E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating: 5.20
www.agronomyjournals.com
2025; SP-8(3): 124-128
Received: 28-12-2024
Accepted: 06-02-2025

Bhawna Bhagat
Department of Agronomy, Ranchi Agriculture College, Birsa Agricultural University, Kanke, Jharkhand, India

RP Manjhi
Department of Agronomy, Ranchi Agriculture College, Birsa Agricultural University, Kanke, Jharkhand, India

Niketa Tirkey
Department of Agronomy, Ranchi Agriculture College, Birsa Agricultural University, Kanke, Jharkhand, India

Chitrotpala Dehury
Department of Agronomy, Ranchi Agriculture College, Birsa Agricultural University, Kanke, Jharkhand, India

Kundan Kumar
Department of Plant Breeding, Ranchi Agriculture College, Birsa Agricultural University, Kanke, Jharkhand, India

Juhi Rani
Department of Horticulture, Ranchi Agriculture College, Birsa Agricultural University, Kanke, Jharkhand, India

Darkshan Taiyab
Department of Agronomy, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

Corresponding Author:
Bhawna Bhagat
Department of Agronomy, Ranchi Agriculture College, Birsa Agricultural University, Kanke, Jharkhand, India

Growth, yield, and economics of chickpea (*Cicer arietinum* L.) as influenced by herbicides

Bhawna Bhagat, RP Manjhi, Niketa Tirkey, Chitrotpala Dehury, Kundan Kumar, Juhi Rani and Darkshan Taiyab

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i3Sb.2639

Abstract
A field experiment was conducted during rabi season of 2021-22 under limited irrigation at Rice Research farm, BAU, Kanke, Ranchi to study the "Efficacy of herbicides on chickpea (Cicer arietinum L.) Production". The experiment was laid out in randomized block design (RBD) replicated thrice with the variety Birsa Chana-3 under limited irrigation condition. The treatments consists of oxyfluorfen (150 g/ha), oxyfluorfen (250 g/ha), quizalofop-p-ethyl (100 g/ha) at 21 DAS, propaquizafop (100 g/ha) at 21 DAS, topramezone 20.6g/ha at 21 DAS, oxyfluorfen 150 g/ha (PE) fb quizalofop-p-ethyl 100 g/ha at 15-20 DAS (PoE), oxyfluorfen 150 g/ha(PE) fb propaquizafop 100 g/ha at 15-20 DAS (PoE), oxyfluorfen 150 g/ha (PE) fb topramezone 20.6g/ha at 14-21 DAS (PoE), imazethapyr 60 g/ha (PoE) at 21 DAS, Manual Weeding (Weed free) at 25 DAS and 45 DAS, Weedy Check. oxyfluorfen @150 g/ha as pre-emergence fb topramezone 20.6g/ha at 14-21 DAS as post-emergence recorded maximum growth attributes, yield and yield attributes, *viz*. plant height (cm) (11.53), plant population (37/m^2), number of branches/plant (21.77), number of pods/branch (1.74), number of seeds/pod (1.78), number of pod/plant (36.98), 1000 seeds weight (290.5 g) and yield of chickpea (19.15 q/ha), harvest index (35.97%) during initial crop growth stage and realized maximum net return (₹64131/ha) and B:C ratio (1.81) of chickpea under medium land situation in irrigated condition (3 irrigations) of Jharkhand.

Keywords: Growth attributes, chickpea, oxyfluorfen fb topramezone, plant population and yield attributes

Introduction
Chickpea (*Cicer arietinum* L.) is one of the world's most important legumes crops, with more than 44 countries growing it across five continents. Chickpea is India's most important rabi pulse crop, and it ranks top among pulses. India is the world's largest producer of chickpeas, India has a land area of 98.86 lakh hectares, produces 107.37 lakh tons, and has a productivity of 1086 kg/ha and in Jharkhand land area is 2.26 lakh hectares, produces 2.73 lakh tons, and has a productivity of 1208 kg/ha.

Chickpea is very susceptible to weed competition due to its slow early growth and petite statured plants, and weeds can result in yield losses of up to 75% (Chaudhary *et al*., 2005) [2]. Although the first 60 days are considered crucial for weed crop competitiveness in chickpea (Singh and Singh, 2000) [11], manual weed management has become a difficult undertaking due to labour scarcity and rising labour costs. For better adoption in chickpea, a suitable herbicide for effective control of mixed weed flora is required. Manual weeding is common in state but it is expensive and labour intensive. Presently, there is need to increase the productivity to augment the total production. Poor weed management is one of the most important yield limiting factors in chickpea. Suitable herbicide for effective control of mixed weed flora is required for better adoption in chickpea. Many research workers from the various parts of the country have reported that the application of Oxyfluorfen as weed control treatment (Dubey, S.K., Kumar, 2018) [4] provided effective control of annual broad leaved and grassy weeds in chick pea field at early stages.

