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Effect of integrated weed management practices on growth parameters, yield attributes and yield of *Rabi* groundnut

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Abstract

Background: The main problems limiting production of groundnut are poor cultural practices as well as inadequate weed management. Besides competing for nutrients, soil moisture, sunlight, weeds inhibit pegging, pod development in groundnut and also interfere with harvest. Manual weeding, an age old practice for weed control in this crop is very laborious, time consuming and expensive, most importantly when there is dearth of manpower. In groundnut, chemical weed control has been found to be easier; less time consuming and more cost effective and efficient in reducing weed menace compared to hand weeding. By integrating man, mechanical and chemicals we can achieve better yield and also can retain the soil health. Hence the objective of this experiment was to study the effect of integrated weed management practices on the growth and yield of groundnut.

Methods: In this experiment during 2020-21, different weed management practices and their effect on growth parameters, yield attributes and yield of groundnut at College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Hyderabad were surveyed. The experiment consisted of ten treatments laid out in randomised block design replicated thrice.

Result: Among the different weed management practices growth parameters *i.e.*, plant height, leaf area index and dry matter production, yield attributes *i.e.*, number of pods per plant, filled pods per plant, hundred pod weight and hundred kernel weight and yield were significantly higher with intercultivation *fb* hand weeding at 20 and 40 DAS. Among herbicides, diclosulam 26 g ha⁻¹ PE *fb* intercultivation at 20 DAS, pendimethalin + imazethapyr (pre-mix) 960 g ha⁻¹ *fb* intercultivation at 20 DAS and sodium acifluorfen + clodinafop propargyl 250 g ha⁻¹ PoE *fb* intercultivation at 40 DAS were superior to the all other treatments.

Keywords: Filled pods, intercultivation, plant height, sodium acifluorfen and yield attributes

Introduction

Groundnut (*Arachis hypogaea* L.) is the second most important edible oilseed crop of the India, which is the second largest producer of groundnut in the world. Weed menace is one of the serious bottlenecks in limiting the productivity of groundnut (Chaitanya *et al.*, 2012) ^[1]. India has a diverse climate and groundnut is grown throughout the year in *Kharif* (rainy), *Rabi*, (winter) and spring seasons in one or other part of the country. Among non-stable productivity factors, weed infestation is considered to be one of the major cause to reduce the productivity. Yield loss due to weed infestation amounts to 47% in groundnut. Weeds when allowed to compete till harvest depleted 162.8 kg N, 21.7 kg P₂O₅, 141.8 kg K₂O ha⁻¹. Weeds reduce yield by competing with the groundnut plants for resources such as sunlight, space, moisture and nutrients throughout the growing season (Regar 2017) ^[9]. Besides competing for resources weeds hinder pegging, compete for underground space, and make harvesting of groundnut cumbersome. The presence of weeds for long time in the field affects the pod size, thus deteriorating the quality of the produce and fetching a lower price in market. During initial growth stages, crop canopy is relatively less, which allows higher weeds growth making groundnut more susceptible to weeds competition in the earlier growth period of the crop. Conventional methods like manual weeding is mostly practiced to control weeds in groundnut. But unavailability and scarcity of labourers, hike in the labour wages and unfavourable environmental conditions during the critical period of crop-weed competition reduces the

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effectiveness and reliability of hand weeding. Therefore, herbicides alone or in combination with manual weeding provide an economically viable alternative for weed control. Thus the present study was undertaken to assess the efficacy of conventional and herbicidal approach on growth and yield attributes in *Rabi* groundnut.

