 g a.i./ha at	61.94	51.87	56.91	53.14	46.14	49.64	9.03	15.92	12.48

21 DAS									
T7: Topromezone @ 25.7 g a.i./ha at 21 DAS	61.70	50.95	56.33	52.80	45.32	49.06	9.76	19.54	14.65
T8: Oxyfluorfen 150 g *fb* Quizalofop-p-ethyl @ 100 g a.i./ha at 15-20 DAS	69.36	67.85	68.61	62.32	57.61	59.97	4.16	6.97	5.57
T9: Oxyfluorfen 150 g *fb* Propaquizafop @ 100 ga.i./ha at 15-20 DAS	63.62	53.07	58.35	55.21	47.32	51.27	8.86	16.00	12.43
T10: Oxyfluorfen 150 g *fb* Topramezone @ 20.6 g a.i./ha at 14-21 DAS	62.75	52.09	57.42	54.15	46.34	50.25	9.11	16.51	12.81
T11: Pendimethalin @ 1000 g a.i./ha	62.02	49.14	55.58	53.20	43.43	48.32	10.46	20.59	15.53
T12: Weedy check	-	-	-	-	-	-	20.55	25.13	22.84
T13: Weed free check	100	100	100	100	100	100	0.00	0.00	0.00
S. Em±	2.20	2.12	2.16	2.72	2.29	2.51	0.65	1.99	1.32
CD at 5%	6.61	6.36	6.49	7.95	6.69	7.32	1.90	5.79	3.85

Table 4: Growth parameters of chickpea as influenced by different weed management treatments at harvest

Treatments	Plant height (cm)			No. of branches per plant			TDM (g/plant)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
T1: Oxyfluorfen @ 150 g a.i./ha (PRE)	31.13	32.51	31.82	3.60	3.22	3.41	12.44	14.51	13.48
T2: Oxyfluorfen @ 250 g a.i./ha (PRE)	28.03	30.94	29.49	3.42	3.06	3.24	11.65	13.94	12.80
T3: Quizalofop-P-Ethyl @ 100 ga.i./ha at 15-20 DAS	33.36	34.40	33.88	4.46	4.20	4.33	16.83	16.40	16.62
T4: Propaquizafop @ 100 g a.i./ha at 15-20 DAS	31.58	32.62	32.10	3.51	3.23	3.37	13.36	14.62	13.99
T5: Topromezone @ 20.6 g a.i./ha at 14 DAS	31.98	32.66	32.32	3.57	3.83	3.70	13.50	14.66	14.08
T6: Topromezone @ 20.6 g a.i./ha at 21 DAS	31.71	32.89	32.30	3.61	3.31	3.46	13.62	15.09	14.36
T7: Topromezone @ 25.7 g a.i./ha at 21 DAS	31.46	32.91	32.19	3.69	3.26	3.48	13.89	14.91	14.40
T8: Oxyfluorfen 150 g *fb* Quizalofop-p-ethyl @ 100 g a.i./ha at 15-20 DAS	35.09	35.33	35.21	4.85	4.50	4.68	17.58	17.13	17.36
T9: Oxyfluorfen 150 g *fb* Propaquizafop @ 100 ga.i./ha at 15-20 DAS	32.23	32.46	32.35	3.71	3.21	3.46	14.35	14.46	14.41
T10: Oxyfluorfen 150 g *fb* Topramezone @ 20.6 g a.i./ha at 14-21 DAS	31.82	34.57	33.20	3.87	3.52	3.70	14.52	15.17	14.85
T11: Pendimethalin @ 750 g a.i./ha	31.43	32.92	32.17	3.45	3.39	3.42	14.33	14.22	14.28
T12: Weedy check	28.06	27.93	28.00	3.52	2.57	3.05	10.02	7.93	8.98
T13: Weed free check	36.78	38.55	37.67	5.36	5.31	5.34	19.21	20.55	19.88
S. Em±	0.93	1.01	0.97	0.14	0.13	0.14	0.49	1.01	0.75
CD at 5%	2.72	2.94	2.83	0.40	0.38	0.39	1.44	2.94	2.19