The use of a pre- and post-emergence herbicide in chickpea could be a game changer in terms of weed management. In chickpea, the efficacy and selectivity of these herbicides have yet to be determined. In the Jharkhand region, there is also a scarcity of information on herbicidal weed

control methods for Indian chickpea. Therefore, the present study was conducted to study the effect of herbicides on growth, yield, and economics of chickpea.

Materials and Methods

The present study was carried out at Agronomical research farm of Birsa Agricultural University, Ranchi, Jharkhand is situated at 23°17' N latitude and longitude of 85°19' E with an altitude of 625 m above the mean sea level during the rabi seasons of 2021–22. A few showers are expected during winters and occasionally during summer months. May and June are the hottest months with average maximum temperature of 35.6 °C and 36.2 °C, respectively. January is the coldest month of the year when the temperature falls 8.1°C. It receives an average annual rainfall of 32.4 mm. Initial status of soil (0–15 cm) of experimental field was sandy loam (37.3% sand, 30.2% silt and 32.5% clay) in nature, low in organic carbon (4.5) and available nitrogen (247.4 kg N/ha), medium in available phosphorus (20.6 kg P/ha), medium in available potassium (156.2 kg K/ ha) and low in soil reaction (pH 5.7). The experiment was laid out in randomized block design (RBD) replicated thrice with the variety Birsa Chana-3 under limited irrigation condition. The treatments consists of oxyfluorfen (150 g/ha), oxyfluorfen (250 g/ha), quizalofop-p-ethyl (100 g/ha) at 21 DAS, propaquizafop (100 g/ha) at 21 DAS, topramezone 20.6g/ha at 21 DAS, oxyfluorfen 150 g/ha (PE) fb quizalofop-p-ethyl 100 g/ha at 15-20 DAS (PoE), oxyfluorfen 150 g/ha(PE) fb propaquizafop 100 g/ha at 15-20 DAS (PoE), oxyfluorfen 150 g/ha (PE) fb topramezone 20.6g/ha at 14-21 DAS (PoE), imazethapyr 60 g/ha (PoE) at 21 DAS, Manual Weeding (Weed free) at 25 DAS and 45 DAS, Weedy check. Herbicides were thoroughly dissolved in water at a rate of 500 litres per hectare as a carrier and sprayed with a knapsack sprayer using a flat fan nozzle. The observations on weeds were recorded at 30 and 60 DAS. Weeds were counted using a quadrat of (25 x 25 cm), and data obtained were expressed as density (no./m^2). Data on weeds were subjected to square root transformation ($\sqrt{X+0.5}$) before its statistical analysis.

Results and Discussion

Effect of herbicides on growth attributes

The various weed control treatments significantly influenced plant height at all growth stages where the treatment difference was significant thereafter it was significantly influenced at all periodic interval. Data showed that mean height of chickpea plant increased with increase in age of crop.

At 30 DAS, the maximum plant height (12.00 cm) was reported with 2 manual weeding (weed free) at 25 and 45 DAS (T_{10}). Among herbicides, application of oxyfluorfen @150 g/ha fb topramezone 20.6g/ha at 14-21 DAS (T_8) recorded highest plant height (11.53 cm) (Table 2). The decrease in plant height in weedy check plots clearly showed the weed competition effect on plant growth and development and thus resulted in decrease in their height. The results are contrary to those reported by Khan *et al*. (2000) [6].

Effect on chickpea yield attributes and yield

The significant difference was found among different weed management practices. Among the treatments, manual weeding (weed free) at 25 and 45 DAS recorded maximum number of branches/plant (21.98) (Table 2). More number of fruit bearing branches/plant in hand weeding treatment was the result of absence of weeds and better utilization of resources i.e. moisture, light, nutrients, space etc by the crop plants and thus produced a greater number of brunches. While, it is true for weedy check treatment due to the result of more weed infestation. These findings are similar with the results of Althahi *et al*. (1994) [1].

