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Bio-efficacy of Herbicides on Weed Density, Weed Control Efficiency, Productivity and Groundnut Quality in Coastal Zone of Karnataka under Rice-Groundnut System

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted at Agricultural Research Station, Kumta, Uttara Kannada district during the rabi-summer season of 2016-17 to investigate the Bio-efficacy of herbicides on weed density, weed control efficiency, productivity and groundnut quality in coastal zone of Karnataka under rice-groundnut system**.** The experiment followed a RBD with nine treatments out of which six treatments involved the pre-emergence application of herbicides followed by either hand weeding or early post-emergence application, along with control treatments. The results indicated that the pre-emergence application of pendimethalin 30% E.C. (1.5 kg ha^{-1}), followed by one hand weeding at 25 days after sowing (DAS), resulted in significantly reduced total weed density and weed dry matter. This treatment also demonstrated higher weed control efficiency and lower weed index. Moreover, it led to increased pod yield, kernel yield and improved quality of groundnut compared to other treatments.

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1. INTRODUCTION

"In India, groundnut cultivation spans across 8.59 million hectares, yielding a total production of 6.56 million tonnes and boasting a productivity of 1,764 kg ha^{-1}" [1]. "The primary groundnut-producing states include Gujarat, Andhra Pradesh, Tamil Nadu, Rajasthan, Karnataka, and Maharashtra, collectively contributing 90 per cent of the nation's total groundnut yield. Karnataka, ranking fifth in the country, produces 0.56 million tonnes from 0.82 million hectares, with an average yield of 907 kg ha^{-1}" [1]. However, this output falls below the national productivity average. Notably, Udupi and Uttara Kannada are among the major groundnut-growing districts during the rabi season in Karnataka. 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, Tamil Nadu and Karnataka. Groundnut is one of the alternatives to these pulses in rice-fallows under coastal areas.

Weed infestation poses a significant challenge for crop cultivation. Particularly during the initial growth stages, crops face considerable weed pressure due to their slower growth compared to weeds. This imbalance often leads to intense competition for essential resources such as nutrients, light, and water, with weeds often out competing the crop. The first four to eight weeks after sowing are critical for weed management, as this period greatly influences crop growth [2]. Studies suggest that weed interference can result in significant losses in groundnut production, ranging from 15 to 75 per cent nationally [3].

Chemical weed control methods offer a viable alternative to manual and mechanical approaches. However, the effectiveness of pre-emergence herbicides is limited, often requiring supplementary hand weeding 25-40 days after sowing. In such cases, post-emergence herbicides like Imazethapyr and Quizalofop-p-ethyl are recommended to manage weeds during critical growth stages. Developing effective weed management strategies is essential to mitigate weed pressure and enhance crop productivity. Therefore, there is a pressing need to evaluate the efficacy of herbicides in controlling weed density, improving weed control efficiency, and enhancing overall productivity and quality in groundnut cultivation within the rice-groundnut system in the coastal region of Karnataka.

2. MATERIALS AND METHODS

A field experiment was conducted at Agricultural Research Station, Kumta, Uttara Kannada district during the rabi-summer season of 2016-17 to investigate the Bio-efficacy of herbicides on weed density, weed control efficiency, productivity and groundnut quality in coastal zone of Karnataka under rice-groundnut system**.** The experiment was laid out in a Randomized Block Design having nine treatments with three replications. Treatment details such as., T_1: Unweeded check, T_2: Weed free check, T_3: Two hand weeding at 20 and 40 DAS), T_4: pendimethalin 30% E.C. (1.5 kg ha^{-1}) pre emergence (PE) *fb* one hand weeding at 25 DAS, T_5: oxyfluorfen 23.5% E.C. (200 g ha^{-1}) pre emergence (PE) *fb* one hand weeding at 25 DAS, T_6: pendimethalin 30% E.C. (1.5 kg ha^{-1}) pre emergence (PE) *fb* quizalofop-p-ethyl 5% E.C. (50 g ha^{-1} at 20-30 DAS post emergence (POE), T_7: pendimethalin 30% E.C. (1.5 kg ha^{-1}) pre emergence (PE) *fb* imazethapyr 10% S.L. (75 g ha^{-1}) at 20- 30 DAS post emergence (POE), T_8: pendimethalin 30% E.C. (1.5 kg ha^{-1}) pre emergence (PE) *fb* oxyfluorfen 23.5% E.C. (100 g ha^{-1}) at 20-30 DAS post emergence (POE) and T_9: pendimethalin 30% E.C. (1.0 kg ha^{-1}) pre emergence (PE) *fb* one hand weeding at 25 DAS. Hand weeding was done at 20, 25 and 40 days after sowing as per treatment. In weed free treatment, throught the crop growth period weed free condition was maintained as when weeds emerged. Observations on weed dry matter, weed density, weed index and weed control efficiency were calculated as per treatments. Similarly plant observations were taken at harvest.

