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# Weed Management Studies in Rice-Fallow Groundnut (*Arachis hypogaea* L.) Under Coastal Sandy Soils

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**ABSTRACT**

A field experiment was conducted during *rabi,* 2012-13 at the Agricultural College Farm, Bapatla to evaluate the weed management practices in rice-fallow groundnut. Among the treatments, pendimethalin @ 1.0 kg a.i. $ha^{-1}$ as pre-emergence followed by imazethapyr @ 63 g a.i. $ha^{-1}$ at 20 DAS and pendimethalin @ 1.0 kg a.i. $ha^{-1}$ pre-emergence followed by handweeding at 40 DAS significantly reduced weed growth and recorded increased plant height, dry weight, yield attributes and yield in these treatments and found to be equally effective as that of handweeding at 20 and 40 DAS. Though yield and gross returns was found to be highest with hand weeding, when net returns and BCR were considered application of pendimethalin followed by imazethapyr is the most profitable treatment.

**Key words :** Imazethapyr, Pendimethalin, Propaquizafop, Rice-fallow groundnut, Weed management.

Among the various oilseed crops, groundnut (*Arachis hypogaea* L.) is an important commercial crop. Cultivation of pulses (green gram and black gram) in rice-fallow is a common practice in coastal areas of Andhra Pradesh and Tamilnadu. Groundnut is one of the alternatives to these pulses in rice-fallows under coastal areas. Among the various production constraints of groundnut production in rice-fallows, weed infestation is considered to be serious, because of severe weed problem in upland crops after *kharif* rice. Besides their major competition for soil moisture, nutrients and light, weeds inhibit pegging. Groundnut has poor competitive ability against weeds due to slow emergence, slow establishment, short plant height and underground pod bearing habit of groundnut. The critical period of crop weed competition was up to 45 days after sowing. Yield loss in groundnut due to weed infestation accounted for 74-92 percent (Agostinho *et al.,* 2006). Weed management plays a promising role in boosting up the groundnut yields in rice-fallow situation. So there is a need to identify the effective and economical weed management practice in rice-fallow groundnut. The present study was therefore undertaken to evaluate different weed management practices to enhance growth and yield of rice-fallow groundnut.

## MATERIAL AND METHODS

A field experiment was carried out during *rabi*, 2012-13 at Agricultural College Farm, Bapatla. The experimental soil was sandy in texture, slightly acidic in reaction ($p^H$ 6.9), very low in available nitrogen (182.0 kg $ha^{-1}$), low in available phosphorus (21.0 kg $ha^{-1}$) and medium in available potassium (223.5 kg $ha^{-1}$) and organic carbon (0.4%). The experiment consisted of eight weed management treatments (Table 1) laid out in randomised block design and replicated thrice. The groundnut variety used was TAG 24, adopted a seed rate of 150 kg $ha^{-1}$. Harvesting of paddy was done on 23-01-2013. The sowing of groundnut was done on 24-01-2013 by dibbling with a spacing of 30 cm x10 cm. The plot was fertilized with N-P-K @ 30, 40, 50 kg $ha^{-1}$, respectively. The pre- emergence herbicide (pendimethalin) was applied on the day of sowing and the post emergence herbicides (imazethapyr and propaquizafop) were applied at 20 DAS by using knap-sack sprayer with a spray volume of 500 L $ha^{-1}$. The data on weed density and dry weight were subjected to square root (x + 0.5) transformation before statistical analysis to normalize their distribution (Panse and Sukhatme, 1978). Economics of different treatments were calculated taking into account the prevailing market pricing inputs and out puts.

Table 1. Weed Density (No. $m^{-2}$), Dry Weight (g $m^{-2}$) and Weed Control Efficiency (%) as affected by different weed management practices at harvest.