Among different weed management practices, 2 hand weeding at 25 and 45 DAS observed significantly higher seeds per pod (1.90), pods per plant (37.68) (Table 2) and 1000 seed weight (291.2 g) (Table 3) and (Figure 1 and 2) However, among herbicides application of oxyfluorfen @150 g/ha fb topramezone 20.6g/ha at 14-21 DAS recorded significantly highest number of seeds per pod, pods per plant, 1000 seed weight (Table 3) and (Figure 1 and 2). The lowest yield attributes values were recorded in weedy check. This might be due to better growth of crop because of less crop weed competition under herbicidal treatment that subsequently increased nutrient and moisture availability to the chickpea crop. Similar results were also reported by Reddy *et al*. (2008) [10] and Chavada *et al*. (2017) [3].

Among different herbicides, oxyfluorfen @150 g/ha fb topramezone 20.6g/ha at 14-21 DAS proved to be best treatment in producing significantly higher seed yield (19.15 q/ha) followed by oxyfluorfen @150 g/ha fb propaquizafop @ 100 g/ha at 21 DAS compared to weedy check (Table 3) and (Figure 1 and 2). Various weed control strategies significantly boosted seed yield as compared to the weedy control; this could be due to improved weed protection paired with reduced weed population and improved yield contributing features in these treatments. Higher seed output in the above treatments due to the chickpea crop's proper use of moisture, nutrients, light, and space in the absence of weed competition. These results are in accordance with the findings of Singh *et al*. (2008) [12].

Economics

A critical analysis of data on economics revealed that the highest gross return (₹108336/ha) was obtained with two manual weeding at 25 and 45 DAS (weed free). But higher cost of cultivation in two manual weeding at 25 and 45 DAS due to engagement of more labourers for weeding. This confirms the findings of Pritam *et al*. (2015) [9]. oxyfluorfen @150 g/ha fb topramezone 20.6g/ha at 14-21 DAS had reduced the cost of cultivation compared to 2 manual weeding at 25 and 45 DAS. Maximum net return (₹64131/ha) were obtained with oxyfluorfen @150 g/ha fb topramezone 20.6g/ha at 14-21 DAS being at par to oxyfluorfen 250 g/ha) with higher benefit: cost ratio of (1.81) (Table 4). The higher net returns in this treatment oxyfluorfen @150 g/ha fb topramezone 20.6g/ha at 14-21 DAS when compared to oxyfluorfen 250 g/ha was not because of higher yield because of lower cost involved in herbicide application than to oxyfluorfen 250 g/ha). This confirms the findings of Kalyani (2011) [5]. The weedy check recorded significantly minimum net return (₹9002/ha) and propaquizafop @100 g/ha at 21 DAS recorded significantly minimum benefit: cost ratio (0.32) (Table 4). Similar findings were earlier observed by Pritam *et al*. (2015) [9]. Therefore, the highest cost involved in 2 manual weeding at 25 and 45 DAS was not compensated by net returns, resulting in lower return per rupee invested. The lowest gross returns, net returns and return per rupee investment were observed in weedy check. The results are corroborating with those reported by Pritam *et al*. (2015) [9]. Similar results were obtained by Patel and Patel (2006) [8] and Muhammad *et al*. (2011) [7].

Table 1: Treatment details of the chickpea experiment as influenced by weed control treatments (2021-22)

	Treatment details	Dose (Kg a.i./ha)
T_1:	Oxyfluorfen 150 g a.i./ha (PE)	0.15
T_2:	Oxyfluorfen 250 g a.i./ha (PE)	0.25
T_3:	Quizalofop-p-ethyl 100 g a.i./ha at 21 DAS(PoE)	0.1
T_4:	Propaquizafop 100 g a.i./ha at 21 DAS(PoE)	0.1
T_5:	Topramezone 20.6 g a.i./ha at 21 DAS(PoE)	0.0206
T_6:	Oxyfluorfen 150 g a.i./ha (PE) fb Quizalofop-p-ethyl 100 g a.i./ha at 15-20 DAS(PoE)	0.15+0.1
T_7:	Oxyfluorfen 150 g a.i./ha (PE) fb Propaquizafop 100 g a.i./ha at 15-20 DAS(PoE)	0.15+0.1
T_8:	Oxyfluorfen 150 g a.i./ha (PE) fb Topramezone 20.6 g a.i./ha at 14-21 DAS (PoE)	0.15+0.0206
T_9:	Imazethapyr 60 g a.i./ha (PoE) at 21 DAS	0.06
T_{10}:	Manual Weeding (Weed free) at 25 DAS and 45 DAS	-
T_{11}:	Weedy Check	-

Table 2: Plant height, plant population and yield attributes of chickpea as influenced by weed control treatments (2021-22).

