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Effects of Integrated Weed Management Practices on Nutrient Uptake by Weeds and Chickpea (*Cicer arietinum* L.)

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A B S T R A C T

A field experiment was conducted at Agriculture Research Station, Annigeri, University of Agricultural Sciences, Dharwad during *Rabi* season of 2015-16 to find out the effects of integrated weed management practices on nutrient uptake by weeds and chickpea under rainfed condition. All integrated treatments effectively maximized nutrient uptake by crop and reduced uptake of nutrients by weeds. Results revealed that as expected weed check (T_{11}) recorded significantly the highest uptake of nutrients (NPK) by weeds, but treatments T_{10} (application of pendimethalin @ 1.0 kg a.i ha^{-1} (PE) fb imazethapyr @ 75 g a.i ha^{-1} at 20 DAS (POE) fb hoeing at 40 DAS), T_9 (pendimethalin @ 1.0 kg a.i ha^{-1} (PE) fb quizalofop-p-ethyl @ 40 g a.i ha^{-1} at 20 DAS (POE) fb hoeing at 40 DAS) and T_2 (pendimethalin @ 1.0 kg a.i ha^{-1} (PE) + hoeing twice at 20 and 40 DAS) recorded the lower uptake of nutrients by weeds, at 40 DAS and at harvest. Weed free check (T_{12}) recorded significantly highest uptake of nutrients (NPK) by chickpea but was on par with treatments, T_{10}, T_9 and T_2.

Introduction

Chickpea [*Cicer arietinum* L. Wilczek] is one of the most ancient and extensively grown pulse crops of India. In India, it is mainly cultivated in Madhya Pradesh, Maharashtra, Andhra Pradesh, Rajasthan, Odisha and Karnataka. India is the largest producer of chickpea accounting to 75% of the world production. Chickpea, being slow in its early growth and short stature plant, is highly susceptible to weed competition and often considerable losses may occur if weeds are not controlled at proper time. Competition of weeds with chickpea assumes more importance as the crop is sown during post-rainy season under rainfed and dryland conditions, thus requires timely and effective weed management practices. Weeds compete severely with crop for nutrient, moisture, light and space and causes yield reduction to the extent of 75% in chickpea (Chaudhary *et al.*, 2005). Nutrients are very much essential for growth and development of chickpea and these deficiency leads to decrease the crop yield. Therefore, it is necessary to know the uptake of nutrients by crop and weeds very important. Thus, this research was conducted with the objective of to study the effects of integrated weed management practices on nutrient uptake by weeds and chickpea.

Materials and Methods

A field experiment was conducted at Agriculture Research Station, Annigeri,

University of Agricultural Sciences, Dharwad during *Rabi* seasons of 2015-16 under rainfed condition. The experiment was laid out in a randomized complete block design (RCBD) with three replications and 12 treatments comprising, T_1 - Hoeing twice at 20 and 40 DAS, T_2 - Pendimethalin @ 1.0 kg a.i ha^{-1} (PE) + Hoeing twice at 20 and 40 DAS, T_3 - Quizalofop-p-ethyl @ 40 g a.i ha^{-1} at 20 DAS (POE), T_4 - Imazethapyr @ 75 g a.i ha^{-1} at 20 DAS (POE), T_5 - T_3 + Hoeing at 40 DAS, T_6 - T_4 + Hoeing at 40 DAS, T_7 - Pendimethalin @ 1.0 kg a.i ha^{-1} (PE) + T_3, T_8 - Pendimethalin @ 1.0 kg a.i ha^{-1} (PE) + T_4, T_9 - Pendimethalin @ 1.0 kg a.i ha^{-1} (PE) + T_3 + Hoeing at 40 DAS, T_{10} - Pendimethalin @ 1.0 kg a.i ha^{-1} (PE) + T_4 + Hoeing at 40 DAS, T_{11} - Weedy check and T_{12} - Weed free. The soil of the experimental field was clayey in texture and soil in low, low and high rating for available nitrogen (224 kg N ha^{-1}) (Kjeldal method), available phosphorus (20.86 kg P_2O_5 ha^{-1}) (Olesen's method) and available potassium (342 kg K_2O ha^{-1}) (Flame photometric method), respectively. The soil was found slightly alkaline (pH 7.95) (Potentiometric method) with normal electric conductivity.

Chickpea JG-11 variety was sown on 7th October, 2015 at row spacing of 37.5 x 10 cm with using 50 kg ha^{-1} seed rate and fertilized with 25 kg N, 50 kg P_2O_5 and 25 kg K_2O ha^{-1} at the time of sowing. The crop was grown with recommended package of practices of Agriculture Research Station, Annigeri, for Northern Dry Zone (zone-3) of Karnataka. During the crop growth period October to January received rainfall was 38.40 mm, which was 120.65 mm lower than average rainfall. The pre-emergence herbicide was sprayed immediately after sowing on wet soil and post-emergence herbicides at 20 DAS as per treatment with knapsack sprayer.

