



A Study on Influence of Different Weed Management Practices on Yield and Economics of *Rabi* Groundnut in Telangana State

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

An experiment was conducted to study the effect of different high efficiency herbicides as pre and post-emergence application on the economics of groundnut at College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Hyderabad, during *rabi* 2020-21. The experiment consisted of ten treatments laid out in randomised block design (RBD) replicated thrice. Treatments are diclosulam 84% WDG 26 g ha⁻¹ PE *fb* intercultivation at 20 DAS, imazethapyr 2% EC + pendimethalin 30% EC 960 g ha⁻¹ PE *fb* intercultivation at 20 DAS, pyroxasulfone 85 % WDG 127.5 g ha⁻¹ PE *fb* intercultivation at 20 DAS, propaquizafop 2.5% + imazethapyr 3.75% w/w ME 125 g ha⁻¹ PoE *fb* intercultivation at 40 DAS, imazethapyr 35% + imazamox 35% WG 70 g ha⁻¹ PoE *fb* intercultivation at 40 DAS, sodium acifluorfen 16.5% EC + clodinafop propargyl 8% EC 250 g ha⁻¹ PoE *fb* intercultivation at 40 DAS, imazethapyr 10% SL 100 g ha⁻¹ PoE *fb* intercultivation at 40 DAS, intercultivation (20 and 40 DAS), intercultivation *fb* hand weeding (20 and 40 DAS) (Weed-free) and Unweeded control. The findings also conveys that, among all the weed

management practices, higher gross returns were realized with intercultivation *fb* hand weeding at 20 and 40 DAS and among the herbicides, diclosulam 26 g ha⁻¹ PE *fb* intercultivation at 20 DAS and imazethapyr + pendimethalin 960 g ha⁻¹ PE of *fb* intercultivation at 20 DAS recorded higher returns. However the net returns and B: C ratio was significantly highest with diclosulam 26 g ha⁻¹ PE *fb* intercultivation at 20 DAS and imazethapyr + pendimethalin at 960 g ha⁻¹ PE *fb* intercultivation at 20 DAS.

Keywords: B:C ratio; diclosulam; gross returns; net returns and Peanut.

1. INTRODUCTION

Groundnut or peanut (*Arachis hypogaea* L.) is grown over 20 million hectares in the tropical and subtropical part of about one hundred countries in the world. The total annual world production amounts to about 25 million tons of unshelled nuts, 70% of which is contributed by India, China and U.S.A. (El Naim et al., 2010) [1]. Groundnut is an excellent source of nutrients contains 45–50% oil, 27–33% protein as well as essential minerals and vitamins. They play an important role in the dietary requirements of resource poor women and children and haulms are used as livestock feed. The main problems limiting production of groundnut are poor cultural practices as well as inadequate weed management (EL Naim et al., 2010). Groundnut (*Arachis hypogaea* L.) is considered to be one of the most important food legume and oilseed crop in India, cultivated over an area of 6.65 lakh ha, with a production of 1.56 m t and average productivity of 2352 kg ha⁻¹(www.indiastat.com, 2019-20) [2]. The productivity of crops under irrigated condition is not stable due to various reasons. Among them weed infestation is considered to be one of the major problems. Yield loss due to weed infestation amounts to 80 percent in groundnut. So weed infestation is one of the major constraints that limit the productivity of groundnut [3]. Critical period of crop weed competition is ranged between 40 to 60 days after sowing. Though, groundnut is a hardy crop, but it is highly susceptible to weed preponderance due to small canopy and slow initial growth. In groundnut, weeds compete with crop plants for nutrients and remove 30-40% of applied nutrients resulting in significant yield reduction [4]. Weed infestation is one of the major constraints in productivity of any crop. The slow initial growth of groundnut favours the weed growth and reduces yield up to 75% [5]. In India, yield losses of groundnut due to weeds ranged from 24-70 percent [6]. Generally weeds are controlled by hand weeding, which is very expensive, laborious and shortage of labours. It is therefore important to find out suitable

herbicides that will control the weeds economically and safely. Use of pre-and postemergence herbicides mixtures offers an alternative viable option for effective and timely control of all categories of weeds in groundnut. Hence, there is a need to evaluate the pre-and post-emergence herbicide mixtures for obtaining broad spectrum weed control in *rabi* groundnut.

