Eco. Env. & Cons. 30 (January Suppl. Issue) : 2024; pp. (S138-S142)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2024.v30i01s.025

Relative efficacy of pre and post-emergence herbicides on productivity and profitability of groundnut (*Arachis hypogaea* L.)

Lingampally Shiva Raj Kumar, Pradeep Kumar Knaujiya, Awadhesh Kishore, Jaidev Sharma and Abhinandan Singh*[1]

Department of Agronomy, School of Agriculture, ITM University Gwalior 475 001, M.P., India
[1]Department of Agronomy, COA, Acharya Narendra Deva University of Agriculture & Technology, Ayodhya 224 229, U.P., India

(Received 30 June, 2023; Accepted 9 August, 2023)

ABSTRACT

A field experiment was conducted at the Crop Research Centre, School of Agriculture, ITM University, Gwalior (M.P.) during *Kharif* season 2022. The experiment was conducted with Randomized Block Design and replicated three times and comprised with ten treatments. The herbicides were used individually as well as in combinations viz; T_1 to T_{10} The crop was infested with the different types of weed flora. eg; *Dinebra retroflexa* and *Digitaria sanguinalis* of grassy, *Amaranthus viridis* and *Commelina benghalensis* of Broad leaved and *Cyperus rotundus* of sedges group. Weed density of the different weed species and total weeds effected significantlydue to different weed management practices. The result indicated that the total weed population and its dry weight weed index were lowest with Pendimethalin (30 % EC) at 1250 g ha^{-1} (PE) *fb* hand weeding at 40 DAS. However, highest weed control efficiency was recorded with Pendimethalin (30 % EC) at 1250 g ha^{-1} (PE) *fb* hand weeding at 40 DAS, followed by Metribuzin (30% EC) at 350 g ha^{-1}*fb* hand weeding at 40 DAS. Yield attributes and yield like number of pods $plant^{-1}$,number of kernelspod^{-1}, Test weight (g), Pod yield (kg ha^{-1}), Haulm yield (kg ha^{-1}), Harvest index were significantly higher with T_1; Pendimethalin (30 % EC) at 1250 g ha^{-1} (PE) *fb*hand weeding at 40 DAS.

Key words*: Groundnut, Pendimethalin, Metribuzin, Weed Density, Weeds, Pod Yield. Net Returns,*

Introduction

Groundnut (*Arachis hypogaea* L.) is the third-most essential source of vegetable protein and the fourth-most important source of edible oil in the world (Guchli (2015) and Kombiok *et al*. (2012),. It belongs to the plant kingdom's leguminous family and is extensively farmed in tropical and subtropical areas between the 400 N and 400 S latitudes. It is a Brazilian native, an annual, herbaceous, geotropically auto-tetraploid legume with 2n = 40. It has earned the moniker "king of oilseed" crops. Other names for groundnut include Wonder Nut and Poor Man's Cashew Nut. It is higher in energy (567 calories per 100 g) and carbs (20%) than all vegetable oils and polyunsaturated fatty acids (oleic acid). Additionally, it is a significant source of dietary fiber. According to Walia *et al.* (2007), there is a pressing want to investigate the potential for raising productivity through a better comprehension of the production restrictions in oilseed crops, particularly groundnut. Approximately 85% of the country's groundnut production is cultivated during the kharif season in rainfed environments, where the whims of the mon-

soon and seasonal biotic and abiotic pressures result in low productivity (Devi Dayal, 2004). Although grassy weeds predominate in terms of population, broad-leaf weeds also present a serious threat to the crop. According to reports, the groundnut crop's important phase for crop-weed competition can last up to 45 DAS, and by maintaining weed-free conditions throughout this time, we can increase pod yield (Geetha *et al*., 2017). The primary crop and the weeds compete for resources including soil moisture, nutrients, light, and space as the weeds emerge and grow more quickly. It has been calculated that weeds reduce groundnut production in the nation by 30% to 50% on average (Jhala *et al.*, 2005). For groundnut, the first three to four weeks of the growing season are crucial for weed management (Maulik *et al.*, 2010). After a crucial period of weed control, there is no appreciable increase in groundnut productivity. In groundnut, the loss in pod yield varies from 13 to 100% depending on the season, weed composition, length of crop weed competition, and the set of methods used.