Table 5: Yield parameters of chickpea as influenced by different weed management treatments at harvest

Treatments	Number of pods / plant			Seed weight per plant (g/pl)			100 Seed weight (g)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
T1: Oxyfluorfen @ 150 g a.i./ha (PRE)	20.4	22.51	21.46	8.26	7.08	7.67	18.66	19.59	19.13
T2: Oxyfluorfen @ 250 g a.i./ha (PRE)	18.83	21.94	20.39	7.11	6.74	6.93	18.38	19.34	18.86
T3: Quizalofop-P-Ethyl @ 100 ga.i./ha at 15-20 DAS	25.74	27.4	26.57	9.56	9.25	9.41	20.63	21.28	20.96
T4: Propaquizafop @ 100 g a.i./ha at 15-20 DAS	21.29	23.62	22.46	7.33	7.51	7.42	18.9	20.26	19.58
T5: Topromezone @ 20.6 g a.i./ha at 14 DAS	21.35	24.66	23.01	6.56	7.43	7.00	18.7	20.06	19.38
T6: Topromezone @ 20.6 g a.i./ha at 21 DAS	21.61	25.09	23.35	7.55	8.12	7.84	18.89	20.15	19.52
T7: Topromezone @ 25.7 g a.i./ha at 21 DAS	22.16	24.91	23.54	6.79	7.16	6.98	18.83	20.19	19.51
T8: Oxyfluorfen 150 g *fb* Quizalofop-p-ethyl @ 100 g a.i./ha at 15-20 DAS	27.69	28.33	28.01	9.78	9.8	9.79	20.89	21.48	21.19
T9: Oxyfluorfen 150 g *fb* Propaquizafop @ 100 ga.i./ha at 15-20 DAS	22.4	24.46	23.43	7.72	7.57	7.65	19.23	20.59	19.91
T10: Oxyfluorfen 150 g *fb* Topramezone @ 20.6 g a.i./ha at 14-21 DAS	22.62	25.17	23.90	7.89	7.65	7.77	19.98	20.34	20.16
T11: Pendimethalin @ 1000 g a.i./ha	22.33	23.22	22.78	6.83	7.45	7.14	19.13	20.17	19.65
T12: Weedy check	18.06	17.93	18.00	5.34	6.35	5.85	17.3	18.66	17.98
T13: Weed free check	31.48	30.56	31.02	10.73	10.59	10.66	21.23	21.74	21.49
S. Em±	0.81	1.01	0.91	0.23	0.29	0.26	0.54	0.54	0.54
CD at 5%	2.37	2.94	2.66	0.66	0.84	0.75	1.59	1.59	1.59

Table 6: Seed yield, haulm yield and harvest index of chickpea as influenced by different weed management treatments at harvest

Treatments	Seed yield (kg/ha)			Haulm yield (kg/ha)			Harvest index (%)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
T1: Oxyfluorfen @ 150 g a.i./ha (PRE)	1593	1615	1604	3255	2938	3097	32.89	35.37	34.13
T2: Oxyfluorfen @ 250 g a.i./ha (PRE)	1560	1548	1554	3087	2902	2995	33.60	34.80	34.20
T3: Quizalofop-P-Ethyl @ 100 ga.i./ha at 15-20 DAS	1690	1794	1742	3203	3193	3198	34.54	35.98	35.26
T4: Propaquizafop @ 100 g a.i./ha at 15-20 DAS	1613	1622	1618	3081	3039	3060	34.41	34.80	34.61
T5: Topromezone @ 20.6 g a.i./ha at 14 DAS	1626	1637	1632	3096	3009	3053	34.51	35.31	34.91
T6: Topromezone @ 20.6 g a.i./ha at 21 DAS	1631	1654	1643	3106	3053	3080	34.46	35.14	34.80
T7: Topromezone @ 25.7 g a.i./ha at 21 DAS	1618	1583	1601	3100	3021	3061	34.16	34.20	34.18
T8: Oxyfluorfen 150 g *fb* Quizalofop-p-ethyl @ 100 g a.i./ha at 15-20 DAS	1719	1830	1775	3320	3222	3271	34.13	36.23	35.18
T9: Oxyfluorfen 150 g *fb* Propaquizafop @ 100 ga.i./ha at 15-20 DAS	1635	1654	1645	3135	3089	3112	34.29	34.89	34.59
T10: Oxyfluorfen 150 g *fb* Topramezone @ 20.6 g a.i./ha at 14-21 DAS	1630	1640	1635	3167	3052	3110	33.98	34.96	34.47
T11: Pendimethalin @ 1000 g a.i./ha	1606	1560	1583	3126	2990	3058	33.94	34.28	34.11
T12: Weedy check	1425	1471	1448	2929	2852	2891	32.21	33.49	32.85
T13: Weed free check	1793	1968	1881	3406	3428	3417	34.51	36.49	35.50
S. Em±	27	35	31	85	54	70	0.16	0.21	0.19
CD at 5%	80	106	93	256	161	209	0.49	0.62	0.56