Materials and Methods

A field experiment was carried out at College Farm, College of Agriculture, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Rajendranagar, Hyderabad, Telangana State during *Rabi* of 2020-2021. The objective of the study was to quantify the effect of integration of inter-cultivation with pre- and post-emergence application of herbicides and manual weeding on weeds growth and yield of groundnut. The farm is geographically situated at an altitude of 542.3 m above mean sea level at 17°19' N latitude and 78°23' E longitude in the Southern Telangana agro-climatic zone of Telangana and it is classified under semi-arid tropics (SAT) according to Troll's classification. A randomized block design with three replications was used with 10 treatments, which include: diclosulam 26 g ha⁻¹ pre-emergence application (PE) followed by (*fb*) inter-cultivation at 20 days after sowing (DAS); imazethapyr 2% EC + pendimethalin 30% EC (ready-mix) 960 g/ha PE *fb* inter-cultivation at 20 DAS; pyroxasulfone 127.5 g/ha PE *fb* inter-cultivation at 20 DAS; propaquizafop 2.5% + imazethapyr 3.75% w/w ME (ready-mix) 125 g/ha post-emergence application (PoE) *fb* inter-cultivation at 40 DAS; imazethapyr 35% + imazomox 35% WG (ready-mix) 70 g/ha PoE *fb* inter-cultivation at 40 DAS; sodium acifluorfen 16.5% EC + clodinafop-propargyl 8% EC (ready-mix) 250 g/ha post-emergence application (PoE) *fb* inter-cultivation at 40 DAS; imazethapyr 100 g/ha PoE *fb* inter-cultivation at 40 DAS; inter-cultivation (20 and 40 DAS); inter-cultivation *fb* hand weeding (20 and 40 DAS) (weed-free) and Unweeded control. Groundnut crop (variety kadiri-9) was sown on 8th October 2020 at spacing of 30x10 cm using a seed rate of 300 kg/ha. Herbicides were applied using a Knap sack sprayer fitted with flat fan nozzle calibrated to deliver 500 litres of water per hectare. Inter-cultivation was done with power weeder and pre-emergence herbicides application was done at 2 DAS and post emergence herbicides application was done at 20 DAS. Cultural practices recommended by PJTSAU for groundnut were adopted during the crop growth period. The crop was fertilized with recommended dose of fertilizers with 20 kg N, 40 kg P₂O₅ and 50 kg K₂O ha⁻¹ using urea, single super phosphate and muriate of potash, respectively as basal. Top dressing of 10 kg N was applied in form of urea at 25 DAS. The groundnut crop growth parameters *i.e.*, plant height, leaf area index and dry matter production were recorded at 90 DAS and yield and yield attributes were recorded at its harvest which is on 12th February 2021.

Results and Discussion

Effect on growth parameters

Plant height (cm)

The tallest plants were recorded in intercultivation *fb* hand weeding at 20 and 40 DAS (32.42 cm) which was statistically on par with diclosulam PE *fb* intercultivation at 20 DAS (32.08 cm), imazethapyr + pendimethalin PE *fb* intercultivation at 20 DAS (31.92 cm) and sodium acifluorfen + clodinafop propargyl PoE *fb* intercultivation at 40 DAS (30.87 cm). These treatments did not show any phytotoxicity symptoms on the groundnut crop lead to increased cell division and cell elongation and there by increased the plant height. This was followed by intercultivation

at 20 and 40 DAS which was on par with propaquizafop + imazethapyr PoE *fb* intercultivation at 40 DAS. The least plant height was noticed in the treatment where no operation was done *i.e.* unweeded control this was due to heavy weed competition which suppressed the plant growth. The lowest plant height was recorded with the unweeded control this might be due to heavy weed infestation, which in turn increased the competition for growth resources resulting in shorter internodal length.

Leaf area index

The highest leaf area index was recorded with intercultivation *fb* hand weeding at 20 and 40 DAS (4.38) which was statistically on par with diclosulam PE *fb* intercultivation at 20 DAS (4.15). This was followed by imazethapyr + pendimethalin PE *fb* intercultivation at 20 DAS and sodium acifluorfen + clodinafop propargyl PoE *fb* intercultivation at 40 DAS both of which were statistically on par with each other. The next best treatments were intercultivation at 20 and 40 DAS, imazethapyr + propaquizafop PoE *fb* intercultivation at 40 DAS, pyroxasulfone PE *fb* intercultivation at 20 DAS and imazethapyr + imazomox PoE *fb* intercultivation at 40 DAS. The leaf area index was minimum with the unweeded control.