To analyse the density and dry matter of weeds, we employed transformed values ($\sqrt{x+1}$) for statistical purposes, following the recommendation of Gomez and Gomez [4].

3. RESULTS AND DISCUSSION

3.1 Weed Density Influenced by Bio-efficacy of Herbicides

Among the various methods employed for weed management, the treatment denoted as T_4, involving the application of pendimethalin 30% E.C. (1.5 kg ha^{-1}) before emergence followed by manual weeding at 25 DAS, exhibited the lowest total weed density at 20, 40, and 60 DAS, as well as at harvest, with recorded values of 18.33 m^{-2}, 15.67 m^{-2}, 19.33 m^{-2}, and 14.33 m^{-2}, respectively. This performance was comparable to treatments T_5, T_6, T_7, and T_8, which involved various herbicide applications followed by manual weeding at different stages of crop growth. However, treatment T_3, which consisted of two manual weeding at 20 and 40 DAS, did not significantly differ from the aforementioned treatments in total weed density. Conversely, the un-weeded check exhibited significantly higher total weed density throughout the observation periods, with recorded values of 34.33 m^{-2}, 48.67 m^{-2}, 57.33 m^{-2}, and 42.67 m^{-2} at 20, 40, 60 DAS and at harvest, respectively (Table 1).

The highest and lowest weed densities were observed in plots with no weed control and those maintained weed-free. Application of Pendimethalin 30% E.C. (1.5 kg ha^{-1}) followed by manual weeding at 25 DAS showed comparable results with Pendimethalin 30% E.C. (1.5 kg ha^{-1}) followed by Quizalofop-p-ethyl 5% E.C. (50 g ha^{-1}) between 20-30 DAS, and Pendimethalin 30% E.C. (1.5 kg ha^{-1}) followed by Imazethapyr 10% S.L. (75 g ha^{-1}) between 20-30 DAS. Previous studies by Sumathi et al. [5] also reported similar outcomes. The effectiveness of Pendimethalin as a pre-emergence herbicide in suppressing early-emerging broad-leaved weeds, combined with post-emergence application of Imazethapyr in suppressing late-emerging weeds, might explain these results, consistent with findings from Sasikala [6] and Chaitanya et al. [7]. The decreased weed density in these treatments could also be attributed to the initial suppression of weeds by pre-emergence herbicide, followed by manual weeding or sequential herbicide applications, aligning with results reported by Rao [8] and Chaitanya et al. [7].

