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RESEARCH NOTE

Weed control efficiency, weed index and yield in groundnut as influenced by weed management practices under rice-groundnut system in coastal zone of Karnataka

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The field experiment was conducted at the Agricultural Research Station, Kumta, Uttar Kannada, University of Agricultural Sciences, Dharwad (Karnataka) during *rabi*-summer 2016-17 under coastal zone to evaluate the weed management practices for weed control efficiency, weed index and yield of groundnut. Among the weed management practices, At harvest, significantly higher weed management efficiency (71.1 %) was observed with Two hand weeding (At 20 and 40 DAS) which was on par with T_4: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} followed by One hand weeding at 25 DAS, T_7: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} followed by imazethapyr 10 % SL @ 75 g ha^{-1} at 20-30 DAS and T_9: Pendimethalin 30 % EC @ 1.0 kg ha^{-1} followed by One hand weeding at 25 DAS. Lowest weed index (6.4 %) was recorded with the treatments where pre-emergence application of pendimethalin 30 % EC @ 1.5 kg ha^{-1} followed by one hand weeding at 25 DAS. Higher pod yield (2255 kg ha^{-1}) and kernel yield (1294 kg ha^{-1}) was recorded with the treatment where Pendimethalin 30 % EC @ 1.5 kg ha^{-1} followed by one hand weeding at 25 DAS, whereas, un-weeded check treatment recorded significantly lower pod yield (1453 kg ha^{-1}) and kernel yield (777 kg ha^{-1}) than all other treatments.

Key words: Groundnut, Weed control efficiency, Weed index, Yield

In India, groundnut is being cultivated over an area of 8.59 million hectares with a total production of 6.56 million tonnes with productivity of 1,764 kg ha^{-1} (Anon., 2015). Major groundnut growing states *viz.,* Gujarat, Andhra Pradesh, Tamil Nadu, Rajasthan, Karnataka and Maharashtra, which contribute 90 per cent of total groundnut production. Karnataka ranks fifth in the country with a production of 0.56 million tonnes from an area of 0.82 million hectares and an average yield of 907 kg ha^{-1} (Anon., 2015). This is very low when compared to the national productivity. The major groundnut growing districts in *rabi* season in Karnataka are Udupi and Uttara kannada.To meet the growing demand of oilseed production the groundnut cultivation has been extended to *rabi*/summer or post rainy season in Andhra Pradesh, Tamil Nadu, Orissa, Kerala, West Bengal, Karnataka and Jharkhand, where in most of the land remains fallow after *kharif* rice. Cultivation of pulses (green gram and black gram) in rice-fallow is a common practice in coastal areas of Andhra Pradesh, Karnataka and Tamil Nadu. Groundnut is one of the alternatives to these pulses in rice-fallows under coastal areas. Groundnut is grown during *kharif, rabi* and summer season in India. Low productivity of groundnut mainly attributed to number of factors *viz*., vagaries of monsoon, unavailability of irrigation facilities, poor management, heavy weed infestation and lack of improved technologies. Amongst these, weed infestation is one of the key factors. During the early stages of crop growth, it encounters severe weed problem, because of slow growth of crop in the initial stages. Moreover, shoot growth is very less when compared to the root development. The weeds emerge fast and grow rapidly competing with the crop severely for the resources *viz.,* nutrients, light, and also transpire lot of water from the soil. The initial four to eight weeks after sowing are considered as the critical period of weed competition during the crop growth period (Jat *et al.,* 2011). Lack of pre-emergence herbicide activity for longer period's results in weed growth that necessitate hand weeding at 25-40 days after sowing. In such situation post-emergence herbicides (imazethapyr and quizalofop-p-ethyl) were suggested for weed management at critical weed stage. Development of suitable weed management strategies to alleviate weed pressure on the available resources is known to prop up the crop productivity considerably. Hence, the present investigation was undertaken to study the weed control efficiency; weed index and yield in groundnut as influenced by weed management practices under rice-groundnut system in coastal zone of Karnataka.