Dry matter production

Intercultivation *fb* hand weeding at 20 and 40 DAS (4693 kg ha⁻¹) recorded the highest dry matter production which was statistically on par with diclosulam PE *fb* intercultivation at 20 DAS (4608 kg ha⁻¹), imazethapyr + pendimethalin PE *fb* intercultivation at 20 DAS (4642 kg ha⁻¹) and sodium acifluorfen + clodinafop propargyl PoE *fb* intercultivation at 40 DAS (4469 kg ha⁻¹). The highest dry matter production in these treatments might be due to effective control of all category of weeds during active crop growth period, which might have increased the plant height, LAI and number of branches plant⁻¹, which in turn resulted in higher dry matter production. These results are in agreement with that of Kalhapure *et al.* (2013)^[6]. Further timely and effective control of weeds might have facilitated the better availability of moisture, nutrients and solar radiation to the crop plants, thereby increased chlorophyll content, photosynthetic rate and nitrate reductase activity, leading to higher supply of carbohydrates, which resulted in increased dry matter production (Channappagoudar *et al.* 2008)^[2].

Effect on yield attributes

No. of filled pods per plant, pod weight and kernel weight are the important yield attributing characters which influence yield potential of the crop.

Number of filled pods plant⁻¹

The number of filled pods per plant of groundnut differed significantly due to different weed management practices. Significantly highest number of filled pods plant⁻¹ were recorded with intercultivation *fb* hand weeding at 20 and 40 DAS (11.60), which was statistically on par with diclosulam PE *fb* intercultivation at 20 DAS (11.53) and imazethapyr + pendimethalin PE *fb* intercultivation at 20 DAS (11.27). This might be due to the weed free environment maintained during initial critical stages, which facilitated better peg penetration and development as well as better partitioning of photosynthates, leading to increased number of filled pods plant⁻¹. These treatments maintained significant superiority over sodium acifluorfen + clodinafop propargyl PoE *fb* intercultivation at 40 DAS. The next best treatment was intercultivation at 20 and 40 DAS and was superior to all other treatments. The lowest number of filled pods plant⁻¹ was recorded with unweeded

control, due to heavy weed infestation throughout the crop growth period. These results are in accordance with those of Yadav *et al.* (2015)^[13] and Dixit *et al.* (2016)^[3].

Hundred pod weight (g)

Among the different weed management practices, hundred pod weight was highest recorded with intercultivation *fb* hand weeding at 20 and 40 DAS (89.87 g) which was followed by diclosulam PE *fb* intercultivation at 20 DAS (86.86 g), imazethapyr + pendimethalin PE *fb* intercultivation at 20 DAS (85.83g) and sodium acifluorfen + clodinafop propargyl PoE *fb* intercultivation at 40 DAS (85.79 g) and these were at par with each other. The next best treatments were intercultivation at 20 and 40 DAS and propaquizafop + imazethapyr PoE *fb* intercultivation at 40 DAS and were on par with each other and significantly superior to all other treatments. The lowest hundred pod weight was recorded with the unweeded control due to higher weed infestation causing severe competition between the crop and weed, for growth resources there by poor pod filling resulting in deflated stature of hundred pod weight. These results are in confirmity with the findings of Dutta *et al.* (2005)^[4].

Hundred kernel weight (g)

The hundred kernel weight of groundnut showed significant difference among different weed management practices. The test weight ranged from 34.31 to 47.82 g. highest kernel weight was recorded with intercultivation *fb* hand weeding at 20 and 40 DAS which was statistically on par with diclosulam PE *fb* intercultivation at 20 DAS and sodium acifluorfen + clodinafop propargyl PoE *fb* intercultivation at 40 DAS and were significantly superior to all other weed management practices. This was due to the less weed density during the initial crop growth period which is critical for crop weed competition. The lowest kernal weight was recorded with unweeded control due to the more number shrivelled pods as there was heavy weed infestation. These results were in line with Kumar *et al.* (2016)^[7, 8].