Treatments	Plant height (cm)	Plant population (no./m^2) initial	maturity	No. of branches/ plant	No. of pods/ branch	No. of seeds/pod	No. of pod/plant
T_1: Oxyfluorfen @ 150 g a.i./ha (PE)	9.83	36.00	32.00	19.74	1.69	1.59	34.52
T_2: Oxyfluorfen @ 250 g a.i./ha (PE)	10.00	36.00	32.00	20.56	1.72	1.70	34.80
T_3: Quizalofop-p-ethyl @ 100 g a.i./ha at 21 DAS (PoE)	9.66	35.00	31.00	19.10	1.65	1.54	34.46
T_4: Propaquizafop @100 g a.i./ha at 21 DAS (PoE)	9.26	35.00	31.00	18.78	1.65	1.47	34.45
T_5: Topramezone @ 20.6 g a.i./ha at 21 DAS (PoE)	9.76	34.00	30.00	19.56	1.68	1.53	34.48
T_6: Oxyfluorfen @ 150 g a.i./ha (PE) fb Quizalofop-p-ethyl @100 g a.i./ha at 21 DAS(PoE)	10.53	36.00	33.00	21.36	1.72	1.72	34.81
T_7: Oxyfluorfen @ 150 g a.i /ha (PE) fb Propaquizafop @ 100 g a.i/ha at 21 DAS(PoE)	11.06	36.00	33.00	21.49	1.73	1.76	35.55
T_8: Oxyfluorfen 150 g a.i/ha (PE) fb Topramezone 20.6g a.i/ha at 14-21 DAS (PoE)	11.53	37.00	33.00	21.77	1.74	1.78	36.98
T_9: Imazathapyr 60 g a.i/ha (PoE) at 21 DAS	9.80	36.00	32.00	19.60	1.68	1.55	34.50
T_{10}: Manual Weeding (Weed free) at 25 DAS and 45 DAS	12.00	37.00	33.00	21.98	1.81	1.90	37.68
T_{11}: Weedy Check	9.13	35.00	31.00	16.14	1.26	1.17	30.64
SE m ±	0.77	0.67	0.73	0.13	0.38	0.09	1.85
CD (P = 0.05)	2.27	NS	NS	0.42	0.50	0.15	2.65
CV (%)	13.03	3.36	3.08	9.64	8.59	8.43	8.34

Note: PE = pre-emergence application, PoE = post-emergence application

Table 3: Seed weight, yield and harvest index of chickpea as influenced by weed control treatments (2021-2022)

Treatments	1000 seed weight (g)	Yield (q/ha)	Harvest index (%)
T_1: Oxyfluorfen @ 150 g a.i./ha (PE)	284.2	15.89	35.08
T_2: Oxyfluorfen @ 250 g a.i./ha (PE)	284.5	16.94	35.21
T_3: Quizalofop-p-ethyl @ 100 g a.i./ha at 21 DAS (PoE)	279.0	15.05	34.84
T_4: Propaquizafop @100 g a.i./ha at 21 DAS (PoE)	278.9	14.20	34.72
T_5: Topramezone @ 20.6 g a.i./ha at 21 DAS (PoE)	283.8	15.77	35.33
T_6: Oxyfluorfen @ 150 g a.i./ha (PE) fb Quizalofop-p-ethyl @100 g a.i./ha at 21 DAS(PoE)	284.8	17.04	35.46
T_7: Oxyfluorfen @ 150 g a.i /ha (PE) fb Propaquizafop @ 100 g a.i./ha at 21 DAS(PoE)	289.6	18.12	35.71
T_8: Oxyfluorfen 150 g a.i/ha (PE) fb Topramezone 20.6g a.i./ha at 14-21 DAS (PoE)	290.5	19.15	35.97
T_9: Imazethapyr 60 g a.i/ha (PoE) at 21 DAS	284.0	16.89	34.96
T_{10}: Manual Weeding (Weed free) at 25 DAS and 45 DAS	291.2	20.88	36.10
T_{11}: Weedy Check	263.7	7.14	34.48
SE m ±	0.65	1.07	1.93
CD (P = 0.05)	NS	2.78	NS
CV (%)	6.04	10.02	8.38

