EFFECT OF WEED MANAGEMENT ON YIELD QUALITY AND ECONOMICAS OF SUMMER GROUNDNUT (*Arachis hypogaea* L.) UNDER SOUTH GUJARAT CONDITION

ABSTRACT

A field experiment was conducted during the *summer* 2023 at Agricultural experimental Station, Paria, Gujarat with The experiment designed in randomized block design with four replications. The treatments were T_1: unweeded control, T_2: weed-free hand weeding at 20, 30, and 40 DAS, T_3: pre-emergence application of pendimethalin (EC) at 1.0 kg/ha + 1 HW, T_4: pre-emergence application of pendimethalin (CS) at 1.0 kg/ha + 1 HW, T_5: pre-emergence application of flumioxazin (SC) @ 0.05 kg/ha + 1 HW, T_6: pre-emergence application of diclosulam (WDG) at 20 g/ha (PE) + 1 HW; T_7: pre-emergence application of pendimethalin (EC) at 1.0 kg/ha (PE) + imazamox + imazethapyr at 70 g/ha in pre-mix as post-emergence; T_8: post-emergence application of propaquizafop (EC) at 75 g/ha. The results revealed that significantly higher values of growth parameter viz, plant height, yield attributing parameters *viz*., number pods per plant, shelling percentage, test weight, harvest index and pod as well as haulm yield were recorded under weed free (Hand weeding at 20, 30 and 40 DAS) (T_2). Treatment T_3 and T_4 were found equally effective in recording higher values of growth parameters and yield attributes and yield than rest of treatments. Whereas weed management treatments did not excert any significant effect on oil content of groundnut. The highest net profit and B:C ratio were accrued from weed-free (T_2), closely followed by pendimethalin EC @ 1.0 kg/ha as pre-emergence + 1 HW (T_3) and pendimethalin CS @ 1.0 kg/ha as pre-emergence + 1 HW (T_4). The results of the study showed that T_2 (weed-free, hand-weeding at 20, 30, and 40 DAS) produced the best outcomes, whereas T_3 and T4 herbicide treatments produced results that were comparable to T_1

Key words: Groundnut, weed, pendimethalin, growth, yield.

1. INTRODUCTION

One of the most significant oilseed crops in India is groundnut, which is known as the "king of oilseed crops." Products made from groundnuts include peanut butter, flour, oil, and protein. The leguminous oilseed crop known as groundnut *(Arachis hypogaea* L.) is indigenous to South Africa and is a member of the Fabaceae and Papillionaceae sub-families (Hammons, 1982). Despite being farmed on every continent, only three countries *i.e*. China, India, and the United States of America with account for more than 75% of the world's groundnut production. In 2022, India contributed nearly 19% to global production of groundnuts. India ranks first in area and second in production after China. Groundnuts are grown on 6.09 million hectares of land in India, yielding 10.21 million tonnes at a productivity of 16.76 q/ha (Anon., 2023). In India, the states of Gujarat, Andhra Pradesh, Telangana, Tamil Nadu, Karnataka, and Maharashtra account for 80% of groundnut area and 84% of production. Gujarat is the top producing state for groundnuts in India, contributing 35.50 percent of the total area (2.16 mha)

40.42 percent of the total production (4.13 million tonnes), with an average productivity of 19.08 q/ha (Anon., 2023). Gujarat's Saurashtra area is known as the "Bowl of Groundnut."

Groundnut is an important food, fodder and cash crop for the farmers of India. Groundnut kernels contains 48-50 per cent of edible oil and 26-28 per cent protein, along with rich dietary fiber, minerals and vitamins (Ntare *et al.,* 2008). Weed infestation is the main biotic factor behind groundnut productivity being low, among other biotic and abiotic issues. Groundnut yields are significantly reduced because weeds fight with crop plants for nutrients and take away 30–40% of applied fertilizers (Dryden and Krishnamurthy, 1997). Groundnut production losses of up to 70% were noted as a result of weed infestation during the key period for crop-weed competition, which was found to be up to 45 days after sowing (Prasad *et al.,* 2002). Generally, weeds are controlled through hand weeding in groundnut, but it is expensive and laborious. However, to manage these weeds the availability of labours at the right time and at nominal cost is the biggest challenge being faced by the farmers. In such cases, chemical weed control may be a practical and affordable alternate method of managing weeds. An efficient herbicide used at the right dosage may prove to be an effective weed control strategy and take the place of more traditional weed control techniques. Due to the scarcity and high cost of labour, farmers have recently expressed a greater interest in using herbicides to manage weeds and lower cultivation costs (Savu *et al.,* 2005). Very scare scientific information is available particularly regarding weed management in summer groundnut grown under south Gujarat condition. Therefore, the present investigation was undertaken with the objective of finding suitability of different pre- and post-emergence herbicides.