| Treatments | Weed density | | | | Dry weight | Dry weight |
|---|---|---|---|---|---|---|
| | Grasses | Sedges | BLW | Total | | |
| $T_1$-Handweeding at 20 and 40 DAS | 6.06 (36.67) | 3.43 (12.33) | 4.34 (18.67) | 8.20 (67.67) | 16.67 (281.70) | 16.67 (281.70) |
| $T_2$- Pendimethalin 30EC @ 1.0 kg a.i. $ha^{-1}$ as PRE | 10.88 (118.67) | 8.99 (81.00) | 5.79 (34.67) | 15.23 (234.33) | 26.27 (692.07) | 26.27 (692.07) |
| $T_3$- Imazethapyr 10EC @ 63 g a.i. $ha^{-1}$ as POST at 20 DAS. | 8.83 (78.66) | 3.89 (15.00) | 7.16 (52.00) | 12.04 (145.66) | 21.68 (476.00) | 21.68 (476.00) |
| $T_4$- Propaquizafop 10EC @ 63 g a.i. $ha^{-1}$ as POST at 20 DAS. | 7.14 (52.00) | 9.16 (84.00) | 9.80 (96.33) | 15.23 (232.33) | 26.93 (730.43) | 26.93 (730.43) |
| $T_5$-Pendimethalin as PRE fb handweeding at 40 DAS | 6.42 (41.44) | 4.14 (18.67) | 4.59 (20.67) | 8.93 (80.78) | 16.75 (284.47) | 16.75 (284.47) |
| $T_6$-Pendimethalin as PRE fb Imazethapyr @ 63 g a.i. $ha^{-1}$as POST at 20 DAS | 7.03 (49.33) | 3.09 (9.33) | 5.14 (26.67) | 9.20 (85.33) | 20.40 (420.01) | 20.40 (420.01) |
| $T_7$-Pendimethalin as PRE fb Propaquizafop @ 63 g a.i. $ha^{-1}$as POST at 20 DAS | 6.23 (39.00) | 9.13 (83.67) | 6.22 (39.00) | 12.68 (161.67) | 24.45 (604.59) | 24.45 (604.59) |
| $T_8$ -Weedy check | 11.77 (138.67) | 9.51 (90.67) | 9.95 (99.33) | 18.10 (328.67) | 31.17 (977.49) | 31.17 (977.49) |
| SEm ± | 0.67 | 0.58 | 0.66 | 0.81 | 1.43 | 1.43 |
| CD (p = 0.05) | 2.02 | 1.77 | 2.00 | 2.46 | 4.35 | 4.35 |

Note: Figures in the parentheses are original values; "X+0.5 transformation used for statistical analysis of weed density and arc sin transformation is used for WCE.

## RESULTS AND DISCUSSION

**Effect on weeds:**

The dominant weed species which infested the experimental plot were *Cynodon dactylon* (L.) Pers., *Cyperus rotundus* L., *Alternanthera triandra, Eclipta alba* (L.) Hassk., *Trianthema portulacastrum* L. and *Paspalum notatum* L..

Among the herbicide treatments, the lowest density of grasses was recorded with the treatment pendimethalin fb propaquizafop ($T_7$) which was on a par with pendimethalin fb hand weeding ($T_5$), pendimethalin fb imazethapyr ($T_6$) and propaquizafop ($T_4$) treatments. All these treatments were comparable with hand weeding at 20 and 40 DAS (Table 1). This might be due to effective control of grasses with imazethapyr and propquizafop in $T_6$, $T_7$ and with hand weeding at 40 DAS in $T_1$ and $T_5$ treatments. The minimum density of sedges was recorded with pendimethalin fb imazethapyr ($T_6$) and it was on a par with hand weeding at 20 and 40 DAS ($T_1$), alone application of imazethapyr ($T_3$) and pendimethalin fb hand weeding ($T_5$) treatments. This might be due to superiority of imazethapyr in controlling sedges in $T_3$, $T_6$ and hand weeding in $T_1$ and $T_5$ treatments. Density of broad leaved weeds reduced significantly by all weed control treatments compared to weedy check except propaquizafop applied alone ($T_4$). The minimum density of broad leaved weeds was recorded with hand weeding at 20 and 40 DAS ($T_1$) which was on a par with $T_2$, $T_5$, $T_6$ and$T_7$ treatments. The lowest total density of weeds (67.67 $m^{-2}$) was recorded with $T_1$ treatment which was on par with pendimethalin fb imazethapyr ($T_6$) and pendimethalin fb hand weeding ($T_5$) treatments. The reduced weed density in these treatments might be due to initial control of

Table 2. Growth, yield attributes and yield of rice-fallow groundnut as influenced by different weed management practices.