The field experiment was conducted at the Agricultural Research Station, Kumta, Uttar Kannada, University of Agricultural Sciences, Dharwad (Karnataka). Kumta is located at 14.25'54° N latitude and 74.25'16° E longitude and at an altitude of 2 m above the mean sea level. This research station comes under coastal zone (Zone 10) of Karnataka which receives normal rainfall of 3588 mm, highest being in July month.

The experiment was laid out in randomized complete block design with three replications. The soil type of experimental site was loamy sand *i.e.*, coastal sands. The variety used was Dh-86, the experiment comprised nine treatments are as follows.T_1: Unweeded check, T_2: Weed free check, T_3: Two hand weeding (At 20 and 40 DAS), T_4: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} (PE) followed by one hand weeding at 25 DAS, T_5: Oxyfluorfen 23.5 % EC @ 200 g ha^{-1} (PE) followed by one hand weeding at 25 DAS, T_6: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} (PE) followed by quizalofop-p-ethyl 5 % EC @ 50 g ha^{-1} 20-30 DAS (POE), T_7: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} (PE) followed by imazethapyr 10 % SL @ 75 g ha^{-1} 20- 30 DAS (POE), T_8: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} (PE) followed by oxyfluorfen 23.5 % EC @ 100 g ha^{-1} at 20-30 DAS (POE), T_9: Pendimethalin 30 % EC @ 1.0 kg ha^{-1} (PE) followed by one hand weeding at 25 DAS (Note: PE: Pre-emergence and POE: Post-emergence).

The crop was supplied with recommended fertilizer dose of 25:75:25 kg N, P_2O_5 and K_2O along with FYM of 7.5 tons per ha through urea, single super phosphate and muriate of potash, respectively. The entire dose was applied as basal through placement in the furrows and recommended dose of gypsum @ 500 kg ha^{-1} was applied between the rows at the time pegging *i.e.*, 45 days after sowing between the rows and covered with

soil. The observations were recorded at different stages, in weed control efficiency, weed index and yield of groundnut.

Weed management efficiency varied significantly due to different weed management treatments at different stages of crop growth and is presented in the

Table 1. At 20 DAS, the weed control efficiency ranging from 20.7 to 44.9 per cent was recorded in various treatments. Among the weed management treatments, pre-emergence application of pendimethalin 30 % EC @ 1.5 kg ha^{-1} followed by one hand weeding at 25 DAS was recorded significantly higher WCE (44.9 %) and which was on par with T_5: Oxyfluorfen 23.5 % EC @ 200 g ha^{-1} followed by (*fb*) One hand weeding at 25 DAS, T_6: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} *fb* Quizalofop-p-ethyl 5 % EC @ 50 g ha^{-1} 20-30 DAS, T_7: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} *fb* Imazethapyr 10 % SL @ 75 g ha^{-1} at 20-30 DAS and T_8: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} *fb* Oxyfluorfen 23.5 % EC @ 100 g ha^{-1} at 20-30 DAS This might be due to reduced density and dry weight of weeds to some extent with the pre-emergence application of pendimethalin. At 40 DAS, the weed control efficiency ranged from 38.6 to 66.6 per cent in various treatments. Among the weed management treatments, application of pendimethalin 30 % EC @ 1.0 kg ha^{-1} followed by one hand weeding at 25 DAS was recorded significantly higher WCE (66.6 %) and which was on par with T_5: Oxyfluorfen 23.5 % EC @ 200 g ha^{-1} *fb* One hand weeding at 25 DAS (63.6 %), T_6: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} *fb* Quizalofop-p-ethyl 5 % EC @ 50 g ha^{-1} 20-30 DAS (58.9 %), T_7: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} *fb* Imazethapyr 10 % SL @ 75 g ha^{-1} at 20-30 DAS (58.1 %) T_8: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} *fb* Oxyfluorfen 23.5 % EC @ 100 g ha^{-1} at 20-30 DAS (57.4 %). Similar results were reported by Sasikala *et al*. (2006) and Chaitanya *et al*. (2012) in groundnut. At 60 DAS, among the weed management treatments, significantly higher weed control efficiency (70.3 %) was observed in Two hand weeding (At 20 and 40 DAS) which was on par with , T_5: Oxyfluorfen 23.5 % EC @ 200 g ha^{-1} *fb* One hand weeding at 25 DAS, T_6: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} *fb* quizalofop-p-ethyl 5 % E.C. @ 50 g ha^{-1} 20-30 DAS, T_7: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} *fb* Imazethapyr 10 % SL @ 75 g ha^{-1} at 20-30 DAS and T_9: Pendimethalin 30 % EC @ 1.0 kg ha^{-1} *fb* One hand weeding at 25 DAS. These results are akin to those reported by Sailaja *et al.* (2002), Chandrika (2004) and Chaitanya *et al.* (2012). Higher weed control efficiency in these treatments might be due to lower dry weight of weeds