2. MATERIALS AND METHODS

The present experiment was carried out at College Farm, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad, Telangana State. 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. The weather during the crop period was most congenial for better performance of groundnut. Weather parameters did not deviate much from the normal values mean of the location of study. The rainfall received during the entire crop growth period is 363.40 mm in 11 rainy days. The experiment was planned in a randomized block design with three replications of 10 treatments; which included diclosulam 84% WDG 26 g ha⁻¹ PE *fb* intercultivation at 20 DAS (T₁), imazethapyr 2% EC + pendimethalin 30% EC 960 g ha⁻¹ PE *fb* intercultivation at 20 DAS (T₂), pyroxasulfone 85% WDG 127.5 g ha⁻¹ PE *fb* intercultivation at 20 DAS (T₃), propaquizofop 2.5% + imazethapyr 3.75% w/w ME 125 g ha⁻¹ early PoE *fb* intercultivation at 40 DAS (T₄), imazethapyr 35% + imazomox 35% WG 70 g ha⁻¹ early PoE *fb* intercultivation at 40 DAS (T₅), sodium acifluorfen 16.5% EC + clodinafop propargyl 8% EC 250 g ha⁻¹ PoE *fb* intercultivation at 40 DAS (T₆), imazethapyr 10% SL 100 g ha⁻¹ PoE *fb* intercultivation at 40 DAS (T₇), intercultivation (20 and 40 DAS) (T₈), intercultivation *fb* hand weeding (20 and 40 DAS) (Weed-free) (T₉) and Unweeded control (T₁₀). Groundnut crop (variety kadiri-9) was sown on 8th

October 2020 at spacing of 30*10 cm using a seed rate of 300 kg ha⁻¹. Herbicides were applied using a Knap sack sprayer fitted with flat fan nozzle calibrated to deliver 500 litres of water per hectare. Cultural practices recommended for groundnut were adopted during the crop growth period. The crop was supplied with recommended fertilizer dose of fertilizers with 20 kg N, 40 kg P₂O₅ and 50 kg K₂O ha⁻¹ through urea, single super phosphate and muriate of potash, respectively to all the plots as basal. Top dressing of 10kg of N was applied in form of urea at 25 DAS. Density and dry weight of weeds were recorded and transformed to square root transformation ($\sqrt{x + 1}$) to normalize their distribution. Yield and yield attributes were recorded at harvest of crop. Crop was harvested on 10th February 2021. The prices of the herbicides prevailed in local market during experimentation were considered for working out the cost of cultivation of Groundnut. The gross returns were calculated using the pod yield of groundnut and the market price of the produce at the time of marketing. The net returns per hectare were calculated by deducting the cost of cultivation per hectare from the gross returns per hectare.

Net monetary return = Gross monetary return - Total cost of cultivation

Benefit cost ratio = Gross returns (Rs ha⁻¹) / Cost of cultivation (Rs ha⁻¹)

3. RESULTS AND DISCUSSION

3.1 Pod Yield

Pod yield of groundnut varied significantly with different weed management practices. The pod yield of groundnut with different weed management practices ranged from 1460 to 2743 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 in turn 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. [7] and Sandil et al. [8]. 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 [5].

The next best treatments were sodium acifluorfen + clodinafop propargyl PoE *fb* intercultivation at 40 DAS and intercultivation at 20 and 40 DAS these were in turn 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. [8].

3.2 Economics

The weed management practices adopted should also be economically feasible for a farmer in order to reduce their input cost without sacrificing yields. The data with respect to gross returns, net returns and benefit cost ratio of groundnut are presented in Table 1 and Fig. 1

3.3 Cost of Cultivation (₹ ha⁻¹)

Among different weed management practices, maximum cost of cultivation was recorded with intercultivation *fb* handweeding 20 and 40 DAS (60,040 ₹ ha⁻¹) this was due to the higher cost incurred in cleaning of the infested area using power weeder and minimum cost of cultivation was recorded with unweeded control (46440 ₹ ha⁻¹).

3.4 Gross Returns (₹ ha⁻¹)

Weed management practices significantly influenced the gross returns of groundnut cultivation. The highest gross returns were recorded with intercultivation *fb* hand weeding at

Table 1. Yield and Economics as influenced by weed management practices in groundnut