Estimation of N, P and K uptake by crop and weeds

To estimate the uptake of N, P and K, samples were collected 40 DAS and at harvest for weeds and only at harvest for crop. The samples were oven dried at 65^0 C and ground in Willey mill to pass through two mm sieve. The two mm sieved samples were used for the estimation of nitrogen, phosphorus and potassium content in crop and weeds. Nitrogen uptake by crop and weeds were determined by digesting the plant samples with suitable acid mixture of concentrated sulphuric acid. The digested samples were distilled by Microkjeldhal method in an alkaline condition and titrated against standard acid Piper (2002). Phosphorus was estimated by Vanedomolybdate method in diacid mixture as detailed by Jackson (1973). The intensity of the colour developed was measured in a spectrophotometer, using blue filter. Potassium content was estimated from diacid digest material using Flame Photometer as described by Muhr *et al.,* 1965 and was expressed as percentage K. The nutrient content and dry weight were used to calculate the total uptake of nutrients (N P K) and expressed in kg ha-1.

$$\text{Nutrient uptake (kg ha}^{-1}) = \frac{\text{Nutrient content (\%)}}{100} \text{ X Dry weight (kg ha}^{-1})$$

Results and Discussion

Nutrients (NPK) uptake by weeds

The predominant weed flora of the experimental field comprised of *Cyperus rotundus* L. (53.67%), *Panicum dichotomiflorum* L. (14.38%), *Commelina benghalensis* L. (11.93%), *Convolvulus arvensis* L. (9.25%), *Euphorbia geniculata* L. (6.33%) and *Parthenium hysterophorus* L. (4.25%). Among the different weeds *Cyperus rotundus, Panicum dichotomiflorum* and *Commelina benghalensis* were dominant than others.

Table.1 Nitrogen, phosphorus and potash content (%) and uptake (kg ha^{-1}) by weeds as influenced by weeds control treatments

Treatment	40 DAS						At harvest					
	Nutrient content (%)			Uptake (kg ha^{-1})			Nutrient content (%)			Uptake (kg ha^{-1})		
	N	P	K	N	P	K	N	P	K	N	P	K
T_1- Hoeing twice at 20 and 40 DAS	1.64	0.23	1.33	2.36	0.32	1.91	1.65	0.24	1.34	0.76	0.11	0.62
T_2 - Pendimethalin @ 1.0 kg a.i ha^{-1} (PE) + T_1	1.63	0.24	1.32	2.07	0.30	1.68	1.64	0.25	1.34	0.64	0.10	0.53
T_3 - Quizalofop-p-ethyl @ 40 g a.i ha^{-1} at 20 DAS (POE)	1.68	0.31	1.38	2.71	0.49	2.22	1.70	0.32	1.40	3.04	0.57	2.50
T_4 - Imazethapyr @ 75 g a.i ha^{-1} at 20 DAS (POE)	1.67	0.29	1.37	2.47	0.43	2.04	1.69	0.30	1.39	2.92	0.52	2.39
T_5 - T_3 + Hoeing at 40 DAS	1.67	0.26	1.37	2.70	0.42	2.21	1.67	0.27	1.38	0.74	0.12	0.61
T_6 - T_4 + Hoeing at 40 DAS	1.66	0.30	1.36	2.41	0.43	1.96	1.67	0.30	1.37	0.77	0.14	0.63
T_7 - Pendimethalin @ 1.0 kg a.i ha^{-1} (PE) + T_3	1.70	0.30	1.40	2.17	0.38	1.78	1.70	0.30	1.42	2.51	0.45	2.09
T_8 - Pendimethalin @ 1.0 kg a.i ha^{-1} (PE) + T_4	1.69	0.28	1.39	2.03	0.36	1.68	1.69	0.29	1.41	2.09	0.35	1.74
T_9 - T_7 + Hoeing at 40 DAS	1.71	0.30	1.42	1.88	0.31	1.55	1.72	0.31	1.43	0.67	0.12	0.56
T_{10} - T_8 + Hoeing at 40 DAS	1.72	0.27	1.42	1.83	0.29	1.51	1.72	0.28	1.43	0.49	0.08	0.41
T_{11} - Weedy check	1.71	0.33	1.38	6.19	1.20	5.00	1.73	0.34	1.40	6.74	1.32	5.45
T_{12} - Weed free	1.70	0.30	1.39	0.17	0.03	0.14	1.71	0.31	1.41	0.08	0.01	0.06
S.Em±	0.009	0.012	0.006	0.15	0.029	0.011	0.008	0.013	0.007	0.12	0.024	0.10
CD (5%)	0.027	0.036	0.024	0.45	0.086	0.033	0.024	0.051	0.021	0.37	0.071	0.30

Note: DAS- Days after sowing, PE- Pre-emergence, POE- Post-emergence

Table.2 Nitrogen, phosphorus and potash content (%) and uptake (kg ha^{-1}) by chickpea at harvest as influenced by weeds control treatments

