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Effect of Weed Management Practices on Weed and Plant Growth, and Yield of groundnut (*Arachis hypogea* L.)

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ABSTRACT: Controlling weeds in groundnut by cultural practices, which are time consuming, expensive and laborious. Application of selective pre-emergence herbicides such as oxyfluorfen or alachlor is an usual method for controlling weeds during the early stages, however this allows weeds to emerge at later stages, especially in groundnut. So, The present investigation was framed and carried out during *rabi* season, 2020–21 on a sandy loamy soil at the Agricultural College Farm, Bapatla to examine the effect of different weed management practices on groundnut. The experiment was set up with nine treatments and three replications in a randomized block design. The outcomes of the experiment revealed that the lowest weed density, dry weight and the highest weed control efficiency were recorded with hand weeding at 20 and 40 DAS, which was at par with alachlor @ 1.5 kg a.i ha^{-1} as PE *fb* hand weeding at 30 DAS and fomesafen @ 110g + fluazifop-p-butyl @ 110 g a.i ha^{-1} as PoE at 20 DAS. Crop growth parameters like plant height, dry matter production and leaf area index were found superior with hand weeding at 20 and 40 DAS, which was on a par with alachlor @ 1.5 kg a.i ha^{-1} as PE *fb* hand weeding at 30 DAS and propaquizafop @ 50 g + imazethapyr @ 75 g a.i ha^{-1} as PoE at 20 DAS. Highest pod yield was recorded with hand weeding at 20 and 40 DAS, which was at par with alachlor @ 1.5 kg a.i ha^{-1} as PE *fb* hand weeding at 30 DAS and propaquizafop @ 50 g + imazethapyr @ 75 g a.i ha^{-1} as PoE at 20 DAS.

Keywords: Weed density, dryweight, Plant growth and Yield.

INTRODUCTION

Groundnut is the fourth most important oilseed crop and 13th crucial food crop of the world. China and India are huge producers of groundnut, accounting for over 41% and 18% of total world's production, respectively (Mishra *et. al.*, 2020). It has a global area of 27.96 m ha, produces 47.09 m t, and has a yield of 1680 kg ha^{-1}(FAOSTAT, 2018-19). Whereas in India, it is grown on 4.88 m ha, yielding 9.25 m t and 1893 kg ha^{-1}(www.indiastat.com, 2017-18). Being the "King of oilseed", it consists of 50% oil, 21.4-36.4% high quality protein, 24.09% carbohydrates, minerals and vitamins. Besides, it is also called as "Poor man's cashew nut" and "wonder nut" (Shah and Pramanik 2020).

Groundnut cultivation is associated with several constraints of which weed interference is the major bottle neck for achieving high yield. They are the certain class of pests which can limit the production of major crops and cause serious losses of about 33% on an average (DWR-ICAR, 2015). Weeds directly compete for all resources, such as light, moisture, and space, when resources are scarce. They can remove about 30-40% of applied nutrients (Divyamani *et al.*, 2018). Due to short stature and initial slow growth, groundnut is highly susceptible to weed preponderance. Weed infestation can reduce the yield of *kharif* groundnut by 15 to 75% (Priya *et al*., 2013). The age-old practice of controlling weeds in groundnut by cultural practices (hand weeding and inter cultivation), which although much effective but time consuming, expensive and laborious. Application of selective pre-emergence herbicides like oxyfluorfen or metalachlor or alachlor (Choudhary *et al*., 2012) and pre-emergence followed by one hand weeding are common practices for managing weeds during early stages. This allows emergence of weeds at later stages particularly in groundnut where most of the research work confirm the same. Early post-emergence herbicides offer a great scope to tide over these situations. This warrants development of early post-emergence herbicides in order to manage the late emerging weeds potentially. Post-emergence application of imazethapyr @ 75 g a.i. ha^{-1} is very effective against broad leaved weeds and sedges, but less efficient to control grasses (Sondhia *et al*., 2015) whereas, quizalofop-p-ethyl shows plausible effect against grasses but less fruitful against broad leaved weeds and sedges. Application of herbicide mixtures having different modes of action against diverse weed flora can bring them below threshold levels. By using efficient herbicide mixtures with better economic feasibility compared to other methods of weed control, cost of weed management can be reduced which can help to improve returns per rupee invested. In this situation, new generation post-emergence

herbicide mixtures are needed to effectively control broad spectrum weeds in groundnut.