3.2 Influence of Bio-efficacy of Herbicides on Weed Dry Matter

Total weed dry matter varied significantly across different weed management treatments. The lowest total weed dry matter (36.00 g m^{-2}), (36.03 g m^{-2}), (37.57 g m^{-2}), and (29.26 g m^{-2}) at 20, 40, 60 DAS and at harvest respectively were recorded with T_4, which involved pre-emergence application of pendimethalin 30% E.C. (1.5 kg ha^{-1}) followed by one hand weeding at 25 DAS, followed by T_7: pendimethalin 30% E.C. (1.5 kg ha^{-1}) imazethapyr 10 % S.L. (75 g ha^{-1}) at 20-30 DAS and T_9. Conversely, significantly higher total weed dry matter (68.73 g m^{-2}), (101.43g m^{-2}), (118.47 g m^{-2}) and (86.77 g m^{-2}) was observed in the un-weeded check. At 60 DAS and at harvest, dry weight of weeds was significantly reduced by all treatments compared to the control. The maximum dry weight was recorded with the weedy check, and the minimum with the two hand weedings at 20 and 40 DAS. Treatment involving hand weeding at 20 and 40 DAS (T_3) was comparable to pendimethalin followed by hand weeding at 25 DAS (T_4). Similar findings were reported by Chandolia et al. [9].

3.3 Influence of Bio-efficacy of Herbicides on Weed Control Efficiency

Weed control efficiency, which assesses the effectiveness of herbicides or treatments in reducing weed dry weight, was evaluated at various stages of crop growth. At 20 days after sowing (DAS), pendimethalin 30% E.C. (1.5 kg ha^{-1}) followed by one hand weeding at 25 DAS, as well as combinations involving quizalofop-p-ethyl 5% E.C. (50 g ha^{-1}) or imazethapyr 10% S.L. (75 g ha^{-1}) applied at 20-30 DAS, exhibited higher weed control efficiency (44.9%). This effectiveness could be attributed to the decreased density and dry weight of weeds due to pre-emergence application of pendimethalin. At 40 DAS, pendimethalin 30% E.C. (1.5 kg ha^{-1}) followed by one hand weeding at 25 DAS demonstrated higher weed control efficiency (66.2%). Similar results were observed with combinations involving quizalofop-p-ethyl 5% E.C. (50 g ha^{-1}) or imazethapyr 10% S.L. 75 g ha^{-1}) applied at 20-30 DAS. These findings are consistent with previous studies on groundnut by Sasikala et al. [10] and Chaitanya et al. [7].

By 60 DAS, the treatment involving two hand weedings at 20 and 40 DAS showed the highest weed control efficiency (70.31%). This result was comparable to treatments involving pendimethalin 30% E.C. followed by one hand weeding at 25 DAS, oxyfluorfen 23.5% E.C. followed by one hand weeding at 25 DAS, or combinations of pendimethalin with quizalofop-p-ethyl or imazethapyr applied at 20-30 DAS. These findings were consistent with those

Table 1. Total weed density of groundnut as influenced by weed management treatments at different growth stages

Treatments		Total weed density (No. m^{-2})			
		20 DAS	**40 DAS**	**60 DAS**	**At harvest**
T_1	Un-weeded check	12.95 (34.33)	14.93 (48.67)	16.01 (57.33)	13.96 (42.67)
T_2	Weed free check	3.00 (0.00)	3.00 (0.00)	3.00 (0.00)	3.00 (0.00)
T_3	Two hand weeding at 20 and 40 DAS	12.97 (29.33)	12.24 (29.00)	9.83 (17.00)	8.94 (12.33)
T_4	Pendimethalin 30% E.C. (1.5 kg ha^{-1}) (PE) *fb* one hand weeding at 25 DAS (POE)	10.28 (18.33)	9.80 (15.67)	10.17 (19.33)	9.38 (14.33)
T_5	Oxyfluorfen 23.5% E.C. (200 g ha^{-1}) (PE) *fb* one hand weeding at 25 DAS	11.01 (22.00)	10.20 (16.66)	10.30 (18.00)	10.14 (17.33)
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)	10.66 (20.33)	10.55 (19.33)	10.46 (18.67)	10.01 (17.67)
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)	10.74 (20.37)	10.48 (19.67)	10.33 (18.33)	9.58 (15.00)
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)	10.82 (21.00)	10.70 (20.33)	11.01 (22.00)	10.27 (18.00)
T_9	Pendimethalin 30% E.C. (1.0 kg ha^{-1}) (PE) *fb* one hand weeding at 25 DAS	11.77 (26.00)	9.76 (16.33)	10.84 (20.67)	9.66 (15.33)
	S.Em.±	0.34	0.51	0.28	0.23
	C.D. at 5%	1.03	1.54	0.84	0.70

