Journal Crop and Weed, 11(1):232-235(2015)

Effect of herbicides and cultural practices on nutrient uptake by chickpea and weed

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Received: 26-01-2015, Revised: 27-04-2015, Accepted: 03-05-2015

ABSTRACT

Chickpea is one of the important and most commonly using pulse crop in the world. Just like other pulse crops, yield of chickpea, nutrient, resources may be drastically reduced by weed infestation. The objective of the study was to study the relative efficacy of herbicides and cultural practices on nutrient uptake by Chickpea and weed. The maximum nutrient uptake by chickpea was found in 2H at 15 and 30 DAS + HW at 40 DAS (T_{10}) followed by T_8, T_4, T_9, and T_5. The uptake of highest nutrients was found in treatments T_{10} followed by T_8, which may be due to lowest weed count. treatment T_{10} show high gross monetary return, net return and B: C ratio due to best weed control high Fertilizer use efficiency.

Keywords: Chickpea, herbicide, weed control, winter sowing, FUE, WCE

Chickpea (*Cicer aritinum*) is one of the most important pulse (*rabi*) crop grown in rainfed farming system throughout India. It is use for human consumption as well as animal feeding. Both husks and bits of the *dal* are valuable cattle feed. Fresh green leaves use for vegetable. It is rich source of protein 21.1%. Besides it contain 61.5% carbohydrates, and 4.5% fat, also rich in Ca, Fe, and Niacin. Its leaves secrete malicacid (90-95%) and oxalic acid (5-10%), which have medicinal properties important against stomachache, intestinal disorder and blood purification. (Singh *et al.*, 2003).

Chickpea is important pulse crop globally, it is cultivated on about 10.4 million hector area adding 8.57 million tons of grain to the Global food basket with an average productivity of 826 Kg ha^{-1}. As many as 45 countries grow chickpea. India grows chickpea on about 8.0 million ha with 7.1 metric ton production and average productivity of 885 Kg ha^{-1}. In Maharashtra area under gram is 12.50 lakh ha and production 9.15 lakh metric tons with productivity of 730 Kg ha^{-1}. In Vidarbha region area under gram is 5.14 lakh ha with production 5.42 lakh tons and productivity 997 Kg ha^{-1}. Chickpea is an important crop of *rabi* crop besides limited moisture crop has to compete with weeds. Timely weed management practices play an important role in the successful cultivation of the crop. Chickpea suffers severely due to competition stress of weeds with yield reduction to the tune of 20 to 49.5 % depending on nature and density of weeds. Weed infestation is one of the major limiting factors in the productivity of the crops both under rainfed and irrigated situations. On an average, the reduction in crop yield to the tune of 20-40% has been reported in weed infested crops which calls for effective weed control measures. Control of weeds is vitally important not only to check the losses, caused by them but also to increase the fertilizer use efficiency. The present study was, therefore, undertaken to assess the losses of nutrients caused by weeds in chickpea.

An investigation was carried out during this year 2010-2011 at farm of Agronomy Department, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The experiment was laid out in Randomized Block Design with 3 replication and 10 treatments. These treatments combination of pre and post emergence herbicides with cultural practices and one weedy check. The soil characterized clay loam in texture and moderately alkaline in reaction. As regards to fertility status, the soil was medium in organic carbon, lower in available nitrogen, medium in available phosphorus and very high in potassium. Chickpea was sown with 85 kg seed per hectare used. Prior to sowing seed was treated with *Rhizobium* culture at the rate of 250 g per 10 kg of seed. Sowing of gram variety Jaki 9218 was carried out by drilling method keeping 30 cm distance between two rows. Thinning was carried out at 8 days after sowing to maintain optimum plant population and plant to plant distance maintained was 10 cm.