At harvest, significantly higher weed management efficiency (71.1 %) was observed with Two hand weeding (At 20 and 40 DAS) which was on par with T_4: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} *fb* One hand weeding at 25 DAS, T_7: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} *fb* Imazethapyr 10 % SL @ 75 g ha^{-1} at 20-30 DAS and T_9: Pendimethalin 30 % EC @ 1.0 kg ha^{-1} *fb* One hand weeding at 25 DAS. The application of pendimethalin 30 % EC @ 1.5 kg ha^{-1} followed by one hand weeding at 25 DAS recorded significantly higher than

Table 1. Weed check efficiency, weed index, pod yield and kernel yield of groundnut as influenced by weed management treatments

Treatments		Weed control efficiency (%)				Weed	Pod	Shelling	Pod	Kernel	Haulm	Harvest
		20 DAS	40 DAS	60 DAS	At harvest	index (%)	yield (kg ha^{-1})	(%)	yield (kg ha^{-1})	yield (kg ha^{-1})	yield (kg ha^{-1})	index
T_1	Un-weeded check	0.0	0.0	0.0	0.0	39.2	1453	53.55	1453	777	1612	0.25
T_2	Weed free check	100.0	100.0	100.0	100.0	0.0	2408	58.62	2408	1412	2397	0.29
T_3	Two hand weeding (At 20 and 40 DAS)	20.7	38.6	70.3	71.1	17.6	1974	54.96	1974	1080	2053	0.27
T_4	Pendimethalin 30 % E.C.@1.5 kg ha^{-1} (PE) *fb* One hand weeding at 25 DAS (POE)	44.9	66.2	66.3	66.2	6.4	2255	57.46	2255	1294	2233	0.29
T_5	Oxyfluorfen 23.5% E.C. @ 200 g ha^{-1} (PE) *fb* One hand weeding at 25 DAS	34.2	63.6	68.4	59.3	31.9	1633	53.81	1633	881	1787	0.27
T_6	Pendimethalin 30 % E.C.@1.5 kg ha^{-1} (PE) *fb* Quizalofop-p-ethyl 5%E.C. @ 50 g ha^{-1} 20- 30 DAS (POE)	39.4	58.9	67.4	59.2	11.0	2145	56.07	2145	1201	2228	0.27
T_7	Pendimethalin 30% E.C.@1.5 kg ha^{-1} (PE) *fb* Imazethapyr 10 % S.L.@ 75 g ha^{-1} at 20- 30 DAS (POE)	38.4	58.1	68.0	64.8	11.4	2133	55.47	2133	1181	2106	0.28
T_8	Pendimethalin 30% E.C.@1.5 kg ha^{-1} (PE) *fb* Oxyfluorfen 23.5% E.C. @ 100 g ha^{-1} at 20-30 DAS (POE)	36.4	57.4	61.5	57.2	29.4	1688	53.77	1688	907	1808	0.28
T_9	Pendimethalin 30% E.C.@1.0 kg ha^{-1} (PE) *fb* One hand weeding at 25 DAS.	21.4	66.6	64.0	63.8	15.9	2023	54.01	2023	1092	2063	0.27
	S.Em.±	5.8	5.3	2.5	3.1	3.6	98	1.98	98	39	96	0.01
	C.D. at 5%	17.5	16.0	7.5	9.2	10.8	293	NS	293	119	288	0.02