Table 2. Total weed dry matter of groundnut as influenced by weed management treatments at different growth stages

Treatments		Total weed dry matter (g m-2)			
		20 DAS	**40 DAS**	**60 DAS**	**At harvest**
T_1	Un-weeded check	16.89 (68.73)	20.22 (101.43)	21.70 (118.47)	18.62 (86.77)
T_2	Weed free check	3.00 (0.00)	3.00 (0.00)	3.00 (0.00)	3.00 (0.00)
T_3	Two hand weeding at 20 and 40 DAS	16.10 (60.73)	16.62 (62.63)	13.24 (36.90)	11.89 (27.07)
T_4	Pendimethalin 30% E.C. (1.5 kg ha^{-1}) (PE) *fb* one hand weeding at 25 DAS (POE)	13.17 (36.00)	13.35 (36.03)	13.55 (37.57)	12.24 (29.26)
T_5	Oxyfluorfen 23.5% E.C. (200 g ha^{-1}) (PE) *fb* one hand weeding at 25 DAS	13.86 (40.43)	14.01 (40.63)	14.62 (45.20)	13.10 (34.93)
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)	13.66 (40.20)	15.10 (43.80)	14.59 (45.40)	13.41 (37.31)
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)	13.81 (41.20)	14.39 (45.30)	14.54 (45.00)	12.74 (32.47)
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)	13.95 (41.13)	14.43 (44.83)	14.70 (46.00)	13.38 (36.80)
T_9	Pendimethalin 30% E.C. (1.0 kg ha^{-1}) (PE) *fb* one hand weeding at 25 DAS	14.80 (48.67)	13.85 (39.40)	13.93 (40.00)	12.74 (32.23)
	S.Em.±	0.49	0.66	0.31	0.22
	C.D. at 5%	1.46	1.97	0.94	0.65

Table 3. Weed check efficiency and weed index of groundnut as influenced by weed management treatments at different stages

Treatments		Weed control efficiency (%)				Weed index (%)
		20 DAS	40 DAS	60 DAS	At harvest	
T_1	Un-weeded check	0.0	0.0	0.0	0.0	39.2
T_2	Weed free check	100.0	100.0	100.0	100.0	0.0
T_3	Two hand weeding at 20 and 40 DAS	20.7	38.6	70.3	71.1	17.6
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
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
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
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
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
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
	S.Em.±	5.8	5.3	2.5	3.1	3.6
	C.D. at 5%	17.5	16.0	7.5	9.2	10.8

Table 4. Pod yield, kernel yield and harvest index of groundnut as influenced by weed management treatments

Treatments		Pod yield (kg ha^{-1})	Kernel yield (kg ha^{-1})	Harvest index
T_1	Un-weeded check	1,453	777	0.25
T_2	Weed free check	2,408	1,412	0.29
T_3	Two hand weeding at 20 and 40 DAS	1,974	1,080	0.27
T_4	Pendimethalin 30% E.C. (1.5 kg ha^{-1}) (PE) *fb* one hand weeding at 25 DAS (POE)	2,255	1,294	0.29
T_5	Oxyfluorfen 23.5% E.C. (200 g ha^{-1}) (PE) *fb* one hand weeding at 25 DAS	1,633	881	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)	2,145	1,201	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)	2,133	1,181	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)	1,688	907	0.28
T_9	Pendimethalin 30% E.C. (1.0 kg ha^{-1}) (PE) *fb* one hand weeding at 25 DAS	2,023	1,092	0.27
	S.Em.±	98	39	0.01
	C.D. at 5%	293	119	0.02

Table 5. Quality parameters of groundnut as influenced by weed management treatments

