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## Effect of integrated weed management on growth and yield of irrigated groundnut (*Arachis hypogaea* L.)

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### Abstract

A field experiment was carried out at Annamalai University, Annamalai Nagar of Chidambaram taluk, Cuddalore district, Tamil Nadu during January – April 2023 to study the “Integrated weed management of irrigated groundnut (*Arachis hypogaea* L.)”. The study included ten treatments, a randomised block design, and three replications. The treatments that produced the highest values of yield components at harvest, such as kernel yield, pod yield and growth parameters were the two hand weeding treatments on 20 and 40 DAS (T<sub>2</sub>) and it was on par with the pre-emergence application of pendimethalin 1.0 kg a.i. ha<sup>-1</sup> at 3 DAS followed by the post-emergence application of quizalofop 100 g a.i. ha<sup>-1</sup> at 21 DAS (T<sub>4</sub>). This was followed by (T<sub>6</sub>) Groundnut shell cover mulch @ 2000 kg ha<sup>-1</sup> followed by Early Post-emergence (Sodium acifluorfen) 900 g a.i. ha<sup>-1</sup> on 15 DAS. The unweeded control (T<sub>1</sub>) had the largest biomass and weed counts, which led to an extremely low grain yield. This experiment observed that, twice hand weeding on 20 and 40 DAS (T<sub>2</sub>) and it was on par with Pre emergence application of pendimethalin 1.0 kg a.i. ha<sup>-1</sup> at 3 DAS followed by post emergence application of quizalofop 100 g a.i. ha<sup>-1</sup> at 21 DAS (T<sub>4</sub>) was the most effective weed control technique, increasing yield production and growth and reduce the nutrient uptake by weeds and higher economic returns from irrigated groundnut.

**Keywords:** Weed management, growth, yield attributes, herbicide, irrigated groundnut

### Introduction

Groundnut (*Arachis hypogaea* L.) is referred to as the ‘king of oilseeds’. It is regarded as one of India's most significant oilseed and legume crops. Containing 45–50% oil, 27–33 percent protein, and vital minerals and vitamins, groundnuts are a great source of plant nutrition. It has a significant impact on the food needs of children and women who are resource deprived. The fourth-most significant source of edible oil. By 2022 A.D., the Indian Council of Medical Research (ICMR) suggested that each person consume 20–30 g of edible oil each day. It is the richest plant source of thiamine and is also rich in niacin, which is low in cereals (Patel and Zinzala, 2018) [9]. According to Ravikumar *et al.* (2020) [10], groundnut is the most important oilseed crop grown in India, mostly for human consumption and animal feed.

Although the domestic market's demand for vegetable oils and fats has been growing at a quick pace @ 6 percent annually, our domestic production has only been growing at a rate of roughly 2 percent annually. In worldwide, groundnut is grown in an area of 327 lakh ha with the production of 539 lakh tonnes and the average productivity of 1648 kg ha<sup>-1</sup> (FAOSTAT, 2021) [5]. Globally, India ranks first in area and production after china. It is cultivated in 54.2 lakh ha with the production of 101 lakh tonnes and the average productivity of 1863 kg ha<sup>-1</sup> (FAOSTAT, 2022) [5]. In India, Gujarat leads the country in groundnut production, accounting for 33% of the total, followed by Rajasthan (21%), Tamil Nadu (14%), and other states. One of the states that produces the most groundnuts is Tamil Nadu, with an area, productivity, and production of 3.40 lakh ha, 10.13 lakh tonnes, and 2980 kg ha<sup>-1</sup>, respectively (ANGRAU, 2021) [11]. In Kharif 2022-23, groundnut production was 83.69 lakh tonnes in an area of 45.53 lakh hectares.

### Materials and Methods

The field experiment study was conducted at Annamalai University, Annamalai Nagar in Chidambaram taluk of Cuddalore district.

The experiment field was geographically situated at 11.38° N latitude, 79.72° E longitude with an altitude of +5.71 meters above mean sea level. It is located at Cauvery delta agro-climate zone of Tamil Nadu. The maximum temperature during cropping period ranged from 28.20°C to 33.3 °C, with a mean of 31.4 °C and the minimum temperature ranged from 16.8 to 22.0 °C with a mean of 19.8 °C. The relative humidity ranged from 69 to 82 percent, while the average relative humidity was 75 percent. The total rainfall received during the cropping period was 161.9 mm in 9 rainy days. The available nitrogen, phosphorus, and potassium contents of the soil were all medium. Ten treatments, three replications, and a randomised block design were employed in the experiment. The following was the treatment schedule: T<sub>1</sub> - Unweeded Control, T<sub>2</sub> - Twice Hand weeding on 20 & 40 DAS, T<sub>3</sub> - Groundnut shell cover mulch 2000 kg ha<sup>-1</sup> followed by Hand weeding on 40 DAS, T<sub>4</sub> - Pre-emergence (Pendimethalin) 1.0 kg a.i. ha<sup>-1</sup> at 3 DAS followed by Post-emergence (Quizalofop ethyl) 100 g a.i. ha<sup>-1</sup> at 21 DAS, T<sub>5</sub> - Pre-emergence (Pendimethalin) 1.0 kg a.i. ha<sup>-1</sup> at 3 DAS followed by hand weeding on 40 DAS, T<sub>6</sub> - Groundnut shell cover mulch 2000 kg ha<sup>-1</sup> followed by Early Post-emergence (Sodium acifluorfen) 900 g a.i. ha<sup>-1</sup> on 15 DAS, T<sub>7</sub> - Early Post-emergence (Sodium acifluorfen) 900 g a.i. ha<sup>-1</sup> on 15 DAS followed by Hand weeding on 40 DAS.