2.MATERIAL AND METHODS

The field experiment was carried out during summer season of the year 2023 on Plot No. 2 of Agricultural Experimental Station, Navsari Agricultural University, Paria, Gujarat. Geographically the campus of Agricultural Experimental Station in Paria is located at 20º44' N latitude and 72º97' E longitude, at an altitude of 12 m above the mean sea level. The maximum and minimum temperature during crop growth period ranged between 26.07 to 39.04 °C and 10.36 to 25.00 °C, respectively during 2023. The soil of the experimental field was clayey in texture, slightly alkaline in reaction with pH (7.68) and EC (0.38 ds/m), low in available nitrogen (238.6 kg/ha), medium in organic carbon (0.52 %) and available phosphorus (50.8 kg/ha) and high in potassium (356.2 kg/ha). A combination of 8 treatments, *viz*. T1: unweeded control, T2: weed-free hand weeding at 20, 30, and 40 DAS, T3: pre-emergence application of pendimethalin (EC) at 1.0 kg/ha + 1 HW, T4: pre-emergence application of pendimethalin (CS) at 1.0 kg/ha + 1 HW, T5: pre-emergence application of flumioxazin (SC) @ 0.05 kg/ha + 1 HW, T6: pre-emergence application of diclosulam (WDG) at 20 g/ha (PE) + 1 HW; T7: pre-emergence application of pendimethalin (EC) at 1.0 kg/ha (PE) + imazamox + imazethapyr at 70 g/ha in pre-mix as post-emergence; T8: post-emergence application of propaquizafop (EC) at 75 g/ha, were tested in randomized block design. Pre- and post-emergence herbicides were applied manually using knapsack sprayer fitted with flat-fan nozzle by mixing in 500 litre of water/ha as per treatments. Groundnut *cv*. GG 34 was sown on 8th February, 2023 keeping spacing of 30 cm between row by using seed rate of 100 kg/ha. The recommended dose of fertilizers, i.e. 12.5 kg N/ha and 25 kg P_2O_5/ha was applied

before sowing in the seed row zone. Nitrogen and P_2O_5 were applied through urea and DAP, respectively. The initial plant height and population were counted at 30 days after sowing. Whereas final plant height and population were counted at harvest. The crop was harvested on 26th May, 2023. The pod and haulm yield of groundnut was recorded at time of crop harvest separately for each net plot and converted into kg/ha.

3.RESULTS AND DISCUSSION

3.1 Weed Flora seen the experimental plot

The weed flora of the experimental field was dominated by *Digitaria sanguinalist*, *Sorghum halepense, Echinochloa crusgalli, Cynodon dactylon, Barcharia Spp.*, *Amaranthus virdis, Digera arvensi, Convovulus arvensis, Eclipta alba, Euphorbia hirta, Cassia tora, Trianthema portulacustrum* and *Cyperus rotundus* during summer 2023.

3.2 Growth attributes in Groundnut

The results revealed that all the weed-control measures including weed-free control significantly improved the growth parameters, except plant population, over unweeded control (Table 1 and figure 1). The various weed management treatments did not exert any significant influence on plant population at 30 DAS and harvest, indicating no phytotoxic/ inhibitory effect of different herbicides on groundnut crop.

Pendimethalin EC @ 1.0 kg/ha as pre-emergence + 1 HW (T_3), pendimethalin CS @ 1.0 kg/ha as pre-emergence + 1 HW (T_4), and pendimethalin EC @ 1.0 kg/ha as pre-emergence + Imazamox + Imazethapyr @ 70 g/ha in pre-mix as post-emergence (T_7) had almost equal effect on plant height at 60 DAS and were at par with weed free (hand weeding at 20, 30, and 40 DAS) (T_2). At harvest, the higher plant height (48.93 cm) was noted with T_2 weed free – hand weeding at 20, 30, and 40 DAS, which remained statistically at par with pendimethalin EC @ 1.0 kg/ha as pre-emergence + 1 HW (T_3), pendimethalin CS @ 1.0 kg/ha as pre-emergence + 1 HW (T_4). While lower plant height (31.03 cm) at harvest was recorded under unweeded control (T_1) at harvest. It could be because of increased competition between weeds and crop plants as a result of poor weed management. A favourable environment for plant growth was created by the efficient control of weeds using hand weeding in treatment T_2 (weed-free) and a combination of pre-emergence herbicides and hand weeding, which reduced weed-crop competition throughout the crop's growth stage. Thus, improved access to nutrients, water, light, and space may have speed up the rate of photosynthetic energy production, which in turn increased the supply of carbohydrates and caused a rise in plant height. These findings are in agreement with those of Nambi *et al.* (2019), Bhattarai *et al*. (2021) and Kakade *et al*. (2023).