MATERIALS AND METHODS

During the rabi season of 2020–21, a field experiment was conducted at the Agricultural College Farm, Bapatla, which is located in the Krishna Agro-Climatic Zone of Andhra Pradesh, India, between 15° 55' N latitude and 80° 28' E longitude, at an altitude of 5.49 m above the mean sea level. The soil at the test site was sandy loam in texture, slightly acidic in reaction, and low in organic carbon (0.25%), available nitrogen (188 kg ha^{-1}), available potassium (211.5 kg ha^{-1}), and available phosphorus (21.7 kg ha^{-1}). A total rainfall of 268.6 mm was received in 11 rainy days during the crop growth period.

The experiment was laid out in randomized block design with nine treatments *viz.*,T_1: Weedy check, T_2: Hand weeding at 20DAS and 40DAS, T_3: Alachlor@ 1.5 kg a.i ha^{-1}as PE *fb* hand weeding at 30 DAS,T_4: Imazethapyr @ 50 g a.i ha^{-1} as PoE, T_5: Quizalofop ethyl @ 50 g a.i ha^{-1} as PoE, T_6: Alachlor@ 1.5 kg a.i ha^{-1}as PE *fb* hand weeding at 30DAS, T_7: Propaquizafop @ 50g + imazethapyr @ 75 ga.i ha^{-1} as PoE at 20 DAS, T_8: Acifluorfen @ 160g + clodinafop propargyl @ 80 g a.i ha^{-1} as PoE at 20DAS, T_9: Fomesafen @ 110g + fluazifop-p-butyl @ 110 g a.i ha^{-1} as PoE at 20 DAS and three replications.

Groundnut variety "DHARANI" was sown at a distance of22.5 x 10 cm. Application of nutrients was done as per the recommendation, 30 kg N, 40 kg P_2O_5 and 50 kg K_2O ha^{-1} in the form of urea, single super phosphate (SSP) and muriate of potash (MOP) respectively. 20 kg of nitrogen and the entire phosphorous and potassium doses were applied as a basal, and the remaining 10 kg of nitrogen was top dressed at 25 DAS. Gypsum was applied at the rate of 500 kg ha^{-1} at 30 DAS in the podding zone through band placement. Application of herbicides were done to the respective treatments. Pre-emergence herbicide *i.e.* alachlor was applied at suitable soil moisture on one day after sowing with hand sprayer fitted with flat fan nozzle and Post-emergence herbicides were blanket sprayed on tender and actively developing weeds at 20 DAS using 500 L ha^{-1} spray fluid with a hand sprayer fitted with a solid cone nozzle. Field operations, such as irrigation and protection, were carried out as needed. The data was recorded as per standard procedures and analyzed using ANOVA and the significance was tested by Fisher's least significance difference (p=0.05).

RESULTS AND DISCUSSION

The major weed species noticed in experimental plot were grasses like *Cynodon dactylon*, *Digitaria sanguinalis* and *Panicum repens*, sedge *Cyperus rotundus* and broad-leaved weeds like *Trichodesma indica*, *Cleome viscosa*, *Indigiofera hirsuta* and *Phyllanthus niruri*.

The lowest weed density and dryweightwere observed with all weed management practices over the weedy check (Table.1). The lowest weed density and dryweight (12.87 No. m^{-2}, 5.61 g m^{-2}, respectively) were recorded with hand weeding at 20 and 40 DAS. However, it was at par with alachlor @ 1.5 kg a.i ha^{-1}as PE *fb* hand weeding at 30 DAS (23.67 No. m^{-2}, 15.94 g m^{-2}, respectively).Fomesafen @ 110g + fluazifop-p-butyl @ 110 g a.i ha^{-1} at 20 DAS (22.78 g m^{-2}) performed better throughout the crop growth period than other post emergence herbicides. The highest weed control efficiency (93.84%) was recorded with hand weeding at 20 and 40 DAS, which was at par with alachlor @ 1.5 kg a.i ha^{-1}as PE *fb* hand weeding at 30 DAS (82.48%).

Table 1.

