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**RESEARCH NOTE**

# Impact of integration of inter-cultivation, herbicides and manual weeding in winter groundnut yield

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**ABSTRACT**

A field experiment was conducted in sandy loam soils at College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Hyderabad, during winter *(Rabi)* season 2020-21. The objective was to study the effect of integration of inter-cultivation with pre- and post-emergence application of herbicides and manual weeding on weeds growth and yield of groundnut. A randomized block design, replicated thrice was used with ten treatments. The broad-spectrum weed control, lower weed biomass, higher weed control efficiency, higher groundnut pod and haulm yield were obtained with inter-cultivation followed by (*fb*) hand weeding at 20 and 40 days after sowing (DAS). The herbicides based integration revealed the greater weed management efficacy of pre-emergence application (PE) of diclosulam at 26 g/ha *fb* inter-cultivation at 20 DAS. The next best options for higher WCE and pod yield were imazethapyr + pendimethalin (ready-mix) at 960 g/ha PE *fb* inter-cultivation at 20 DAS and sodium acifluorfen + clodinofop- propargyl 250 g/ha *fb* inter-cultivation at 40 DAS.

**Keywords:** Diclosulam, Groundnut, Iimazethapyr + pendimethalin (ready-mix), Inter-cultivation, Sodium acifluorfen + clodinofop- propargyl (ready-mix) and Weed control efficiency

Groundnut (*Arachis hypogaea* L.) is an important oilseed and cash crop in India. Groundnut is often included in crop rotation as it fixes atmospheric nitrogen being a leguminous crop. Groundnut contributes 67% of total edible oil produced in India. The demand for edible oils is rising at about 6 per cent per year. Therefore, concerted efforts are now being made to stabilize and increase oilseed production. In Telangana, state of India, it is grown in an area of 0.99 lakh hectares with an annual production of 0.23 million tons and average productivity of 2.35 kg/ha (www.indiastat .com 2019-20). India ranks first in the world in groundnut cultivated area but imports 8.3 million tons of edible oil to meet its requirement. The major problems limiting production of groundnut are poor cultural practices as well as inadequate weed management (Naim *et al.* 2010). The weed problem gets more severe due to certain unforeseen factors such as inefficient and untimely weeding or interculture and continuous rains during the early crop growth period, coupled with the non-availability of labour for weeding in time (Mishra *et al.* 2016). Depending upon nature, the density of weeds, and severity of competition, losses in groundnut yield ranged from 13- 80% (Rao and Chauhan 2015). Besides competing for nutrients, soil moisture, sunlight, weeds inhibit pegging, pod development in groundnut and interfere with harvest. In groundnut, less crop canopy during the first 6 weeks of growth favours strong competition with weeds causing significant reduction in yield (Shanwad *et al.* 2011). Minimizing the crop weed competition particularly at the early stages of the growth, the yield could be improved by 20-30%. To overcome the deleterious effects of weeds in groundnut, it is imperative that weeds population be kept below the economic threshold level. For this purpose, several pre-emergence and pre-plant incorporated herbicides have been recommended to control the weeds in groundnut crop (Regar *et al.* 2021). In groundnut, herbicide use followed by inter-cultivation has been found to be easier; less time consuming and more cost effective and efficient in reducing weed menace (Patel *et al.* 2020) compared to hand weeding alone (Kumar 2009).

A field experiment was carried out at College Farm, College of Agriculture, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Rajendranagar, Hyderabad, Telangana State during winter *(Rabi)* season of 2020-2021. The objective of

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the study was to quantify the effect of integration of inter-cultivation with pre- and post-emergence application of herbicides and manual weeding on weeds growth and yield of groundnut. 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. A randomized block design with three replications was used with 10 treatments, which include: diclosulam 26 g/ha pre-emergence application (PE) followed by (*fb*) inter-cultivation at 20 days after seeding (DAS), imazethapyr 2% EC + pendimethalin 30% EC (ready-mix) 960 g/ha PE and *fb* inter-cultivation at 20 DAS; pyroxasulfone 127.5 g/ha PE *fb* inter-cultivation at 20 DAS, propaquizofop 2.5% + imazethapyr 3.75% w/w ME (ready-mix) 125 g/ha post-emergence application (PoE) *fb* inter-cultivation at 40 DAS; imazethapyr 35% + imazomox 35% WG (ready-mix) 70 g/ha PoE *fb* inter-cultivation at 40 DAS; sodium acifluorfen 16.5% EC + clodinafop-propargyl 8% EC (ready-mix) 250 g/ha post-emergence application (PoE) *fb* inter-cultivation at 40 DAS; imazethapyr 100 g/ha PoE *fb* inter-cultivation at 40 DAS; inter-cultivation (20 and 40 DAS); inter-cultivation *fb* hand weeding (20 and 40 DAS) (weed-free) and unweeded control. Groundnut crop (variety *Kadiri-9*) was sown on 8$^{th}$ October 2020 at spacing of 30 x 10 cm using a seed rate of 300 kg/ha. Herbicides were applied using a Knap sack sprayer fitted with flat fan nozzle calibrated to deliver 500 litres of water per hectare. Inter-cultivation was done with power weeder and pre-emergence herbicides application was done at 2 DAS and post-emergence herbicides application was done at 20 DAS. Cultural practices recommended by PJTSAU for groundnut were adopted during the crop growth period. The crop was fertilized with recommended dose of fertilizers with 20 kg N, 40 kg P and 50 kg K/ha using urea, single super phosphate and muriate of potash, respectively as basal. Top dressing of 10 kg N was applied in form of urea at 25 DAS. Weed density and dry weight (biomass) were recorded on 40 DAS and transformed to square root transformation ($\sqrt{x+0.5}$) to normalize their distribution. The groundnut yield and yield attributes were recorded at its harvest on 12$^{th}$ February 2021, following standard procedured.