3.3 Yield and yield attributes

The yield attributes *viz.,* number pods per plant, shelling percentage, test weight, harvest index (Table 2) and pod as well as haulm yield (Table 3 and figure 2) were significantly influenced by weed management methods. The treatment T_2 (weed free) produced the higher number of pods per plant (38.68) and remained at par with pendimethalin EC @ 1.0 kg/ha as pre-emergence + 1 HW (T_3). While test weight (52.81 g) and shelling percentage (70.61 %) were

recorded maximum in with treatment weed free (T_2) being at par with treatment pendimethalin EC @ 1.0 kg/ha as pre-emergence + 1 HW (T_3) and pendimethalin CS @ 1.0 kg/ha as pre-emergence + 1 HW (T_4) and pendimethalin EC @ 1.0 kg/ha as pre-emergence + Imazamox + Imazethapyr @ 70 g/ha in pre-mix as post-emergence (T_7).

Pod yield (3625 kg ha^{-1}) and haulm yield (4940 kg ha^{-1}) were maximum in treatment T_2 (weed free) being at par with pendimethalin EC @ 1.0 kg/ha as pre-emergence + 1 HW (T_3) and pendimethalin CS @ 1.0 kg/ha as pre-emergence + 1 HW (T_4). The treatment weed free (T_2) recorded maximum harvest index (42.30 %) being at par with pendimethalin EC @ 1.0 kg/ha as pre-emergence + 1 HW (T_3), pendimethalin CS @ 1.0 kg/ha as pre-emergence + 1 HW (T_4), pendimethalin EC @ 1.0 kg/ha as pre-emergence + Imazamox + Imazethapyr @ 70 g/ha in pre-mix as post-emergence (T_7), flumioxazin SC @ 0.05 kg/ha (PE) + 1 HW (T_5), diclosulam WDG @ 20 gm/ha (PE) + 1 HW (T_6). The successful weed control in the mentioned treatments enhanced the groundnut's growth and yield-contributing characteristics, resulting in a significantly higher pod yield compared to the unweeded control. These findings were in agreement withresults Vora *et al*. (2019) and Kundu *et al.* (2021).

3.4 Effect of Quality

It was observed (Table2) that different weed management treatments did not show their significant influence on oil content of groundnut. Similar result was obtained by Harikesh *et al*. (2021).

3.5 Economics

Weed management treatments had significantly greater gross return than the unweeded control (T_1), which had the lowest net return, according to an analysis of the data (Table 3). The highest net return (237657 ₹ ha^{-1}) was obtained under the weed-free condition (T_2), which was followed by the following treatments: pendimethalin EC @ 1.0 kg/ha as pre-emergence + 1 HW (T_3), pendimethalin CS @ 1.0 kg/ha as pre-emergence + 1 HW (T_4), and pendimethalin EC @ 1.0 kg/ha as pre-emergence + Imazamox + Imazethapyr @ 70 g/ha in pre-mix as post-emergence (T_7). Whereas the highest B:C ratio of 4.22 was obtained with weed-free (T_1), followed by pendimethalin EC at 1.0 kg/ha as pre-emergence + 1 HW (T_3). This could be because growing labour costs and the necessity for higher-paid workers have driven up the cost of cultivating groundnut crop in unweeded control (T_1). This cost was decreased by applying herbicides *i.e*., pendimethalin EC @ 1.0 kg/ha as pre-emergence + 1 HW (T_3) and pendimethalin CS @ 1.0 kg/ha as pre-emergence + 1 HW (T_4) to effectively control weeds with the least amount of human labour. These findings are in agreement with those of Bhattarai *et al*. (2021) and Kakade *et al*. (2023).

4.CONCLUSION

It can be concluded from study that potential production and effective weed control in summer groundnut can be achieved by keeping weed free (Hand weeding at 20, 30 and 40 DAS) conditions during the crop growth period. When labours are not easily available, apply either pendimethalin (EC) @ 1.0 kg/ha as pre-emergence + 1 HW at 40 DAS or pendimethalin (CS)

@ 1.0 kg/ha as pre-emergence + 1 HW at 40 DAS.This experiments results effective weed control higher yield .BCR and improved quality of Groudnut.