Treatments		Oil content (%)	Crude Protein content (%)	Carbohydrate (%)
T_1	Un-weeded check	44.02	24.89	9.21
T_2	Weed free check	47.28	26.54	9.58
T_3	Two hand weeding at 20 and 40 DAS	45.89	25.45	9.35
T_4	Pendimethalin 30% E.C. (1.5 kg ha^{-1}) (PE) *fb* one hand weeding at 25 DAS (POE)	47.26	26.51	9.57
T_5	Oxyfluorfen 23.5% E.C. (200 g ha^{-1}) (PE) *fb* one hand weeding at 25 DAS	45.12	25.03	9.28
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)	46.58	26.14	9.50
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)	46.25	26.02	9.45
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)	45.21	25.12	9.28
T_9	Pendimethalin 30% E.C. (1.0 kg ha^{-1}) (PE) *fb* one hand weeding at 25 DAS	46.98	26.14	9.48
	S.Em.±	0.12	0.15	0.25
	C.D. at 5%	0.40	0.49	NS

reported by Chandrika [5] and Chaitanya et al. [7], indicating that higher weed control efficiency may be attributed to reduced dry weight of weeds. At harvest, the highest weed control efficiency was observed with two hand weedings at 20 and 40 DAS. Additionally, treatments involving pendimethalin followed by one hand weeding at 25 DAS, or combinations with quizalofop-p-ethyl or imazethapyr applied at 20-30 DAS, showed similar efficiency to the unweeded check. Overall, these results suggest that the application of pendimethalin, combined with appropriate weed management practices such as hand weeding, can effectively control weed growth and reduce weed dry weight, thereby improving crop yield.

3.4 Influence of Bio-efficacy of Herbicides on Weed Index

The weed index, representing the extent of yield reduction due to weed competition, was consistently lower in all weed management treatments compared to the unweeded check. Among the herbicidal treatments, the lowest weed index (6.4%) was observed in the treatment where pendimethalin 30% E.C. was applied pre-emergence (1.5 kg ha^{-1}), followed by one hand weeding at 25 days after sowing (DAS). This treatment performed similarly to two other treatments: T_6, which involved pendimethalin 30% E.C. (1.5 kg ha^{-1}) *fb* quizalofop-p-ethyl 5% E.C. (50 g ha^{-1}) at 20-30 DAS, and T_7, where pendimethalin 30% E.C. (1.5 kg ha^{-1}) imazethapyr 10% S.L. (75 g ha^{-1}) at 20-30 DAS. These results align with those reported by Rao et al. [8]. The unweeded check exhibited the highest weed index, likely attributed to the increased dry matter accumulation of weeds resulting from uninterrupted weed competition throughout the season, consequently leading to reduced crop yield.

3.5 Influence of Bio-efficacy of Herbicides on Yield

A thorough examination of the data revealed that the treatment involving pendimethalin 30% E.C. (1.5 kg ha^{-1}) followed by one hand weeding at 25 days after sowing (DAS) resulted in higher pod yield (2,255 kg ha^{-1}) and kernel yield (1,294 kg ha^{-1}) (Table 4). Similar outcomes were reported by Sagvekar et al. [11]. The combined impact of various yield-contributing factors was evident in the pod yield. The untreated check control exhibited significantly lower pod yield (1,453 kg ha^{-1}) and kernel yield (777 kg ha^{-1}) compared to all other treatments, representing a 35.6 per cent reduction compared to the pendimethalin treatment followed by hand weeding at 25 DAS. This decline could be attributed to the higher weed density and production of weed biomass in the untreated check, leading to depletion of soil nutrients and moisture, which are critical for crop growth, yield, and associated attributes. Furthermore, the untreated check treatment yielded results comparable to treatments involving pendimethalin 30% E.C. at 1.5 kg ha-1 followed by quizalofop-p-ethyl 5% E.C. (50 g ha^{-1}) applied at 20-30 DAS, and pendimethalin 30% E.C. (1.5 kg ha^{-1}) followed by imazethapyr 10% S.L. (75 g ha^{-1}) at 20-30 DAS. Reduction in weed competition facilitated by these treatments improved growth parameters, subsequently enhancing yield attributes and pod yield. These findings are consistent with the studies conducted by Sasikala et al. [6] and Chaitanya et al. [7].