**Weed flora**

The weed flora of the experimental field was dominated by grasses: *Dactyloctenium aegyptium* and *Digitaria sanguinalis*; broad-leaved weeds: *Commelina benghalensis, Phyllanthus niruri, Cleome viscosa, Boerhavia diffusa, Brachiaria reptans, Euphorbia hirta, Digera arvensis, Celosia argentea, Physalis minima, Amaranthus viridis, Datura stramonium, Parthenium hysterophorus* and a sedge *Cyperus rotundus.*

**Weed density and biomass**

The lowest total weed density and biomass was recorded with inter-cultivation *fb* hand weeding twice at 20 and 40 DAS which was comparable with diclosulam at 26 g/ha PE *fb* inter-cultivation at 20 DAS (**Table 1**). Diclosulam 26 g/ha PE was found to be very effective in controlling all the categories of weeds including the predominant perennial sedge, *Cyperus rotundus* and broad-leaved weeds in groundnut.

**Weed control efficiency**

Maximum weed control efficiency was recorded with inter-cultivation *fb* hand weeding twice at 20 and 40 DAS followed by diclosulam at 26 g/ha PE *fb* inter-cultivation at 20 DAS and imazethapyr + pendimethalin at 960 g/ha PE *fb* inter-cultivation at 20 DAS. The initial flush of weeds was controlled by

**Table 1. Weed density, weed biomass, weed control efficiency (WCE), pod and haulm yield of groundnut as influenced by different weed management treatments**

| Treatment | Weed density (no./m$^2$) | Weed biomass (g/m$^2$) | WCE (%) | Pod yield (t/ha) | Haulm yield (t/ha) |
|---|---|---|---|---|---|
| Diclosulam 26 g/ha PE *fb* inter-cultivation at 20 DAS | 3.87(14.0) | 2.31(4.3) | 88.99 | 2.64 | 3.17 |
| Imazethapyr + pendimethalin 960 g/ha PE *fb* inter-cultivation at 20 DAS | 4.08(15.7) | 3.01(8.0) | 79.49 | 2.61 | 3.13 |
| Pyroxasulfone127.5 g/ha PE *fb* inter-cultivation at 20 DAS | 4.25(17.0) | 3.17(9.1) | 76.90 | 2.07 | 2.54 |
| Propaquizofop + imazethapyr 125 g/ha PoE *fb* intercultivation at 40 DAS | 4.32(17.7) | 3.05(8.3) | 78.81 | 2.16 | 2.95 |
| Imazethapyr + imazomox 70 g/ha PoE *fb* inter-cultivation at 40 DAS | 4.51(19.3) | 3.06(8.4) | 78.90 | 2.00 | 2.94 |
| Sodium-acifluorfen + clodinafop-propargyl 250 g/ha PoE *fb* inter-cultivation at 40 DAS | 4.58(20.0) | 2.80(6.8) | 82.55 | 2.45 | 3.02 |
| Imazethapyr 100 g/ha PoE *fb* inter-cultivation at 40 DAS | 5.42(28.3) | 3.07(8.4) | 78.47 | 1.93 | 2.63 |
| Inter-cultivation twice at 20 and 40 DAS | 4.80(22.0) | 3.18(9.1) | 76.75 | 2.39 | 2.99 |
| Intercultivation*fb* hand weeding twice 20 and 40 DAS (weed free) | 3.74(13.0) | 1.97(2.9) | 92.92 | 2.74 | 3.25 |
| Unweeded control | 7.85(60.7) | 6.34(39.2) | - | 1.46 | 1.90 |
| LSD (p=0.05) | 0.37 | 0.49 | - | 0.27 | 0.20 |

PE: Pre-emergence; PoE: Post-emergence; *fb*: followed by; DAS: days after seeding