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Table 1. Effect of different treatments on growth attributes of Groundnut

Treatments		Plant population per net plot		Plant height (cm)		
		30 DAS	At Harvest	30 DAS	60 DAS	At harvest
T_1	Unweeded Control	220.70	213.93	9.25	17.07	31.03
T_2	Weed free (Hand weeding at 20, 30 and 40 DAS)	221.40	219.06	9.86	29.42	48.93
T_3	Pendimethalin (EC) @ 1.0 kg/ha (PE) + 1 HW at 40 DAS	220.06	216.26	9.72	27.51	46.58
T_4	Pendimethalin (CS) @ 1.0 kg/ha (PE) + 1 HW at 40 DAS	220.23	216.13	9.69	27.56	44.09
T_5	Flumioxazin (SC) @ 0.05 kg/ha (PE) + 1 HW at 40 DAS	219.40	215.26	9.49	23.07	37.46
T_6	Diclosulam (WDG) @ 20 gm/ha (PE) + 1 HW at 40 DAS	219.20	214.06	9.41	21.80	36.45
T_7	Pendimethalin (EC) @ 1.0 kg /ha (PE) + Imazamox + Imazethapyr@ 70 gm/ha (Pre-mix) as Post-Emergence	219.53	216.60	9.63	24.92	41.53
T_8	Propaquizafop (EC) @ 75gm/ha as Post-Emergence	219.46	214.60	9.36	20.12	33.39
S.Em. ±		8.65	11.03	0.41	1.19	6.45
CD at 5%		NS	NS	NS	3.49	10.98

PE, Pre-emergence; HW, hand-weeding; DAS, days after sowing; EC, emulsifiable concentration; CS, capsule suspension; SC, soluble concentrate; WDG, water dispersible granule.

Table 2. Effect of different treatments on yield attributes and quality

Treatments		Number of pods/plants	Shelling percentage (%)	Test weight (g)	Oil content (%)	Harvest index (%)
T_1	Unweeded Control	20.43	60.57	38.67	49.05	36.34
T_2	Weed free (Hand weeding at 20, 30 and 40 DAS)	38.68	70.61	52.81	52.90	42.30
T_3	Pendimethalin (EC) @ 1.0 kg/ha (PE) + 1 HW at 40 DAS	36.15	67.69	50.85	51.79	42.06
T_4	Pendimethalin (CS) @ 1.0 kg/ha (PE) + 1 HW at 40 DAS	35.71	67.02	50.73	51.66	41.65
T_5	Flumioxazin (SC) @ 0.05 kg/ha (PE) + 1 HW at 40 DAS	26.18	65.54	46.89	50.22	39.78
T_6	Diclosulam (WDG) @ 20 gm/ha (PE) + 1 HW at 40 DAS	25.18	65.03	45.45	50.01	39.50
T_7	Pendimethalin (EC) @ 1.0 kg /ha (PE) + Imazamox + Imazethapyr@ 70 gm/ha (Pre-mix) as Post-Emergence	31.30	66.67	49.55	50.95	40.83
T_8	Propaquizafop (EC) @ 75gm/ha as Post-Emergence	24.15	63.20	41.67	49.23	37.73
S.Em. ±		1.17	1.35	1.47	2.19	1.08
CD at 5%		3.44	3.98	4.32	NS	3.17

PE, Pre-emergence; HW, hand-weeding; DAS, days after sowing; EC, emulsifiable concentration; CS, capsule suspension; SC, soluble concentrate; WDG, water dispersible granule.

Table 3. Effect of different treatments on yield and Economics

Treatments	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Net return (₹ ha^{-1})	B:C ratio
T_1: Unweeded Control	1565	2730	78797	2.30
T_2: Weed free (Hand weeding at 20, 30 and 40 DAS)	3625	4940	237657	4.22
T_3: Pendimethalin (EC) @ 1.0 kg/ha (PE) + 1 HW at 40 DAS	3258	4488	212656	4.15
T_4: Pendimethalin (CS) @ 1.0 kg/ha (PE) + 1 HW at 40 DAS	3118	4361	201710	4.01
T_5: Flumioxazin (SC) @ 0.05 kg/ha (PE) + 1 HW at 40 DAS	2613	3964	161969	3.46
T_6: Diclosulam (WDG) @ 20 gm/ha (PE) + 1 HW at 40 DAS	2550	3905	155442	3.32
T_7: Pendimethalin (EC) @ 1.0 kg /ha (PE) + Imazamox + Imazethapyr@ 70 gm/ha (Pre-mix) as Post-Emergence	2918	4213	187156	3.86
T_8: Propaquizafop (EC) @ 75gm/ha as Post-Emergence	2212	3636	131730	3.08

PE, Pre-emergence; HW, hand-weeding; DAS, days after sowing; EC, emulsifiable concentration; CS, capsule suspension; SC, soluble concentrate; WDG, water dispersible granule.