Materials and Methods

The field experiment was carried out at the crop research center, school of agriculture, ITM University, Gwalior (M.P.), during the *kharif* season of 2022. The research field is located in the Indo-Gangetic plains region of the subtropics at an elevation of 196 m above sea level with coordinates of 26° 21' N latitude and 78° 17' E longitude. The randomized black design was replicated three times and featured a total of ten treatments. The treatments were: T_1: Pendimethalin (30% EC)@1250 g ha^{-1} (PE) *fb* hand weeding @40 DAS; T_2: Metribuzin (70% WP)@350g ha^{-1} (PE) *fb* hand weeding @40 DAS; T_3: Imazethapyr (10% SL)@80 g ha^{-1} (POE); T_4: Oxadiarzyl (80% WP)@90 g ha^{-1} (POE); T_5: Quizalofop-P-Ethyl (10% EC)@50 g ha^{-1} (POE); T_6: Pendimethalin (30% EC) @1000g ha^{-1} (PE) *fb* Imazethapyr 80 g ha^{-1} (POE); T_7; Pendimethalin (30% EC)@1000 g ha^{-1} (PE) *fb* Oxadiarzyl@90 g ha-^{1} (POE); T8; Propaquizafop (10% EC) @90g ha^{-1} (POE); T_9; Weed free,T_{10}; weedy check. The groundnut variety "Kranthi" was used for the experiment, and sowing was done in 25 July 2022, keeping 45 cm × 15 cm spacing. Pre-emergence applications were applied on the first day after sowing, and post-emergence herbicides were applied on the 21st day of crop sowing by using a knap sack sprayer with a flat-fan nozzle and a 500 L/ha spray volume. A common dose of 40 kg N, 40kg P_2O_5, and 60 kg K_2O per hectare was applied as the basal dose of nutrients at the time of sowing. At 60 DAS, Observations were made about the weed flora, weed density (No. m^{-2}), weed dry weight (g m^{-2}), number of pods per plant, number of grains per pod, pod yield, and haulm yield. Weed flora was categorized into narrow and broad-leaved grasses and sedges. Weed dry weight was calculated after two days of sun drying and 48 hours of Owen drying at 70±1 °C. Category-wise, weed was initially evaluated by counting. Using a common equation, weed control efficiency (WCE) was calculated . The cost of cultivation was subtracted from the gross return to determine the net return. By dividing the net return by the cost of cultivation, the benefit-cost ratio was obtained. On October 24, 2022, the crop was harvested. Statistical information on weeds and crops was examined using randomized block designs and analysis of variance (ANOVA) techniques. (Gomez and Gomez, 1984). The square root transformed data "x + 0.5 on weed density and dry matter were used in an ANOVA.

Formulae were used: Weed control efficiency and weed index

$$WCE\ (\%) = \frac{DMC\text{-}DMT}{DMC}\ \ 100$$

Where, DMC = Dry matter of weeds in the unweeded check (control) DMT=Dry matter of weeds in the treated plot.

$$\text{Weed index WI}(\%) = \frac{X–Y}{X} \times 100$$

Where,

X = Grain yield from weed-free check or maximum yield treatment (Complete removal of weeds)

Y = Grain yield from the treated plot for which weed index is to becalculated.

Results and Discussion

Sedges and weeds with broad and narrow leaves covered the experiment field. At the 60-days stage, the main weed species were *Dinebraretroflexa* (18.16%), *Digitaria sanguinalis* (19.89%), *Amaranthus viridis* (19.01%), *Commelinabenghalensis* (10.88%), *Cyperus rotundus* (19.44%), and other weeds (12.59%). Other weeds include *Cynodondicotylon*, *Euphorbia hirta*, *Digeraarvenis*, and *Portulaca oleracea*. In Table 1, data on density, dry weight of total

weeds, and weed control efficiency (WCE) recorded at the 60-days stage of crop growth have been given. At various periods of observation, the existence of the aforementioned weeds in noticeably different populations under various treatments was noted. The effectiveness of weed control was determined by how successfully weed populations were managed and how well weed control techniques outperformed weedy checks. This was greatly altered by various weed control techniques. Among all weed control methods, the higher weed control efficiency recorded with T_9 weed-free was found to be more effective, followed by T_1: Pendimethalin (30% EC) @ 1250g ha^{-1} (PE) applied on the first day after sowing *fb* hand weeding@40 DAS; T_2: Metribuzin (70% WP)@350 g ha^{-1} (PE) *fb* hand weeding@40 DAS; T_6: Pendimethalin (30% EC)@1000g ha^{-1} (PE) *fb* Imazethapyr@80 g ha^{-1} (POE) and T_7: Pendimethalin (30% EC)@1000 g ha^{-1} (PE) *fb* Oxadiarzyl@90 g ha^{-1} (POE). The lowest weed control efficiency (WCE) recorded in weedy check treatment.