Treatments are Weed check (T_1), Imazethapyr PRE 75 g ha^{-1} (T_2), Imazethapyr POE 75 g ha^{-1} (T_3), Pendimethalin PRE 1 kg ha^{-1} (T_4), Quizalofop-p-ethyl POE 50g ha^{-1} (T_5), Imazethapyr PRE 75 ha^{-1} + 1H at 30 DAS (T_6), Imazethapyr POE 75g ha^{-1} + 1H at 40 DAS (T_7), Pendimethalin PRE 1kg ha^{-1} + 1H at 40 DAS (T_8), Quizalofop-p-ethyl POE 50g ha^{-1} + 1 H at 40 DAS (T_9), 2Hoeing at 15 and 40 DAS + 1 Hand Weeding at 30 DAS

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(T_{10}). The Chickpea variety (Jaki 9218) sown at Gross plot size 5 x 5.5 m and Net plot size 4.2 x 4 m, on 4th Nov.2010. Weed dry weight, WCE, weed index, nutrient uptake, plant height, branches, pods plant^{-1} ,seed weight, grain yield and gross monetary return by crop and weed were workout.

Weed control efficiency

The weed control efficiency was calculated the following formula

$$WCE\ (\%) = \frac{DMC - DMT}{DMC} \times 100$$

Where,

WCE= Weed control efficiency

DMC= Dry matter of weeds in control plot

DMT= Dry matter of weeds in treated plot

Weed index

The weed index was calculated by the formula proposed by (Gill and Vijaykumar, 1969).

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

Where,

WI=Weed index in percent

X =Yield from weed free plot

Y =Yield from the treatment for

In chickpea, major weed flora observed were *Agemone mexicana, Melilotus alba, Portulaca oleraceae, Euphorbia hirita, Digera arvensis, Phasalis minima, Cyperus rotundus, Convolvus arvensis, Amaranthus viridis* etc. in field.

Lowest weed population and weed dry weight was found in pendimethalin 1 kg ha^{-1} with 1H at 40 DAS which was *at par* with cultural treatments 2H at 15 and 40 DAS with HW at 30 DAS. Weed control efficiency denotes the control of weeds in respective treatments. Higher WCE of treatments shows lower weed count and better weed control practices. In peanut crop chemical weed control observed result of pendimethalin at 1 kg ha^{-1} with 1H at 40 DAS have higher reduction in number and dry weight of weeds per square meter and better WCE was reported by Abdur *et al.* (2009). Application of pyrazosulfuron 0.20 kg ha^{-1}+one mechanical weeding and hand weeding at 25 DAS or DAT were more effective to suppressing weed population and weed dry matter accumulation thereby producing higher rice grain yield reported by Hassan and Upasani, (2015).

PE application of pendimethalin at 1 kg ha^{-1} + 1H at 40 DAS registered highest WCE at different stages of crop. Dungarwal *et al.* (2002) and Singh *et al*. (2003) reported that hand weeding at 30 DAS recorded the lowest dry weed biomass and it gives highest WCE (53.80%) but was statistically *at par* with PE application of pendimethalin. Weeds remove 5-6 times more nitrogen, 5-12 times Phosphorous and 2-5 times potassium than crop in the early stages of crop.

Treatment weedy check (T_1) recorded significantly lowest nutrient uptake by plant among all the treatments. The maximum nutrient uptake by plant was found in 2H at 15 and 30 DAS + HW at 40 DAS (T_{10}) followed by T_8, T_4, T_9, and T_5. Similar results were observed by Noor, (1977) in groundnut crop. Treatment weedy check (T_1) recorded significantly maximum nitrogen, phosphorus and potassium uptake by weeds than other weed control treatment.

The lowest uptake of nutrients by weed observed in treatments T_{10} followed by T_8, which may be due to lowest weed count. Similarly Sumathi, (2009) shows that un-weeded check removed 42 kg N, 15.5 kg P and 45.0 Kg ha^{-1} and monetary loss in terms of nutrient removal by weeds was maximum in weedy check.

Plant height recorded highest with treatments PE Pendimethaline 1kg ha^{-1} with H at 40 DAS which was *at par* with treatements 2H at 15 and 40 DAS with HW at 30 DAS. Alone PE application of Pendimethaline 1 kg ha^{-1} also recorded maximum plant height than rest of treatements. Similar result observed in branches plant^{-1}. Number of pods plant^{-1} recorded maximum with treatments 2H at 15 and 40 DAS with HW at 30 DAS which was *at par* with treatments PE Pendimethaline 1kg ha^{-1} with H at 40 DAS. Among herbicidal treatment alone application of PE pendimethaline 1 kg ha^{-1} proves significantly superior over the rest of treatments reported by Singh *et al.* (2001),

Revealed that the weed control treatments had significantly influences on number of pods plant^{-1} weedy check (T_1) recorded significantly lowest number of pods plant^{-1}. Application of PE pendimethalin 1 kg ha^{-1} + H at 40 DAS (T_8) recorded highest number of pods plant $^{-1}$ among chemical treatment which as *at par* with treatment T_{10} which have highest number of pods plant^{-1}.