DAS: Days after sowing, *fb*: followed by, HW: Hand weeding, E.C. Emulsifiable Concentrate, S.L. Soluble liquid, PE: Pre-emergence, POE: Post-emergence

the T_9: Pendimethalin 30 % EC @ 1.0 kg ha^{-1} *fb* One hand weeding at 25 DAS.

Weed index of groundnut as influenced by different weed management treatments is presented in the Table 1. Weed index is the extent of yield reduction due to competition from weeds. All the weed management treatments recorded lower weed index than unweeded check. The data on weed index revealed that, among the herbicidal treatments, the lowest weed index (6.4 %) was recorded with the treatments where pre-emergence application of pendimethalin 30 % EC @ 1.5 kg ha^{-1} followed by one hand weeding at 25 DAS. This treatment was on par with T_6: Pendimethalin 30 % EC @ 1.5 kg ha^{-1}*fb* Quizalofop-p-ethyl 5 % EC @ 50 g ha^{-1} 20-30 DAS and T_7: Pendimethalin 30 % EC @ 1.5 kg ha^{-1} Imazethapyr 10 % SL @ 75 g ha^{-1} at 20-30 DAS. Similar findings were obtained by Srinivasa Rao *et al*. (2011). The highest weed index was recorded with unweeded check which might be due to higher dry matter accumulation of weeds because of season long weed competition which consequently, reduced crop yield.

The data on pod and kernel yield was differed significantly due to weed management treatments (Table 1). A critical examination of the data reveals that the higher pod yield (2,255 kg ha^{-1}) and kernel yield (1,294 kg ha^{-1}) was recorded with the treatment where pendimethalin 30 % EC @ 1.5 kg ha^{-1} *fb* one hand weeding at 25 DAS. Similar findings were reported by Sailaja *et al.* (2002) and Sagvekar *et al*. (2015). The cumulative effect of the yield attributing characters was reflected in terms of pod yield. Unweeded check treatment recorded significantly lower pod yield (1453 kg ha^{-1}) and kernel yield (777 kg ha^{-1}) than all other treatments and it accounted for 35.6 per cent reduction when compared to pendimethalin 30 % EC @ 1.5 kg ha^{-1}*fb* one hand weeding at 25 DAS. This might be due to higher weed density and dry matter production in the unweeded check, which depleted the nutrients and moisture from soil, which were the most limiting factors for growth, yield attributing characters and yield of crop. Further, this treatment was at par with pendimethalin 30 % EC @ 1.5 kg ha^{-1}*fb* quizalofop-p-ethyl 5 % EC @ 50 g ha^{-1} 20-30 DAS and pendimethalin 30 % EC @ 1.5 kg ha^{-1} *fb* imazethapyr 10 % SL @ 75 g ha^{-1} at 20-30 DAS. Reduction in weed competition, improves growth parameters and these improved growth parameters increases the yield attributes which in turn increase pod yield. These results are in conformity with those reported by Sasikala *et al.* (2004) and Chaitanya *et al.* (2013).

Among the combination of herbicides, pre-emergence application of pendimethalin 30 % EC @ 1.5 kg ha^{-1} followed by post-emergence application quizalfop-p-ethyl 5% EC @ 50 g ha^{-1} at 20-30 DAS and pendimethalin 30 % EC @ 1.5 kg ha^{-1} followed by post-emergence application imazethapyr 10 % SL @ 75 g ha^{-1} at 20-30 DAS were proved effective is higher pod and kernel yield and weed control efficiency.

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