Among all weed control methods, the lower weed index recorded with T_9 weed-free followed by T_1: Pendimethalin (30% EC) @ 1250g ha^{-1} (PE) applied on the first day after sowing *fb* hand weeding@40 DAS; T_2: Metribuzin (70% WP) @350 g ha^{-1} (PE) *fb* hand weeding@40 DAS. The highest weed index (WI) recorded in weedy check treatment.

Guggari *et al*. (1995) observed that weeds can be controlled up to 30–35 percent by pre-emergence applications of herbicides. This was caused by the pre-emergence herbicide's broad-spectrum activity, which can be seen in the roots and leaves of the affected plants. Affected plants die soon after emergence or if a subsequent emergence from the soil takes place (Satyanarayana Regars *et al*., 2021). and the timely weeding, which can reduce the population of weeds T_1; Pendimethalin (30% EC) 1250g ha^{-1} (PE) fbhand weeding @40 DAS. The crop canopy has restricted weed development as shown by plant height and the greater number of branches per plant, which cannot allow weeds to grow rapidly. This treatment combination reduced the weed population at harvest.

Irrespective of weed-free treatment (hand weeding as and when required), significantly lower weed density (No. m^{-2}) and weed biomass at the 60-day stage were recorded with the application of T_1: Pendimethalin (30% EC) @1250g ha^{-1} (PE) *fb* hand weeding applied on the first day after sowing *fb* Hand weeding @40 DAS is at par with the T_2: Metribuzin (70% WP) @350 g ha^{-1} (PE) *fb* hand weeding @40 DAS, followed by $T_{6:}$ Pendimethalin (30% EC) @1000g ha^{-1} (PE) *fb* Imazethapyr @80 g ha^{-1} (POE), and T_7: Pendimethalin (30% EC) @1000 g ha^{-1} (PE) *fb* Oxadiarzyl @90 g ha^{-1} (POE). On the weedy check treatment, significantly greater weed weight and density were noted.

Table 1. Effect of different weed control treatments on weed density, dry matter, Weed Control Efficiency and weed index at 60 DAS

S. No.	Treatment	Weed density (no. m^{-2})	Weed dry weight(g m^{-2})	WCE (%)	Weed Index (WI)
T_1	Pendimethalin (30% EC)@1250 g ha^{-1} (PE) fb hand weeding	8.87 (78.68)	6.02 (35.76)	84.68	5.20
T_2	Metribuzin (70% WP)@350 g ha^{-1} (PE) fb Hand weeding,	9.40 (88.44)	6.08 (36.50)	84.36	5.82
T_3	Imazethapyr (10% SL) @80 g ha^{-1} (POE)	10.39 (107.87)	8.86 (78.00)	64.76	18.30
T_4	Oxadiarzyl (80% WP) @90 g ha^{-1} (POE)	10.49 (110.13)	9.10 (82.23)	64.76	31.39
T_5	Quizalofop-P-Ethyl (10% EC) @50 g ha^{-1} (POE)	10.38 (107.77)	9.21 (84.29)	63.88	24.32
T_6	Pendimethalin (30% EC) @1000 g ha^{-1} (PE) fb Imazethapyr 80 g a.i. ha^{-1} (POE)	10.01 (100.13)	8.00 (63.49)	73.15	7.17
T_7	Pendimethalin (30% EC) @ 1000 g ha^{-1} (PE) fb Oxadiarzyl @90 g a.i. ha^{-1} (POE)	9.63 (92.67) 10.48 (109.87)	7.95 (62.67) 9.33 (86.50)	72.79 62.93	9.56 22.04
T_8	Propaquizafop (10% EC) @90 g ha^{-1} (POE)	0.71 (0.00)	0.71 (0.00)	100.00	0.00
T_9	Weed free	16.02	15.29		
T_{10}	Weedy check	(256.60)	(233.37)	0.00	49.00
	SEm+	0.05	0.30	--	-
	C.D.at 5%	0.17	0.89	--	-