Effective weed control in the early stage of crop growth would have resulted in increased pods plant^{-1}. Similar findings were reported by Shrinivasan *et al.* (1992). All the weed management practices significantly improved the yield attributes over weedy check. Yield attributes pod number, weight of seed, 100 grain weight plant^{-1} significantly higher with T_{10} which was *at par* with T_8. This could be because of elimination of crop weed competition during early growth as well as later part of the crop growth and development in these treatments and consequently greater dry matter accumulation by plants causing improvement by plants

Table 1: Different treatments influnced on weed dry weight, WCE, and weed index in chickpea

Treatments	WDW(g)	WCE(%)	WI(%)
T_1 - Weedy check	17.31	0	61.59
T_2- IMZ PE @ 75 gha^{-1}	4.64	73.19	17.71
T_3-IMZ POE @ 75 g ha^{-1}	4.54	73.77	22.88
T_4- Pen @ 1000 g ha^{-1} PE	4	76.89	6.07
T_5-QZF @ 50 g ha^{-1} POE	4.41	74.52	12.53
T_6-IMZ @ 75 g ha-1 PE+1H at 30DAS	4.20	75.73	16.39
T_7-IMZ POE @ 75 g ha^{-1} +1H at 40DAS	4.36	74.81	18.89
T_8- Pen @ 1000 g ha^{-1} PE + 1H at 40DAS	3.10	82.09	2.28
T_9-QZF @ 50 g ha^{-1} POE+1H at 40DAS	4.13	76.14	12.38
T_{10}-2H at 15 and 40 DAS + 1HW at 30 DAS	2.58	85.09	0
SEm(±)	**0.76**		
LSD(0.05)	**2.26**		
G.M.	**5.33**	**69.22**	**61.59**

Table 2: Influence of different treatments on Nutrient uptake by plant and weeds.

Treatments	Uptake by plant (kg ha^{-1})			Uptake by weeds (kg ha^{-1})		
	N	P	K	N	P	K
T_1 - Weedy check	31.72	8.97	29.98	22.96	19.21	20.17
T_2- IMZ PE @ 75 gha^{-1}	88.39	20.56	60.97	12.06	10.72	10.63
T_3-IMZ POE @ 75 g ha^{-1}	84.37	19.41	58.97	13.78	11.11	10.41
T_4- Pen @ 1000 g ha^{-1} PE	102.39	24.59	71.71	10.30	8.50	8.74
T_5-QZF @ 50 g ha^{-1} POE	94.79	22.19	65.60	10.88	8.55	8.72
T_6-IMZ @ 75 g ha-1 PE+1H at 30DAS	91.18	21.31	62.84	12.38	10.21	10.07
T_7-IMZ POE @ 75 g ha^{-1} +1H at 40DAS	87.64	19.97	60.34	11.51	9.98	9.65
T_8- Pen @ 1000 g ha^{-1} PE + 1H at 40DAS	107.16	26.01	77.58	7.71	5.44	5.11
T_9-QZF @ 50 g ha^{-1} POE+1H at 40DAS	96.34	23.09	67.36	7.59	6.36	6.33
T_{10}-2H at 15 and 40 DAS + 1HW at 30 DAS	108.49	27.08	78.67	7.80	5.84	5.68
SEm(±)	**7.95**	**1.78**	**4.61**	**1.18**	**0.46**	**0.48**
LSD(0.05)	**23.63**	**5.3**	**13.71**	**3.52**	**1.38**	**1.42**
G.M.	**89.25**	**21.32**	**63.40**	**11.7**	**8.59**	**9.55**

Table 3: Growth, yield and 100 seed weight under different methods of weed control treatments.