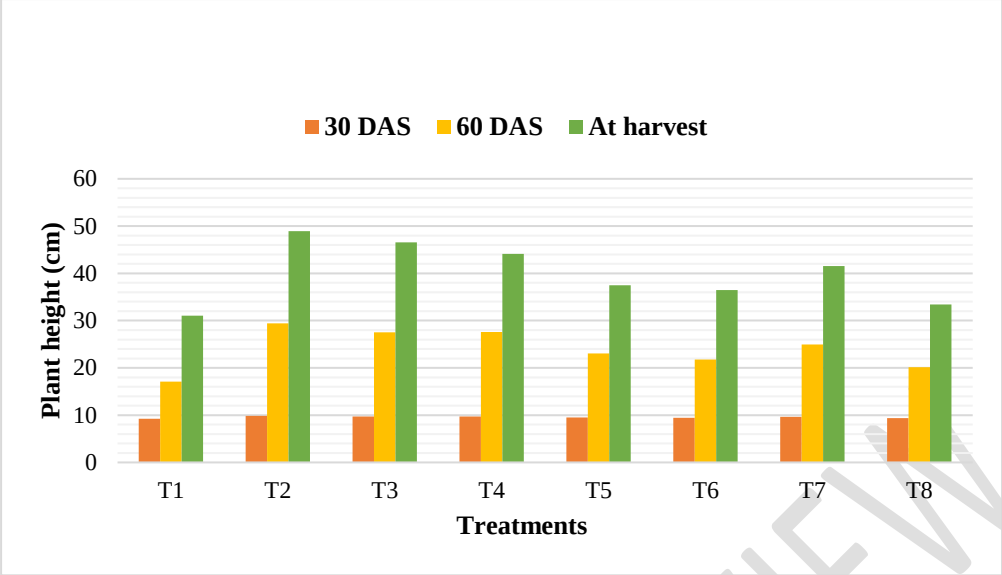

Figure 1. Effect of different treatments on plant height

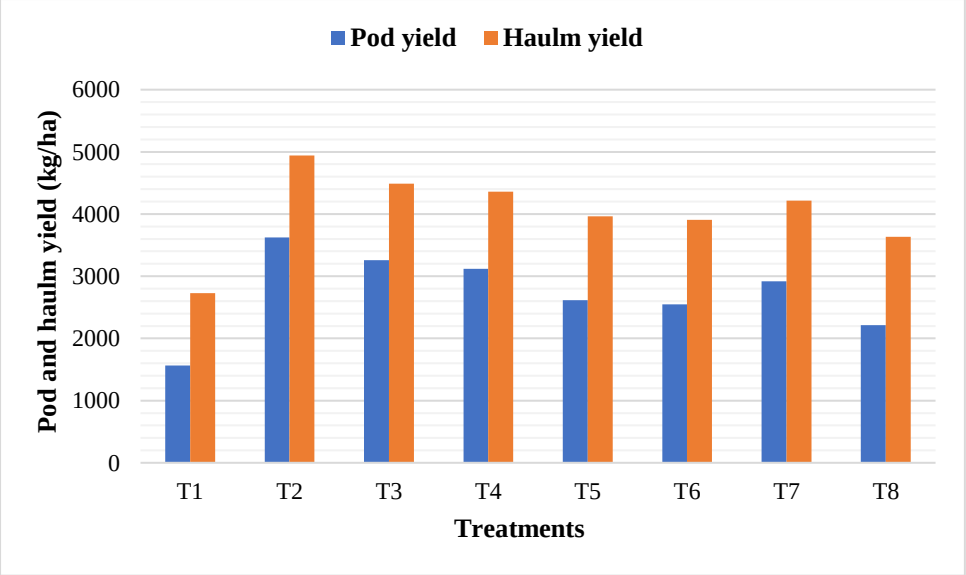

Figure 2. Effect of different treatments on pod and haulm yield