Note:Fig.inparenthesisaretheoriginalvalues,X=”5e+ 0.5transformation

The various weed management techniques had a substantial impact on the groundnut yield characteristics and economics (Table 2). Significantly higher numbers of pods and kernels per pod were recorded in T_9: Weed-free Which is at par with T_1: Pendimethalin (30% EC) @1250g ha^{-1} at the first day after sowing (PE) *fb* hand weeding and T_2: Metribuzin (70% WP) @350 g ha^{-1} (PE) *fb* Hand weeding followed by T_6: Pendimethalin (30% EC) @1000g ha^{-1} (PE) *fb* Imazethapyr 80g ha^{-1} (POE) and T_7: Pendimethalin (30% EC) @1000g ha^{-1} (PE) fbOxadiarzyl @90g ha^{-1} (POE).

Significantly higher yield was recorded in T_9: Weed-free (1603 kg ha^{-1}). Which is at par with T_1: Pendimethalin (30% EC) @1250g ha^{-1} at the first day after sowing (PE) *fb* hand weeding (1520 kg ha$^{-1)}$ and T_2: Metribuzin (70% WP) @350 g ha^{-1} (PE) *fb* Hand weeding (1510 kg ha$^{-1)}$ followed by T_6: Pendimethalin (30% EC) @1000g ha^{-1} (PE) *fb* Imazethapyr 80g ha^{-1} (POE) (1488 kg ha$^{-1)}$ and T_7: Pendimethalin (30% EC) @1000g ha^{-1} (PE) fb Oxadiarzyl @90g ha^{-1} (POE) (1450 kg ha^{-1}). Significantly lower yield was recorded with the T_{10} weedy-check (817.6 kg ha^{-1}), because of a severe weed infestation.

Among all the herbicide treatments, the highest net return was recorded with T_1: Pendimethalin (30% EC) @1250g ha^{-1} at the first day after sowing (PE) fb hand-weeding (95569 ha^{-1}), which is on par with T_2: Metribuzin (70% WP) @350g ha^{-1} (PE) fb hand-weeding (93769 ha^{-1}), followed by; T_6: Pendimethalin (30% EC) @1000g ha^{-1} (PE) fbImazethapyr 80g ha^{-1} (POE) (93333 ha^{-1}) and; T_7: Pendimethalin (30% EC) @1000 g ha^{-1} (PE) fb Oxadiarzyl @90 g ha^{-1} (POE) (90018 ha^{-1}); lowest return was recorded in T_{10}; weedy check the (36647 ha^{-1}). The benefit-cost ratio recorded a higher T_1: Pendimethalin (30% EC) @1250 g ha^{-1} at the first day after sowing (PE) fb hand weeding, followed by (INR 2.54), followed by T_2: Metribuzin (70% WP) @350g ha^{-1} (PE) fbHand weeding (INR 2.43), followed by T_6: Pendimethalin (30% EC) @1000 g ha^{-1} (PE) fb Imazethapyr 80g ha^{-1} (POE) and (INR 2.48) and followed by T_7: Pendimethalin (30% EC) @1000 g ha^{-1} (PE) fb Oxadiarzyl @90g ha^{-1} (POE) (INR 2.42). Similarly, Rao *et al*. (2011) observed that utilizing pre-emergence herbicides in groundnut increased Benefits and BC ratio.

Conclusion

Pre-emergence doses may help boost groundnut pod production and net returns. When compared to the other treatments, using Pendimethalin (30% EC)

Table 2. Effect of different weed control treatments on yield attributes economics of groundnut