Effect on yield

Pod yield (kg ha⁻¹)

Among different weed management practices, the highest pod yield of groundnut was obtained with intercultivation *fb* hand weeding at 20 and 40 DAS (2743 kg ha⁻¹) which was however, statistically on par with diclosulam PE *fb* intercultivation at 20 DAS (2640 kg ha⁻¹) and imazethapyr + pendimethalin PE *fb* intercultivation at 20 DAS (2610 kg ha⁻¹). The higher pod yield in these treatments was due to minimum crop-weed competition and effective control of broad spectrum of weeds for a longer period in the initial stage of crop and provided congenial

environment for growth and development as evident from increase in plant height, leaf area index and dry matter production, improvement in growth parameters which inturn increases the yield attributes like number of filled pods plant⁻¹, hundred pod and kernel weight as well as shelling percentage and ultimately the pod yield. These results were in line with the findings of Kalhapure *et al.* (2013)^[6] and Sandil *et al.* (2015)^[11]. Weed free environment during the critical stages of the groundnut facilitated better peg penetration which tends to increase the number of pods plant⁻¹ and pod yield (Dutta *et al.*, 2005)^[4].

The next best treatments were sodium acifluorfen + clodinafop propargyl PoE *fb* intercultivation at 40 DAS and intercultivation at 20 and 40 DAS these were inturn on par with each other. This was followed by of propaquizafop + imazethapyr PoE *fb* intercultivation at 40 DAS, pyroxasulfone PE *fb* intercultivation at 20 DAS, imazethapyr + imazamox PoE *fb* intercultivation at 40 DAS and imazethapyr PoE *fb* intercultivation at 20 DAS and were on par with each other. The lowest pod yield of groundnut was registered with unweeded control. This might be due to heavy weed infestation resulting in severe competition between the crop and weed for growth resources, right from the crop establishment up to harvest. Similar results were also reported earlier by Sandil *et al.* (2015)^[11].

Haulm yield (kg ha⁻¹)

The highest haulm yield of groundnut was recorded with intercultivation *fb* hand weeding at 20 and 40 DAS (3250 kg ha⁻¹) which was on par with diclosulam PE *fb* intercultivation at 20 DAS (3168 kg ha⁻¹) and imazethapyr + pendimethalin PE *fb* intercultivation at 20 DAS (3132 kg ha⁻¹) which were significantly superior over rest of weed management practices tried. The higher haulm yield with these treatments was attributed to effective control of all categories of weeds in the early stage of the crop, which might have facilitated the crop to utilize the available growth resources more efficiently resulting higher haulm yield. These results are in agreement with those of Jinger *et al.* (2016)^[5].

The next best treatments were sodium acifluorfen + clodinafop propargyl PoE *fb* intercultivation at 40 DAS, intercultivation at 20 and 40 DAS and propaquizafop + imazethapyr PoE *fb* intercultivation at 40 DAS and were on par with each other and inturn superior to the all other treatments. Similar results are also reported by Samant and Mishra (2014)^[10]. The lowest haulm yield was recorded with unweeded control due to heavy weed infestation, which exploited the growth resources, which in turn had have adverse effect on the crop growth and development resulting in reduced crop yield in groundnut (Kumar *et al.*, 2016)^[7, 8].

Table 1: Effect of integrated weed management practices on growth parameters of *Rabi* groundnut