Treatments	Plant height (cm)	Branches plant^{-1}	Pods plant^{-1}	100 seed weight	Grain Yield (q ha^{-1})
T_1 -Weedy check	41.24	20.69	36.54	20.77	11.20
T_2- IMZ PE @ 75 gha^{-1}	51.63	24.92	41.20	23.43	23.62
T_3-IMZ POE @ 75 g ha^{-1}	56.51	25.14	41.15	23.14	22.13
T_4- Pen @ 1000 g ha^{-1} PE	62.42	28.53	46.71	25.55	26.96
T_5-QZF @ 50 g ha^{-1} POE	57.34	25.42	45.02	24.25	24.94
T_6-IMZ @ 75 g ha-1 PE+1H at 30DAS	57.66	25.97	42.19	23.14	24.49
T_7-IMZ POE @ 75 g ha^{-1} +1H at 40DAS	58.27	26.60	44.02	23.50	23.28
T_8- Pen @ 1000 g ha^{-1} PE + 1H at 40DAS	70.34	29.68	52.56	25.55	28.57
T_9-QZF @ 50 g ha^{-1} POE+1H at 40DAS	63.31	27.29	49.92	24.40	25.35
T_{10}-2H at 15 and 40 DAS + 1HW at 30 DAS	67.14	28.75	54.39	26.21	28.71
SEm(±)	**0.93**	**0.87**	**1.55**	**0.66**	**1.55**
LSD(0.05)	**3.76**	**2.60**	**2.20**	**5.9**	**5.76**
G.M.	**58.95**	**26.13**	**45.37**	**23.94**	**26.76**

causing improvement in yield contributing characters. 100 grain weight showed similar trend as yield attributes that prevailed among the treatments. Similar findings by Sharma *et al.* (2005).

Perusal of the data indicated that gross monetary return (GMR) were significantly highest under treatment 2H at 15 DAS and 40 DAS + HW at 30 DAS (T_{10}) and lowest under weedy check T_1. Treatment PE pendimethalin 1 kg ha^{-1} + H at 40 DAS (T_8) recorded higher GMR than other herbicidal treatments. Treatment T_{10} which was *at par* with all other treatments except T_3.

Net monetary return (NMR) were significantly highest under treatment 2H at 15 and 40 DAS + HW at 30 DAS (T_{10}) and lowest under weedy check T_1. Treatment PE pendimethalin 1 kg ha^{-1} + H at 40 DAS (T_8) recorded higher NMR than other herbicidal treatments. Treatment $T_{10,}$ which was at par with all other treatments except T_3.

Maximum B:C ratio was obtained with treatment T8 PE pendimethalin 1 kg ha^{-1} + H at 40 DAS which was followed by T_9. Treatment T_{10} 2H at 15 DAS and 40 DAS + HW at 30 DAS recorded highest B: C ratio.

Table 4: Gross return, cost of cultivation, net monetary return, B: C ratio as influenced by different weed control treatment.

Treatments	Gross return (Rs. ha^{-1})	Cost of cultivation (Rs. ha^{-1})	Net return (Rs. ha^{-1})	B : C ratio
T_1 -Weedy check	26048.7	11641	14407.9	2.237707
T_2- IMZ PE @ 75 gha^{-1}	54597.48	15591	39006.68	3.501904
T_3-IMZ POE @ 75 g ha^{-1}	51256.21	15591	35665.41	3.287593
T_4- Pen @ 1000 g ha^{-1} PE	62305.12	15119	47186.32	4.121036
T_5-QZF @ 50 g ha^{-1} POE	57670.41	14741	42929.61	3.912299
T_6-IMZ @ 75 g ha-1 PE+1H at 30DAS	56621.84	15791	40831.04	3.585749
T_7-IMZ POE @ 75 g ha^{-1} +1H at 40DAS	53844.11	15791	38053.31	3.40984
T_8- Pen @ 1000 g ha^{-1} PE + 1H at 40DAS	65989	15319	50670.2	4.307714
T_9-QZF @ 50 g ha^{-1} POE+1H at 40DAS	58609.74	14941	43668.94	3.922798
T_{10}-2H at 15 and 40 DAS + 1HW at 30 DAS	66308.23	13091	53217.43	5.065254
SEm(±)	**4684.85**	**-**	**4684.85**	**-**
LSD(0.05)	**13919.94**	**-**	**13919.94**	**-**
G.M.	**55325.08**	**14761.4**	**40563.68**	**3.75**

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