S. No.	Treatment	Number of pods (plant^{-1})	Number of kernels (plant^{-1})	Test Weight (g^{-1})	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Net returns (INRha^{-1})	B-C ratio
T_1	Pendimethalin (30% EC) @1250 g ha^{-1} (PE) fb hand weeding	17.36	2.86	44.26	1520.0	3833.3	95569	2.54
T_2	Metribuzin (70% WP) @350 g ha^{-1} (PE) fb Hand weeding,	16.65	2.83	43.10	1510.0	3833.3	93769	2.43
T_3	Imazethapyr (10% SL) @80 g ha^{-1} (POE)	14.62	2.70	42.50	1310.0	3623.3	77639	2.04
T_4	Oxadiarzyl (80% WP) @90 g ha^{-1} 13.46 (POE)	2.56	40.10	1100.0	3600.0	61469	1.64	
T_5	Quizalofop-P-Ethyl (10% EC) @ 50 g ha^{-1} (POE)	13.86	2.43	40.26	1213.3	3466.6	70033	1.87
T_6	Pendimethalin (30% EC) @1000 g ha^{-1} (PE) fb Imazethapyr 80 g ha^{-1} (POE)	16.33	2.80	42.56	1488.3	3933.3	93333	2.48
T_7	Pendimethalin (30% EC) @ 1000 g ha^{-1} (PE)fb Oxadiarzyl @90 g ha^{-1} (POE)	16.00	2.73	42.66	1450.0	3733.3	90018	2.42
T_8	Propaquizafop(10%EC) @90g ha^{-1} (POE)	14.20	2.50	40.20	1250.0	3533.3	72318	1.88
T_9	Weed free	18.37	3.00	44.35	1603.3	3916.6	93583	2.29
T_{10}	Weedy check	12.73	1.60	29.06	817.6	2556.6	36647	1
	SEm+	0.81	0.14	2.61	63.03	172.02	--	--
	C.D. at 5%	2.42	0.42	NS	187.28	511.79	--	--

@1250g ha^{-1}*fb* Hand Weeding and Metribuzin (70%WP) @350g ha^{-1} on the first day after sowing *fb* Hand Weeding on day 40 DAS showed superior results in terms of reducing weed density and dry weight of weeds. It is regarded as an appropriate substitute for groundnuts with a greater B-C ratio and broad-spectrum weed control.

References

Dayal, D. 1990. Response of summer groundnut to mulching under varying irrigation regimes. *Groundnut News*. 11(2): 5.

Dayal, D. 2004. Weed management in groundnut. In: M S Basu and N B Singh Eds, *Groundnut Research in India.* CABI, Wallingford, pp. 248-259.

Geetha, D. S., Venkateshwarulu, S. and Chandrasekar, K. 2017. Effect of integrated weed management practices on weed dynamics, yield and economics of Rabi groundnut. (*Arachis hypogaea*) in sandy loam soils of Andhra Pradesh. *International Journal of Current Research*. 9(01): 44605-44608.

Gomez, K.A. and Gomez, AA. 1984. Statistical for Agricultural Research. John. Wiley and Sons. New York, 704 p.

Guchi, E. 2015. Contamination in Groundnut (*Arachis hypogaea L.*) caused by Asneroillus species Ethionia. *Journal of Anned & Environmental Microbiology*. **3**(1): 11-19.

Guggari, A.K., Manjappa, K., Desai, B.K. and Chandranath, H.T. 1995. Integrated weed management in groundnut. *Journal of Oilseeds Research*. **12** 0: 65-68.

Jhala, A.P., Rathod, H., Patel, K.C. and Damme, P.V. 2005. Growth and yield of groundnut (*Arachis hypogaea L.*) as influenced by weed management practices and rhizobium inoculation. *Commun. Agric. Appl. Bio. Sci.* 70 (3): 493-500

Kombiok, J.M., Buah, S.S.J., Dzomeku, I.K. and Abdulai, H. 2012. Sources of pod yield losses in Groundnutin the Northern Savanna Zone of Ghana. *West African Journal of Applied Ecology.* 20(2): 53-63.

Mulik, B.B., Malunjkar, B.D., Kankal, V.Y. and Patil, S.C. 2010. Chemical weed control in Kharif groundnut (*Arachis hypogaea L.*), pp 86. In: *National Symposium on Integrated Weed Management in the Climate Change*, NASC, New Delhi, 21-22 August, 2010.

Rao, S.S., Madhavi, M. M. and Reddy, C.R. 2011. Integrated approach for weed control in Rabi groundnut (*Arachis hypogaea* L.). *Journal of Research ANGRAU.* 39(1): 60–63

Satyanarayana Regar 2021. Weed Management in Groundnut. *Indian Journal of Weed Science.* **53**(1): 111-113.

Walia, U.S., Surjit Singh and Buta Singh, 2007. Integrated approach for the control of Hardy weeds ingroundnut (*Arachis hypogaea L.*). *Indian J. Weed Sci*., 39 (1&2): 112-115.

Yaduraju, N. T. 1993. Solarization in weed management, In; Proc. Intl. Symp. on integrated weed management forsustainable agriculture. India Society of Weed Science, Hissar, India. 1: 46-347.