S. No.	Treatments	Plant height (cm)	LAI	Dry matter production (kg ha ⁻¹)
T ₁	Diclosulam 84% WDG 26 g ha ⁻¹ PE <i>fb</i> intercultivation at 20 DAS	32.08	4.15	4608
T ₂	Imazethapyr 2% EC+ pendimethalin 30% EC 960 g ha ⁻¹ PE <i>fb</i> intercultivation at 20 DAS	31.92	3.75	4642
T ₃	Pyroxasulfone 85% WDG 127.5 g ha ⁻¹ PE <i>fb</i> intercultivation at 20 DAS	25.06	3.19	3408
T ₄	Propaquizafop 2.5% + imazethapyr 3.75% ME 125 g ha ⁻¹ Early PoE <i>fb</i> intercultivation at 40 DAS	26.55	3.22	4064
T ₅	Imazethapyr 35% + imazamox 35% WG 70 g ha ⁻¹ Early PoE <i>fb</i> intercultivation at 40 DAS	23.55	3.19	3737
T ₆	Sodium acifluorfen 16.5% EC + clodinafop propargyl 8% EC 250 g ha ⁻¹ PoE <i>fb</i> intercultivation at 40 DAS	30.87	3.55	4469
T ₇	Imazethapyr 10% SL 100 g ha ⁻¹ PoE <i>fb</i> intercultivation at 40 DAS	23.22	2.87	3458
T ₈	Intercultivation (20 and 40 DAS)	28.19	3.38	4174
T ₉	Intercultivation <i>fb</i> hand weeding (20 and 40 DAS) (Weed free)	32.42	4.38	4693
T ₁₀	Unweeded control	20.63	2.90	2408
	S.Em ±	0.56	0.09	145.51
	CD (P = 0.05)	1.62	0.28	422.15

Table 2: Effect of integrated weed management practices on Yield attributes and yield of *Rabi* groundnut

S.No.	Treatments	No. of filled pods plant ⁻¹	100 pod weight (g)	100 kernal weight (g)	Pod yield (kg ha ⁻¹)	Haulm yield (kg ha ⁻¹)
T ₁	Diclosulam 84% WDG 26 g ha ⁻¹ PE <i>fb</i> intercultivation at 20 DAS	11.53	86.86	45.34	2640	3168
T ₂	Imazethapyr 2% EC+ pendimethalin 30% EC 960 g ha ⁻¹ PE <i>fb</i> intercultivation at 20 DAS	11.27	85.83	43.59	2610	3132
T ₃	Pyroxasulfone 85% WDG 127.5 g ha ⁻¹ PE <i>fb</i> intercultivation at 20 DAS	9.07	83.07	40.31	2071	2538
T ₄	Propaquizafop 2.5% + imazethapyr 3.75% ME 125 g ha ⁻¹ Early PoE <i>fb</i> intercultivation at 40 DAS	9.17	84.98	44.60	2161	2953
T ₅	Imazethapyr 35% + imazamox 35% WG 70 g ha ⁻¹ Early PoE <i>fb</i> intercultivation at 40 DAS	9.05	82.98	42.43	1996	2941
T ₆	Sodium acifluorfen 16.5% EC + clodinafop propargyl 8% EC 250 g ha ⁻¹ PoE <i>fb</i> intercultivation at 40 DAS	10.96	85.79	45.55	2449	3020
T ₇	Imazethapyr 10% SL 100 g ha ⁻¹ PoE <i>fb</i> intercultivation at 40 DAS	8.96	79.09	40.50	1926	2632
T ₈	Intercultivation (20 and 40 DAS)	9.93	85.47	41.14	2388	2986
T ₉	Intercultivation <i>fb</i> hand weeding (20 and 40 DAS) (Weed free)	11.60	89.87	47.82	2743	3250
T ₁₀	Unweeded control	8.34	64.13	34.31	1460	1898
	S.Em ±	0.13	0.41	1.09	92.97	70.80
	CD (P = 0.05)	0.38	1.19	3.16	269.72	205.42

Conclusion

Growth parameters *i.e.*, plant height, leaf area index and dry matter production and yield attributes *i.e.*, No. of filled pods per plant, hundred pod weight and hundred kernel weight and pod yield and haulm yield were significantly higher with intercultivation *fb* hand weeding at 20 and 40 DAS. Among herbicides, diclosulam 26 g ha⁻¹ PE *fb* intercultivation at 20 DAS, pendimethalin + imazethapyr (pre-mix) 960 g ha⁻¹ *fb* intercultivation at 20 DAS and sodium acifluorfen + clodinafop propargyl 250 g ha⁻¹ PoE *fb* intercultivation at 40 DAS were superior to the all other treatments.

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