## Results and Discussion

### Weed flora

The experimental site consists of about 12 weed species. The weed floras are grouped into grass, sedge and broad leaved weeds. Among the weed flora, *Cyanodon dactylon* and *Echinochloa colonum* were found in higher grass weed population. *Cyperus rotundus*, *Cyperus difformis* was the dominated sedge weed. *Digera arvensis* and *Trianthema portulacastrum* were the dominant weed under BLW. Similar results were also reported by (Babu *et al.*, 2014)<sup>[2]</sup>; (Sathyapriya *et al.*, 2013)<sup>[11]</sup>; (Nikhil reddy *et al.*, 2016)<sup>[8]</sup> and Kabita Mishra. (2020)<sup>[6]</sup>.

### Plant Height

Weed management practices marked significant variation on plant height are presented in Table 1. Highest height of plant (31.54, 48.65 and 59.84) were recorded under twice hand weeding at 20 and 40 DAS (T<sub>2</sub>) which on par with T<sub>4</sub> - Pre-emergence (Pendimethalin) 1.0 kg a.i. ha<sup>-1</sup> at 3 DAS followed by Post-emergence (Quizalofop ethyl) 100 g a.i. ha<sup>-1</sup> (29.87, 46.27 and 57.75). The next best treatment was T<sub>6</sub> - Groundnut shell cover mulch @ 2000 kg ha<sup>-1</sup> followed by Early Post-emergence (Sodium acifluorfen) 900 g a.i. ha<sup>-1</sup> on (26.47, 42.72 and 52.27) during 30, 60 and at harvest respectively. Unweeded control (T<sub>1</sub>) recorded the significantly least number of branches (12.37, 20.13 and 29.87) at 30, 60 and at harvest respectively.

When compared to an unweeded control, the use of herbicides and hand weeding greatly improved the growth components because there was less weed density and growth, which gave the groundnut plant plenty of room, light, and nutrients for root growth, nodulation, the ideal extension of leaves and branches, and the dry weight of crop as suggested by (Verma and Choudhary, 2020)<sup>[13]</sup>. Under unweeded control, significantly lower values of plant height were observed. These outcomes correspond to the findings of Timsina *et al.* (2019)<sup>[12]</sup>.

### Leaf Area Index

Throughout the crop growth phase, the treatments had a

considerable impact on the groundnut's LAI. Of the several weed control methods that have been tested, twice hand weeding at 20 and 40 DAS (T<sub>2</sub>) registered maximum LAI of 4.13, 5.43 and 3.89, respectively and which were on par with T<sub>4</sub> - Pre-emergence (Pendimethalin) 1.0 kg a.i. ha<sup>-1</sup> at 3 DAS followed by Post-emergence (Quizalofop ethyl) 100 g a.i. ha<sup>-1</sup> at 21 DAS (3.98, 5.16 and 3.76) significantly superior over all other treatments presented in Table 1. This was followed by T<sub>6</sub> - Groundnut shell cover mulch @ 2000 kg ha<sup>-1</sup> followed by Early Post-emergence (Sodium acifluorfen) 900 g a.i. ha<sup>-1</sup> on 15 DAS (3.49, 4.67 and 3.59) at 30, 60 and at harvest. The minimum leaf area index was recorded 1.16, 2.07 and 2.32 under T<sub>1</sub> - Unweeded control at 30, 60 and at harvest, respectively.

In comparison to unweeded control, timely and efficient weed control is predicted to improve crop plants availability of nutrients, moisture, and solar radiation. This will increase the total chlorophyll content, photosynthetic rate, and nitrate reductase activity, which will increase the supply of carbohydrates and improve growth attributes, (Channappagoudar *et al.*, 2008)<sup>[14]</sup>.