Treatments	Weed Density (No.m^{-2})	Weed Dry weight (g)	Weed Control Efficiency (%)	Plant Height (cm)	Leaf Area Index	Dry matter Production (kgha^{-1})	Pod Yield (kg ha^{-1})
T_1:Weedy check	10.98 (120.00)	9.56 (90.96)	0.00	24	1.75	2918	1171
T_2: Hand weeding at 20 and 40 DAS	3.66 (12.87)	2.47 (5.61)	93.84	30.4	3.37	4338.6	2287
T_3: Alachlor @ 1.5 kg a.i ha^{-1}as PE	8.17 (66.33)	6.58 (42.85)	52.89	28.5	2.2	3801.3	1470
T_4: Imazethapyr @ 50 g a.i ha^{-1} as PoE	7.22 (51.67)	5.95 (34.89)	61.64	29.2	2.97	3845.1	1609
T_5: Quizalofop ethyl @ 50 g a.i ha^{-1} as PoE	8.22 (67.00)	7.43 (54.68)	39.89	29.1	2.94	3814.3	1681
T_6: Alachlor @ 1.5 kg a.i ha^{-1}as PE *fb* hand weeding at 30 DAS	4.92 (23.67)	4.05 (15.94)	82.48	31	3.17	4217.4	1998
T_7: Propaquizafop @ 50 g + Imazethapyr @75 ga.i ha^{-1} as PoE at 20 DAS	6.10 (36.67)	4.91 (23.60)	74.05	29.9	3.15	4005.5	1986
T_8: Acifluorfen @ 160 g + Clodinafop propargyl @ 80 g a.i ha^{-1} as PoE at 20 DAS	7.25 (52.00)	4.90 (23.56)	66.40	27.6	2.43	3455.9	1667
T_9: Fomesafen @ 110g + Fluazifop-p-butyl @ 110 g a.i. ha^{-1} as PoE at 20 DAS	5.70 (32.00)	4.82 (22.78)	74.96	27.7	2.67	3409.8	1785
SEm±	0.49	0.92	7.61	0.72	0.15	191.84	122.08
CD (P=0.05)	1.48	2.76	22.84	2.16	0.44	575.16	366.02
CV (%)	16.40	21.35	22.09	5.37	9.3	8.85	12.17

The data was transformed into square root form. ($\sqrt{X+0.5}$). The figures in parenthesis are original values.

Among the post-emergence herbicides studied, the highest weed control efficiency (74.96%) was recorded with fomesafen @ 110g + fluazifop-p-butyl @ 110 g a.i ha^{-1} at 20 DAS. This might be due to successful weed control achieved through hand weeding, pre- and post-emergence herbicide application during the initial and early growth stages, which resulted in the lowest weed density, lower total dry weight of weeds, and higher weed control efficiency. These results were in conformity with the findings of Kundu *et al*. (2011), Parvender *et al.* (2016), Patel *et al.* (2019) and Shah and Pramanik (2020).

Hand weeding at 20 and 40 DAS(T_2) resulted in the highest plant height, leaf area index, and dry matter accumulation across all growth phases, which was at par with alachlor @ 1.5 kg a.i ha^{-1}as PE *fb* hand weeding at 30 DAS (T_6) (Table 1). Among the post-emergence herbicides studied, propaquizafop @ 50g + imazethapyr @ 75 ga.i ha^{-1} as PoE at 20 DAS resulted in the highest plant height, leaf area index and dry matter production. This might be due to timely and effective weed control during the critical stage, which increased the availability of resources to the crop, resulting in increased plant height, which in turn resulted in the production of more large size leaves, resulting in increased leaf area index and dry matter production. These similar findings were found by Sandil *et al.* (2015) Parvender *et al.* (2016) Sahoo *et al.* (2017) and Divyamani *et al.* (2018).

Hand weeding at 20 and 40 DAS (T_2) had the highest pod yield (2287 kg ha^{-1}) (Table 1). Propaquizafop @ 50 g + imazethapyr @ 75 g a.i ha^{-1} as PoE at 20 DAS produced equivalent pod yield (1986 kg ha^{-1}) to hand weeding at 20 and 40 DAS among the post-emergence herbicides evaluated. This might be due to less weed competition, which means less rivalry for weed-provided growth resources from planting through harvest, resulting in improved yield attributing characters and, ultimately, higher pod and kernel yield. Similar findings were reported by Kundu *et al.* (2011) and Patel *et al.* (2019).

CONCLUSION

Hand weeding at 20 and 40 DAS (T_2) was found to be superior over other treatments in the overall study. Application of propaquizafop @ 50 g + imazethapyr @ 75 g a.i ha^{-1} as PoE at 20 DAS yielded equivalent pod yield (1986 kg ha^{-1}) to hand weeding at 20 and 40 DAS among the post-emergence herbicides (2287 kg ha^{-1}).

FUTURE SCOPE

1. These findings are based on one season experimentation and needs to be validated through further experimentation to formulate a recommendation.
2. In addition there is a need to study herbicide residues in soil at different intervals
3. Future line of work is to examine various new post-emergence herbicides for selective and effective control of broad leaved weeds and also their phototoxic effect on groundnut.

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