Treatment	Nutrient content (%)			Uptake (kg ha^{-1})		
	N	P	K	N	P	K
T_1- Hoeing twice at 20 and 40 DAS	1.37	0.45	1.30	19.67	6.45	18.71
T_2 - Pendimethalin @ 1.0 kg a.i ha^{-1} (PE) + T_1	1.39	0.47	1.32	21.10	7.27	19.80
T_3 - Quizalofop-p-ethyl @ 40 g a.i ha^{-1} at 20 DAS (POE)	1.29	0.40	1.25	15.61	4.82	15.19
T_4 - Imazethapyr @ 75 g a.i ha^{-1} at 20 DAS (POE)	1.29	0.40	1.26	15.85	4.95	15.45
T_5 - T_3 + Hoeing at 40 DAS	1.34	0.43	1.29	18.59	5.96	17.88
T_6 - T_4 + Hoeing at 40 DAS	1.35	0.44	1.29	19.25	6.26	18.39
T_7 - Pendimethalin @ 1.0 kg a.i ha^{-1} (PE) + T_3	1.31	0.41	1.27	16.63	5.25	16.10
T_8 - Pendimethalin @ 1.0 kg a.i ha^{-1} (PE) + T_4	1.32	0.42	1.28	17.10	5.48	16.56
T_9 - T_7 + Hoeing at 40 DAS	1.39	0.48	1.32	21.19	7.50	20.11
T_{10} - T_8 + Hoeing at 40 DAS	1.40	0.48	1.33	22.08	7.94	21.01
T_{11} - Weedy check	1.28	0.39	1.24	14.73	4.45	14.27
T_{12} - Weed free	1.41	0.50	1.35	23.24	8.30	22.30
S.Em±	0.007	0.014	0.01	0.83	0.42	1.04
CD (5%)	0.021	0.042	0.03	2.24	1.23	3.06

Note: DAS- Days after sowing, PE- Pre-emergence, POE- Post-emergence

Similar finding were reported by Patel *et al.*, 2006; Ratnam *et al.*, 2011; Goud *et al.*, 2013; and Chandrakar *et al.*, 2015. Nutrient (N, P and K) uptake by weeds varied significantly among various weed management treatments. Weedy check (T_{11}) recorded significantly higher uptake of nutrient (6.19 and 6.74 N), (1.20 and 1.32 P) and (5.00 and 5.45 K) at 40 DAS and at harvest respectively, while, weed free check (T_{12}), T_{10} (application of pendimethalin @ 1.0 kg a.i ha^{-1} (PE) fb imazethapyr @ 75 g a.i ha^{-1} at 20 DAS (POE) fb hoeing at 40 DAS), T_9 (pendimethalin @ 1.0 kg a.i ha^{-1} (PE) fb quizalofop-p-ethyl @ 40 g a.i ha^{-1} at 20 DAS (POE) fb hoeing at 40 DAS) and T_2 (pendimethalin @ 1.0 kg a.i ha^{-1} (PE) + hoeing twice at 20 and 40 DAS) recorded significantly the lower uptake of nutrient (N, P and K). Lower uptake of nutrient in these treatments might be due to lower number of weeds as well as lower weed dry weight in these treatments. The results are in conformity with findings of Singh *et al.*, (2014) and Chandrakar *et al.*, (2015).

Nutrients (NPK) uptake by chickpea

Nutrients uptake by chickpea showed significant variations at harvest with NPK uptake. Weed free check (T_{12}) recorded significantly the highest uptake of nitrogen (23.24 kg ha^{-1}), phosphorus (8.30 kg ha^{-1}) and potassium (22.30 kg ha^{-1}) at harvest. Among the integrated treatments, T_{10} (application of pendimethalin @ 1.0 kg a.i ha^{-1} (PE) fb imazethapyr @ 75 g a.i ha^{-1} at 20 DAS (POE) fb hoeing at 40 DAS), T_9 (pendimethalin @ 1.0 kg a.i ha^{-1} (PE) fb quizalofop-p-ethyl @ 40 g a.i ha^{-1} at 20 DAS (POE) fb hoeing at 40 DAS) and T_2 (pendimethalin @ 1.0 kg a.i ha^{-1} (PE) + hoeing twice at 20 and 40 DAS) were found to be on par with weed free check (T_{12}). Higher uptake of nutrients in these treatments in might due to lower competition by weeds which results in production of higher biomass by crop. Similar results were observed in chickpea by Singh *et al.*, (2014) and Chandrakar *et al.*, (2015).

Conclusion based on results of the field experimentation, it seems quite logical to conclude that profitable, potential and effective nutrient management in chickpea by integrated Weed Management Practices can be achieved by application of pendimethalin @ 1.0 kg a.i ha^{-1} (PE) fb imazethapyr @ 75 g a.i ha^{-1} at 20 DAS (POE) fb hoeing at 40 DAS during crop growth period, application of pendimethalin @ 1.0 kg a.i ha^{-1} (PE) fb Quizalofop-p-ethyl @ 40 g a.i ha^{-1} at 20 DAS (POE) fb hoeing at 40 DAS and Pendimethalin @ 1.0 kg a.i ha^{-1} (PE) fb hoeing twice at 20 and 40 DAS.

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