### Dry Matter Production

Twice hand weeding at 20 and 40 DAS (T<sub>2</sub>) recorded higher dry matter production of 2531.36, 4894.78 and 5972.57 kg ha<sup>-1</sup> at 30, 60 and at harvest, respectively which was statistically on par with T<sub>4</sub> - Pre-emergence (Pendimethalin) 1.0 kg a.i. ha<sup>-1</sup> at 3 DAS followed by Post-emergence (Quizalofop ethyl) 100 g a.i. ha<sup>-1</sup> at 21 DAS (2489.26, 4837.96 and 5894.83 kg ha<sup>-1</sup>). The next best was T<sub>6</sub> - Groundnut shell cover mulch @ 2000 kg ha<sup>-1</sup> followed by Early Post-emergence (Sodium acifluorfen) 900 g a.i. ha<sup>-1</sup> on 15 DAS (2397.84, 4754.84 and 5709.26 kg ha<sup>-1</sup>) at 30, 60 and at harvest. The unweeded control (T<sub>1</sub>) recorded the least Dry matter production of 2034.64, 4472.61 and 5052.61 at 30, 60 and harvest, respectively. The groundnut crop may have seen reduced weed competition, which might be the cause of the increased plant dry matter accumulation. Due to intense crop weed competition, as indicated by Table 1. Groundnut dry matter output was reduced under unweeded management.

### Pod yield

Significantly higher pod yield was recorded under hand weeding. Whereas, unweeded control recorded the lower pod yield in groundnut presented in Table 1. The higher pod yield (2410 kg ha<sup>-1</sup>) was recorded under the treatment T<sub>2</sub> - Twice hand weeding at 20 and 40 DAS and it was on par with treatment T<sub>4</sub> - Pre-emergence (Pendimethalin) 1.0 kg a.i. ha<sup>-1</sup> at 3 DAS followed by Post-emergence (Quizalofop ethyl) 100 g a.i. ha<sup>-1</sup> at 21 DAS (2352 kg ha<sup>-1</sup>). These two treatments were superior over rest of the other treatments. The next best was T<sub>6</sub> - Groundnut shell cover mulch @ 2000 kg ha<sup>-1</sup> followed by Early Post-emergence (Sodium acifluorfen) 900 g a.i. ha<sup>-1</sup> on 15 DAS (2154 kg ha<sup>-1</sup>). The lower pod yield (1012 kg ha<sup>-1</sup>) was obtained under unweeded control (T<sub>1</sub>).

The reason for this might be that hand weeding promotes soil pulverisation, improved nodulation, root proliferation, and more pod forms, all of which increase pod production as reported by (Bhale *et al.*, 2012)<sup>[3]</sup>. Applying herbicides early in crop growth minimises the number of weeds, allowing for improved crop growth and peg initiation and development during important groundnut growth phases, which has a synergistic effect on production qualities reported by (Mulik *et al.*, 2010)<sup>[7]</sup> and (Wani *et al.*, 2010)<sup>[14]</sup>. Unweeded control recorded the lower pod and haulm yield.

**Table 1:** Effect of weed management practices on yield and economics of irrigated groundnut.

Treatments	Plant height (cm) (60 DAS)	Leaf area index (60 DAS)	Dry matter production (kg ha <sup>-1</sup> ) (60 DAS)	Pod yield (kg ha <sup>-1</sup> )
T <sub>1</sub> - Unweeded Control	29.87	2.32	5052.61	1012
T <sub>2</sub> - Twice hand weeding on 20 & 40 DAS	59.84	3.89	5972.57	2410
T <sub>3</sub> - Groundnut shell cover mulch 2000 kg ha <sup>-1</sup> followed by hand weeding on 40 DAS	47.57	3.34	5586.71	1959
T <sub>4</sub> - Pre-emergence (Pendimethalin) 1.0 kg a.i. ha <sup>-1</sup> at 3 DAS followed by Post-emergence (Quizalofop ethyl) 100 g a.i. ha <sup>-1</sup> at 15 DAS	57.75	3.76	5894.83	2352
T <sub>5</sub> - Pre-emergence (Pendimethalin) 1.0 kg a.i. ha <sup>-1</sup> at 3 DAS followed by hand weeding on 40 DAS	42.37	3.14	5460.49	1641
T <sub>6</sub> - Groundnut shell cover mulch 2000 kg ha <sup>-1</sup> followed by Early Post-emergence (Sodium acifluorfen) 900 g a.i. ha <sup>-1</sup> on 15 DAS	52.27	3.59	5709.26	2154
T <sub>7</sub> - Early Post-emergence (Sodium acifluorfen) 900 g a.i. ha <sup>-1</sup> on 15 DAS followed by hand weeding on 40 DAS	35.74	2.92	5340.38	1296
SEm±	1.45	0.08	37.86	43.07
CD (p=0.05)	4.37	0.26	113.6	129.21

### Conclusion

Based on the aforementioned findings, it was determined that the most practicable and efficient weed management strategy for groundnut was twice hand weeding and pre-emergence (Pendimethalin) at 1.0 kg a.i. ha<sup>-1</sup> at 3 DAS and post-emergence (Quizalofop ethyl) at 100 g a.i. ha<sup>-1</sup> at 21 DAS.

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