**Table 2. Economics of groundnut as influenced by different weed management treatments**

| Treatment | Cost of cultivation (x10$^3$ `/ha) | Gross returns (x10$^3$ `/ha) | Net returns (x10$^3$ `/ha) | Benefit -cost ratio |
|---|---|---|---|---|
| Diclosulam 26 g/ha PE *fb* intercultivation at 20 DAS | 52.04 | 139.25 | 87.21 | 1.68 |
| Imazethapyr + pendimethalin 960 g/ha PE *fb* intercultivation at 20 DAS | 53.00 | 137.70 | 84.70 | 1.60 |
| Pyroxasulfone 127.5 g/ha PE *fb* intercultivation at 20 DAS | 55.99 | 109.23 | 53.24 | 0.95 |
| Propaquizafop + imazethapyr 125 g/ha early PoE *fb* intercultivation at 40 DAS | 52.34 | 113.98 | 61.64 | 1.18 |
| Imazethapyr + imazamox 70 g/ha Early PoE *fb* intercultivation at 40 DAS | 52.24 | 105.30 | 53.06 | 1.02 |
| Sodium acifluorfen + clodinafop-propargyl 250 g/ha PoE *fb* intercultivation at 40 DAS | 51.76 | 129.18 | 77.42 | 1.50 |
| Imazethapyr 100 g/ha PoE *fb* intercultivation at 40 DAS | 52.32 | 101.62 | 49.30 | 0.94 |
| Intercultivation ( 20 and 40 DAS) | 55.24 | 125.99 | 70.75 | 1.28 |
| Intercultivation *fb* hand weeding (20 and 40 DAS) (weed free) | 60.04 | 144.69 | 84.65 | 1.41 |
| Unweeded control | 46.44 | 77.02 | 30.58 | 0.66 |
| LSD (p=0.05) | - | 14.23 | 14.24 | - |

applied herbicides and the later flush by the inter-cultivation resulting in higher WCE which reduced the crop weed competition.

## Yield

Higher pod yield (2.74 t/ha) and haulm yield (3.25 t/ha) of groundnut was obtained with inter-cultivation *fb* hand weeding at 20 and 40 DAS, which was closely followed by pre-emergence application of diclosulam 26 g/ha *fb* inter-cultivation at 20 DAS (**Table 1**). Application of diclosulam as pre-emergence controlled all the categories of weeds, which in turn increased the yield components and yield of groundnut. The diclosulam was reported to be effective in managing weeds in groundnut, alone (Grey *et al.* 2001) and in combination with hand weeding (Kumar *et al.* 2019). The identified effective treatments will be useful to farmers for effectively managing weeds and improve productivity of groundnut in Southern-Telangana region of Telangana State.

## Economics

Cost of cultivation and gross returns were highest with the inter-cultivation followed by hand weeding at 20 and 40 DAS whereas net returns and benefit cost ratio were highest with the diclosulam at 26 g/ha *fb* intercultivation at 20 DAS. This was due to high yield and the less cost of cultivation compared to all other treatments (**Table 2**).

## Conclusion

Monetary returns play a major role for adopting the any refined agri-techniques. In this study, pre-emergence application of diclosulam at 26 g/ha *fb* inter-cultivation at 20 DAS proved practically more convenient and economically best feasible integrated weed management practice for groundnut as it recorded the highest yield and net returns comparable with other treatments. If inter-cultivation is not possible, post-emergence application of sodium acifluorfen + clodinafop propargylat 250 g/ha could be an alternative method for managing the weeds effectively and improving the productivity of winter groundnut considering the present scarcity and high cost of labor.

## REFERENCES

Grey TL, Bridges DC and Eastin EF. 2001. Influence of application rate and timing of diclosulam on weed control in peanut (*Arachis hypogaea* L.). *Peanut Science* **28**: 13–19.

India Statistics 2019-20. (www.indiastat.com, 2019-20).

Kumar NS. 2009. Effect of plant density and weed management practices on production potential of groundnut (*Arachis hypogaea* L.). *Indian Journal of Agricultural Research* **43**: 13–17.

Kumar NB, Subramanyam D, Nagavani AV and Umamahesh AV. 2019. Weed management in groundnut with new herbicide molecules. *Indian Journal of Weed Science* **51**(3): 306–307.

Mishra JS, Rao AN, Singh VP and Rakesh Kumar. 2016. Weed management in major field crops. pp. 1-20 in: *Advances in Weed Management* (Eds. Yaduraju NT *et al.*). Indian Society of Weed Science, Jabalpur, M.P., India

Naim AM, Eldoma MA and Abdalla AE. 2010. Effect of weeding frequencies and plant density on vegetative growth characteristic of groundnut (*Arachis hypogaea* L.) in North Kordofan of Sudan. *International Journal of Applied Biology and Pharmaceutical Technology* **1**: 1188–1193.

Patel BD, Chaudhari DD, Mor VB, Patel VJ and Patel HK. 2020. Effectiveness of herbicide mixture on weeds and yield of summer groundnut. *Indian Journal of Weed Science* **52**(3): 250–253

Rao AN and Chauhan BS. 2015. Weeds and weed management in India - A Review. pp. 87-118. In: *Weed Science in the Asian-Pacific Region*. Indian Society of Weed Science, Hyderabad.

Regar S, Singh SP, Shivran H, Bairwa RC and Khinch V.2021. Weed management in groundnut. *Indian Journal of Weed Science* **53**(1): 111–113

Shanwad UK, Agasimani CA, Aravindkumar BN, Shuvamurth SD, Surwenshi A and Jalageri BR. 2011. Integrated weed management (IWM): A long time case study in groundnut –wheat cropping system in Northern Karnataka. *Research Journal Agricultural Sciences* **1**: 196–200.