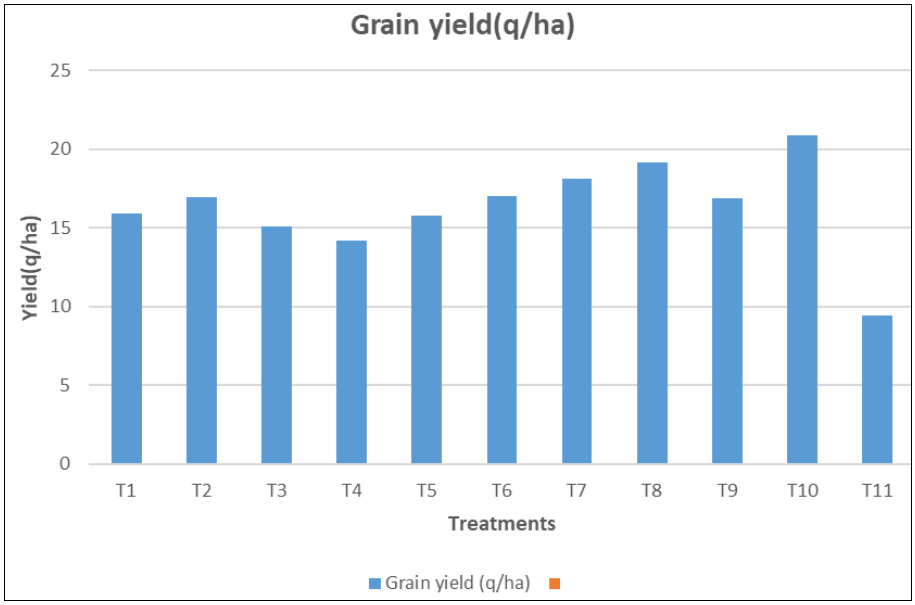

Fig 1: Effect of herbicides on grain yield (q/ha) in chickpea

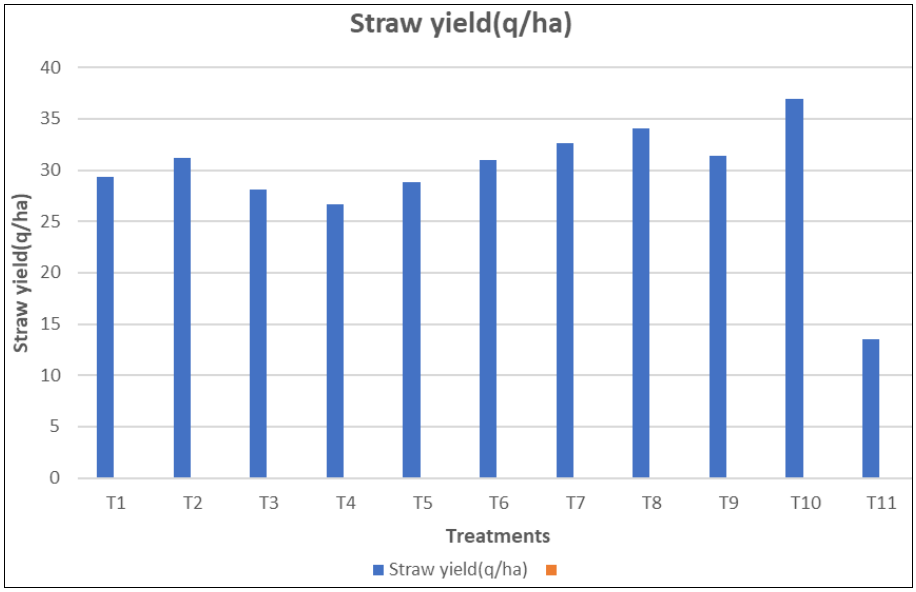

Fig 2: Effect of herbicides on straw yield (q/ha) in chickpea

Table 4: Economics of chickpea as influenced by weed control treatments (2021-2022)