Table 7: Gross returns, net returns and B:C ratio of chickpea as influenced by different weed management treatments

Treatments	GR			CoC			NR			BC		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
T1: Oxyfluorfen @ 150 g a.i./ha (PRE)	76448	87874	82161	22766	23066	22916	53682	64808	59245	3.29	3.81	3.55
T2: Oxyfluorfen @ 250 g a.i./ha (PRE)	74880	84211	79546	23776	24076	23926	51104	60135	55620	3.26	3.5	3.38
T3: Quizalofop-P-Ethyl @ 100 ga.i./ha at 15-20 DAS	81120	97612	89366	23400	23700	23550	57720	73912	65816	3.47	4.12	3.80
T4: Propaquizafop @ 100 g a.i./ha at 15-20 DAS	77424	88255	82840	24200	24500	24350	53224	63755	58490	3.38	3.6	3.49
T5: Topromezone @ 20.6 g a.i./ha at 14 DAS	78032	89035	83534	24758	25058	24908	53274	63977	58626	3.13	3.55	3.34
T6: Topromezone @ 20.6 g a.i./ha at 21 DAS	78288	89978	84133	24758	25058	24908	53530	64920	59225	3.15	3.59	3.37
T7: Topromezone @ 25.7 g a.i./ha at 21 DAS	77680	86097	81889	24923	25223	25073	52757	60874	56816	3.17	3.42	3.30
T8: Oxyfluorfen 150 g *fb* Quizalofop-p-ethyl @ 100 g a.i./ha at 15-20 DAS	82512	99552	91032	24165	24765	24465	58347	74787	66567	3.41	4.02	3.72
T9: Oxyfluorfen 150 g *fb* Propaquizafop @ 100 g a.i./ha at 15-20 DAS	78464	89996	84230	24965	25265	25115	53499	64731	59115	3.33	3.56	3.45
T10: Oxyfluorfen 150 g *fb*Topramezone @ 20.6 g a.i./ha at 14-21 DAS	78240	89216	83728	25523	25823	25673	52717	63393	58055	3.27	3.45	3.36
T11: Pendimethalin @ 1000 g a.i./ha	77072	84864	80968	23259	23559	23409	53813	61305	57559	3.32	3.6	3.46
T12: Weedy check	68384	80004	74194	21639	21939	21789	46745	58065	52405	3.16	3.65	3.41
T13: Weed free check	86080	107059	96570	25600	26000	25800	60547	81059	70803	3.53	4.12	3.83
S. Em±	1596	1779	1687	-	-	-	1596	1595	1595	0.06	0.13	0.10
CD at 5%	4658	5192	4925	-	-	-	4658	4656	4657	0.18	0.38	0.28

4. Conclusion

Performance of chickpea productivity is very much influenced by weed infestation. The weed free check recorded significantly higher growth and yield parameters while weedy check recorded significantly lower growth and yield attributes. Among the herbicides, application of oxyfluorfen 150 g *fb* quizalofop-p-ethyl @ 100 g a.i. ha^{-1} at 15-20 DAS recorded significantly higher growth and yield parameters, suppressing the weeds, effective utilization of growth resources, attaining the higher gross returns, net returns and B:C ratio compared to other herbicide treatments. This treatment can be recommended to farming community for wide spread adoption for getting higher productivity and profitability.