Treatment	Pod yield (kg ha ⁻¹)	Cost of cultivation (₹)	Gross returns (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)	Benefit-cost ratio
T ₁ Diclosulam 84% WDG 26 g ha ⁻¹ PE <i>fb</i> intercultivation at 20 DAS	2640	52040	139248	87208	2.68
T ₂ Imazethapyr 2% EC+ pendimethalin 30% EC 960 g ha ⁻¹ PE <i>fb</i> intercultivation at 20 DAS	2610	53000	137698	84698	2.60
T ₃ Pyroxasulfone 85 % WDG 127.5 g ha ⁻¹ PE <i>fb</i> intercultivation at 20 DAS	2071	55990	109232	53242	1.95
T ₄ Propaquizafop 2.5% + imazethapyr 3.75% ME 125 g ha ⁻¹ Early PoE <i>fb</i> intercultivation at 40 DAS	2161	52340	113985	61645	2.18
T ₅ Imazethapyr 35% + imazamox 35% WG 70 g ha ⁻¹ Early PoE <i>fb</i> intercultivation at 40 DAS	1996	52240	105303	53063	2.02
T ₆ Sodium acifluorfen 16.5% EC + clodinafop propargyl 8% EC 250 g ha ⁻¹ PoE <i>fb</i> intercultivation at 40 DAS	2449	51758	129178	77420	2.50
T ₇ Imazethapyr 10% SL 100 g ha ⁻¹ PoE <i>fb</i> intercultivation at 40 DAS	1926	52320	101620	49300	1.94
T ₈ Intercultivation (20 and 40 DAS)	2388	55240	125987	70747	2.28
T ₉ Intercultivation <i>fb</i> hand weeding (20 and 40 DAS) (Weed free)	2743	60040	144686	84646	2.41
T ₁₀ Unweeded control	1460	46440	77025	30585	1.66
S.Em ±	92.97	-	4904	4912	-
CD (P = 0.05)	269.72	-	14228	14244	-

20 and 40 DAS (1,44,686 ₹ ha⁻¹). Among the chemical weed management practices diclosulam PE *fb* intercultivation at 20 DAS (1,39,248 ₹ ha⁻¹) and imazethapyr + pendimethalin PE *fb* intercultivation at 20 DAS (1,37,698 ₹ ha⁻¹) were statistically on par with the intercultivation *fb* hand weeding at 20 and 40 DAS and were the best among the chemical treatments which was due to increased pod yield.

The next higher gross returns were obtained with sodium acifluorfen + clodinafop propargyl PoE *fb* intercultivation at 40 DAS (1,29,178 ₹ ha⁻¹) which was statistically on par with intercultivation at 20 and 40 DAS (1,25,987 ₹ ha⁻¹) and were significantly superior to the other treatments. The lowest gross returns were recorded with unweeded control, which was significantly lower than the rest of the weed management practices due to reduced pod yield as a result of heavy weed competition.

3.5 Net Returns (₹ ha⁻¹)

The net returns of groundnut cultivation were significantly influenced by different weed management practices. The highest net returns were associated with diclosulam PE *fb* intercultivation at 20 DAS (87,208 ₹ ha⁻¹) which was statistically on par with imazethapyr +

pendimethalin PE *fb* intercultivation at 20 DAS (84,698 ₹ ha⁻¹), intercultivation *fb* hand weeding at 20 and 40 DAS (84,646 ₹ ha⁻¹) and sodium acifluorfen + clodinafop propargyl PoE *fb* hand weeding at 40 DAS (77,420 ₹ ha⁻¹). This might be due to reduced cost involved under herbicidal treatments and increased pod yield as a result of effective control of weeds. These results are in conformity with findings of Kumar et al. [9] and Jinger et al. [10]. These were followed by intercultivation at 20 and 40 DAS (70,747 ₹ ha⁻¹) and propaquizofop + imazethapyr PoE *fb* intercultivation at 40 DAS (61,645 ₹ ha⁻¹) and were statistically on par with each other. Intercultivation at 20 and 40 DAS was lag behind the above weed management practice due to increased cost of cultivation owing to higher need for labourer and higher cost of fuel. These results are in agreement with Sagvekar et al. [11]. The lowest net returns were obtained with unweeded control, which was significantly lesser than the rest of weed management practices due to reduced pod yield as a result of heavy weed infestation.

3.6 Benefit-cost Ratio

The benefit-cost ratio of groundnut cultivation was significantly influenced by different weed

management practices. The highest benefit-cost ratio was recorded with diclosulam PE fb intercultivation at 20 DAS (2.68) which was followed by imazethapyr + pendimethalin PE fb intercultivation at 20 DAS (2.60), sodium acifluorfen + clodinafop propargyl PoE fb intercultivation at 40 DAS (2.50) and intercultivation fb hand weeding at 20 and 40 DAS (2.41). This might be due to reduced cost of cultivation and increased pod yield as a result of effective control of weeds.

4. CONCLUSION

Monetary returns play a key role, for adopting the refined agro techniques. In the present study the net returns recorded with application of either herbicides alone or intercultivation alone as well as integration of herbicides with intercultivation were comparable but pre-emergence application of diclosulam at 26 g ha⁻¹ fb intercultivation at 20 DAS proved practically more convenient and economically best feasible integrated weed management practice for groundnut as it recorded the highest net returns comparable with other treatments. If intercultivation is not possible post-emergence application of sodium acifluorfen + clodinafop propargyl at 250 g ha⁻¹ could be an alternative method for managing the weeds effectively and improving the productivity of rabi groundnut considering the present scarcity and high cost of labour.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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