Treatments	CC	GR	NR	B:C ratio
T_1: Oxyfluorfen @ 150 g a.i./ha (PE)	30461	82509	52048	1.70
T_2: Oxyfluorfen @ 250 g a.i./ha (PE)	31562	87952	56390	1.78
T_3: Quizalofop-p-ethyl @ 100 g a.i./ha at 21 DAS (PoE)	33390	78162	44772	1.34
T_4: Propaquizafop @100 g a.i./ha at 21 DAS (PoE)	43040	73755	30715	0.71
T_5: Topramezone @ 20.6 g a.i./ha at 21 DAS (PoE)	32867	81870	49003	1.49
T_6: Oxyfluorfen @ 150 g a.i./ha (PE) fb Quizalofop-p-ethyl @100 g a.i./ha at 21 DAS(PoE)	35761	88454	52693	1.47
T_7: Oxyfluorfen @ 150 g a.i /ha (PE) fb Propaquizafop @ 100 g a.i/ha at 21 DAS(PoE)	45411	94043	48632	1.07
T_8: Oxyfluorfen 150 g a.i/ha (PE) fb Topramezone 20.6g a.i/ha at 14-21 DAS (PoE)	35238	99369	64131	1.81
T_9: Imazathapyr 60 g a.i/ha (PoE) at 21 DAS	29420	87709	58289	1.98
T_{10}: Manual Weeding (Weed free) at 25 DAS and 45 DAS	51190	108336	57146	1.11
T_{11}: Weedy Check	28090	37092	9002	0.32
SE m ±	-	3272	1271	0.55
CD (P = 0.05)	-	11586	8500	0.35

Conclusion

On the basis of one-year experimentation it may be concluded that among herbicides, application of oxyfluorfen @150 g/ha as pre-emergence fb topramezone 20.6g/ha at 14-21 DAS as post-emergence proved to be effective in resulting higher plant height (11.53 cm) during initial crop growth stage, produced maximum chickpea yield (19.15 q/ha) and net return (₹ 64131 /ha) with B:C ratio (1.81) of chickpea under medium land situation in irrigated condition (3 irrigations) of Jharkhand.

Conflict of Interest
The authors declare no conflict of interest.

Acknowledgement
I would like to express my special thanks to my advisor Dr. R.P. Manjhi, Assistant Professor-cum-Junior Scientist, Department of Agronomy BAU, Ranchi (Jharkhand) and chairman who gave me the golden opportunity to do this fabulous research and very thankful to department of Agronomy, BAU for providing such good laboratory facilities.

References
1. Althahi SA, Yaseen JZ, Irmaileh BE, Haddad NI, Saxena MC. Effect of weed removal on productivity of chickpea and lentil in a Mediterranean, 1994.
2. Chaudhary BM, Patel JJ, Delvadio DR. Effect of weed management practices and seed rates on weeds and yield of chickpea. Ind J Weed Sci. 2005;37:271-2.
3. Chavada JN, Patel CK, Patel SB, Panchal PP, Patel GN. Weed management in chickpea under North Gujarat conditions. Int J Sci Environ Technol. 2017;6(3):ISSN 2278-3687.
4. Dubey SK, Kumar A, Singh D, Pratap T, Chaurasiya A. Effect of different weed control measures on performance of chickpea under irrigated conditions. Int J Curr Microbiol Appl Sci. 2018;7(5):3103-11.
5. Kalyani D, Srinivasulu K. Integrated weed management in chickpea (*Cicer arietinum* L.). Master's thesis, ANGRAU, Ragendranagar, Hyderabad, 2011.
6. Khan A, Rahim M, Ahsanuallah, Khan M. Performance of mid-duration soybean as affected by various pre-emergence herbicides. Pak J Biol Sci. 2000;3(4):658-9.
7. Muhammad N, Sattar A, Ashiq M, Ahmad I. Efficacy of pre and post-emergence herbicides to control weeds in chickpea (*Cicer arietinum*). Pak J Weed Sci Res. 2011;17(1):17-24.
8. Patel BD, Patel VJ, Meisuriya MI. Effect of FYM, molybdenum, and weed management practices on weeds, yield attributes, and yield of chickpea. Indian J Weed Sci. 2006;38(3&4):244-6.
9. Pritam O, Bhutada, Bhale VM. Effect of herbicides and cultural practices on growth and yield of chickpea. J Prog Agric. 2015;6(1):94-9.
10. Reddy KM, Singh S, Kumar VP. Weed control in chickpea under dryland conditions in competition with rice. Weed Res. 2008;37:33-38.
11. Singh S, Singh AN. Crop-weed competition in chickpea. In: National Symposium on Agronomy Challenges and Strategies for the New Millennium, November 15-18, GAU Campus, Junagarh, 2000. p. 199.
12. Singh S, Walia US, Singh B. Effective control of weeds in chickpea (*Cicer arietinum* L.). Indian J Weed Sci. 2008;40(1&2):51-55.