References

1. Anonymous. Annual Report, All India Coordinated Research Project on chickpea. Kalyanpur, Kanpur; 2024. p. 93-102.
2. Anonymous. Annual Report, Department of agriculture, cooperation and farmers welfare, Ministry of agriculture and farmers welfare, Government of India. New Delhi: Krishi Bhavan; 2024a. p. 119-23.
3. Anonymous. Annual Report, Krishi Vigyan Kendra, Kalaburagi, University of Agricultural Sciences. Raichur, Karnataka; 2024b. p. 63-9.
4. Buttar GS, Aggarwal N, Singh S. Efficacy of different herbicides in chickpea (*Cicer arietinum* L.) under irrigated

conditions of Punjab. Indian J Weed Sci. 2008;40(3&4):169-71.
5. Dubey SK, Kumar A, Singh D, Pratap T, Chaurasiya A. Effect of different weed control measures on performance of chickpea under irrigated condition. Int J Curr Microbiol Appl Sci. 2018;7:3103-11.
6. Kachhadiya SP, Savaliya JJ, Bhalu VB, Supriya PAG, Savaliya SG. Evaluation of new herbicides for weed management in chickpea (*Cicer arietinum* L.). Legume Res. 2009;32(4):2293-7.
7. Kalyani D, Srinivasulu K. Integrated Weed management in Chickpea (*Cicer arietinum* L.). Ragendranagar, Hyderabad: ANGRAU; 2011.
8. Kamble AB, Rawan SA, Thawal DW, Pathan SH, Bodake PS. Integrated weed management in chickpea under irrigated condition. In: Biennial Conference of Indian Society of Weed Science on Emerging Challenges in Weed Management; 2014 Feb 15-17.
9. Kashyap AK, Kushwaha HS, Mishra H. Effect of herbicides on weeds, yield and economics of chickpea. Indian J Weed Sci. 2022;54(2):182-6.
10. Khope D, Kumar S, Pannu RK. Evaluation of Post-emergence Herbicides in Chickpea (*Cicer arietinum*). Indian J Weed Sci. 2011;43(1&2):92-3.
11. Kumar N, Nandal DP, Punia SS. Weed management in chickpea under irrigated condition. Indian J Weed Sci. 2014;46(3):300-1.
12. Kumar N, Hazra KK, Yadav SL, Singh SS. Weed dynamics and productivity of chickpea (*Cicer arietinum* L.) under pre-and post-emergence application of herbicides. Indian J Agron. 2015;60(4):570-5.
13. Lal SS. Direct and residual effect of varying levels of herbicides for controlling the weeds in potato-blackgram crop sequence. Indian J Weed Sci. 1990;22(3&4):1-5.
14. Panse VG, Sukhatme PV. Statistical methods for Agricultural workers. New Delhi: ICAR; 1978. 152 p.
15. Poonia TC, Pithia MS. Pre and post-emergence herbicides for weed management in chickpea. Indian J Weed Sci. 2013;45(3):223-5.
16. Ratnam M, Rao AS, Reddy TY. Integrated Weed Management in chickpea. J Res, ANGRAU. 2011;39(1&2):82-3.
17. Rupareliya VV, Chovatia PK, Vekariya SJ, Javiya PP. Effects of different pre- and post-emergences herbicide on growth, yield attributes, yield and quality of chickpea (*Cicer arietinum* L.). Int J Sci Environ Technol. 2017;6(4):2587-93.
18. Sanketh GD, Bhanurekha K, Ramprakash T, Sudhakar KS. Bio-efficacacy of ready and tank mixed herbicides in chickpea. Indian J Weed Sci. 2021;53(3):307-9.
19. Chitale S, Tiwari N, Tiwari M. Studying effectiveness of post- emergence herbicides. Indian J Weed Sci. 2021;56(3):274-8.
20. Yadav LV, Shukla UN, Raiger PR, Mandiwal M. Efficacy of pre and post-emergence herbicides on weed control in chickpea (*Cicer arietinum* L.). Indian J Agric Res. 2019;53(1):112-5.