3.6 Influence of Bio-efficacy of Herbicides on Quality Parameters

The results revealed that significantly higher oil and protein content (47.28 and 26.54%, respectively) was observed in the weed-free check (Table 5) compared to other weed management treatments. Among the weed management practices, higher oil content (47.26%) and protein content (26.51%) were noticed in Pendimethalin 30% E.C. (1.5 kg ha^{-1}) (PE) followed by one hand weeding at 25 DAS (T_4) compared to the un-weeded check (44.02% in oil content) and 24.59 per cent in protein content. These results are consistent with findings by Kumara et al. [12], Rao et al. [13].

4. CONCLUSION

Thus, it can concluded that the pre-emergence utilization of pendimethalin 30 % E.C. (1.5 kg ha^{-1}), coupled with one manual weeding session at 25 days after sowing (DAS), resulted in a notable reduction in overall weed density and weed dry matter. This approach exhibited enhanced weed control efficiency, manifested through a reduced weed index. Moreover, it contributed to increased pod yield, kernel yield, and overall quality of groundnut crops within the rice-groundnut cultivation system in the coastal regions of Karnataka.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Anonymous. Economic survey - 2014-15, Ministry of Agriculture and Co-operation, Govt. of India, New Delhi; 2015.
2. Jat RS, Meena HN, Singh AL, Surya JN, Misra JB. Weed management in groundnut (*Arachis hypogaea* L.) in India - A Review. 2011;32(3):155–171.
3. Sathya PR, Manickasundaram P. New Formulation of oxyfluorfen on weed control of groundnut and its residual effect on succeeding crops. Indian Journal of Applied Research. 2013;3(6):16-18.
4. Gomez KA, Gomez A. Statistical procedures for Agricultural Research (2/E). John Willey and Sons, New York. 1984;28-33.
5. Sumathi V, Chandrika V, Munendra Babu A Nagavani AV. Integrated weed management in rainfed groundnut (*Arachis hypogaea*). Indian Journal of Agronomy. 2000;45(4):765-770.
6. Sasikala B, Rada Kumari C, Obulamm U, Raghava Reddy C. Studies on effect of herbicides in bunch groundnut, Arachis hypogaea L. Journal of Oilseeds Research. 2006;23(1):126-127.
7. Chaitanya S, Shankaranarayana V, Nanjappa HV. Chemical weed management in kharif groundnut. Mysore Journal of Agricultural Science. 2012; 46(2):315-319.
8. Rao JVL. Effect of herbicide combinations on growth and yield of groundnut (*Arachis hypogaea* L.). M.Sc. (Agri.) Thesis, Acharya N.G Ranga Agricultural University, Hyderabad; 2000.
9. Chandolia PC, Dadheech RC, Solanki NS, Mundra SL. Weed management in groundnut (*Arachis hypogaea* L.) under varying crop geometry. Indian Journal of Weed Science. 2010;42 (3 & 4):235-237.
10. Sasikala B, Ramu YR, Reddy RC. Pre and post-emergence herbicides on weed control and yield of groundnut (Arachis hypogaea). Indian Journal of Dry land Agriculture Research and Development. 2004;19(1):78-80.
11. Sagvekar VV, Waghmode BD, Chavan AP, Mahadkar V. Weed management in rabi groundnut (*Arachis hypogaea*) for Konkan region of Maharashtra. Indian Journal of Agronomy. 2015;60(1):116-120.
12. Kumari S. Mahua Banerjee, RK Raj, Antara Chaudhuri and Sujay KM. Effect of weed management practices on yield, quality and economics of groundnut (*Arachis hypogaea* L.) during summer season. International Journal of Chemical Studies. 2020;8(2):2562-2565
13. Rao S, Madhavi M, Raghava Reddy C. Integrated weed management in winter season groundnut (*Arachis hypogaea* L.). Journal of Oilseeds Research. 2011;28 (1):57-59.

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