| Treatments | Plant height (cm) | Dry weight (g $m^{-2}$) | Pods $Plant^{-1}$ | Kernels $Pod^{-1}$ | 100 seed weight (g) | Podyield (kg $ha^{-1}$) | Haulm yield (kg $ha^{-1}$) |
|---|---|---|---|---|---|---|---|
| $T_1$-Handweeding at 20 and 40 DAS | 29.3 | 421.0 | 7.1 | 2.1 | 38.9 | 2261 | 2453 |
| $T_2$- Pendimethalin 30EC @ 1.0 kg a.i. $ha^{-1}$ as PRE | 22.7 | 284.0 | 5.4 | 1.8 | 28.3 | 1494 | 1635 |
| $T_3$- Imazethapyr 10EC @ 63 g a.i. $ha^{-1}$ as POST at 20 DAS. | 22.8 | 322.7 | 5.8 | 1.9 | 31.2 | 1736 | 1957 |
| $T_4$- Propaquizafop 10EC @ 63 g a.i. $ha^{-1}$ as POST at 20 DAS. | 23.6 | 278.3 | 5.7 | 1.8 | 30.0 | 1226 | 1482 |
| $T_5$-Pendimethalin as PRE fb handweeding at 40 DAS | 25.7 | 374.3 | 6.7 | 1.9 | 34.7 | 2086 | 2097 |
| $T_6$-Pendimethalin as PRE fb Imazethapyr @ 63 g a.i. $ha^{-1}$as POST at 20 DAS | 26.3 | 403.3 | 6.8 | 2.0 | 38.4 | 2149 | 2376 |
| $T_7$-Pendimethalin as PRE fb Propaquizafop @ 63 g a.i. $ha^{-1}$as POST at 20 DAS | 28.3 | 356.3 | 6.6 | 2.0 | 35.5 | 1833 | 2193 |
| $T_8$ -Weedy check | 18.8 | 227.0 | 4.9 | 1.6 | 27.8 | 1099 | 1368 |
| SEm ± | 1.3 | 25.3 | 0.4 | 0.07 | 0.8 | 96.6 | 145.5 |
| CD (p = 0.05) | 4.0 | 76.7 | 1.2 | 0.22 | 2.5 | 293.0 | 441.5 |

weeds by pendimethalin and at later stages by hand weeding ($T_1$ and $T_5$) or sequential application of herbicide ($T_6$).

At harvest, dry weight of weeds was significantly reduced by all treatments over control. The maximum dry weight was recorded with weedy check and the minimum with the handweeding at 20 and 40 DAS. Treatment involving handweeding at 20 and 40 DAS ($T_1$) was on a par with pendimethalin fb hand weeding at 40 DAS ($T_5$) and pendimethalin fb imazethapyr ($T_6$). Weedy check ($T_8$) was on a par with post-emergence application propaquizafop at 20 DAS ($T_4$), this might be due to inferiority of propaquizafop in controlling sedges and broadleaved weeds.

From the data (Table 1) it is evident that the higher weed control efficiency (87.1 %) was recorded with the treatment where hand weeding was done at 20 and 40 DAS which was on a par with pendimethalin followed by hand weeding at 40 DAS ($T_5$) and pendimethalin followed by imazethapyr ($T_6$) treatments. These results were akin to those reported by Sailaja *et al.* (2002) and Chandrika (2004). Imazethapyr applied alone ($T_3$) was on a par with pendimethalin followed by imazethapyr ($T_6$). Higher weed control efficiency in these treatments might be due to lower dry weight of weeds.

**Effect on crop:**

All the weed control treatments recorded significantly higher growth, yield attributes and yield compared to the weedy check. Among all the treatments, handweeding at 20 and 40 DAS ($T_1$) recorded maximum crop dry weight, number of pods per plant, number of kernels per pod and pod yield. Pendimethalin fb imazethapyr ($T_6$), pendimethalin fb propaquizafop ($T_7$) and pendimethalin fb handweeding at 40 DAS ($T_5$) were on a par with hand weeding twice. Pendimethalin fb imazethapyr ($T_6$) recorded higher 100 kernel weight next to handweeding at 20 and 40 DAS and was superior to all other treatments. Significantly higher pod yield (2149 kg $ha^{-1}$) was recorded with pendimethalin fb imazethapry ($T_6$) and pendimethalin fb hand weeding at 40 DAS ($T_5$) and these two treatments

Table 3. Economics of different weed management practices in rice-fallow groundnut.

| Treatments | Cost of cultivation (Rs ha$^{-1}$) | Gross returns (Rs ha$^{-1}$) | Net returns (Rs ha$^{-1}$) | BCR |
|---|---|---|---|---|
| $T_1$-Handweeding at 20 and 40 DAS | 45991 | 104689 | 58698 | 1.28 |
| $T_2$- Pendimethalin 30EC @ 1.0 kg a.i. ha$^{-1}$ as PRE | 36201 | 69192 | 32991 | 0.91 |
| $T_3$- Imazethapyr 10EC @ 63 g a.i. ha$^{-1}$ as POST at 20 DAS. | 36015 | 80484 | 44469 | 1.23 |
| $T_4$- Propaquizafop 10EC @ 63 g a.i. ha$^{-1}$ as POST at 20 DAS. | 35989 | 56939 | 20950 | 0.58 |
| $T_5$-Pendimethalin as PRE fb handweeding at 40 DAS | 42081 | 96372 | 54291 | 1.29 |
| $T_6$-Pendimethalin as PRE fb Imazethapyr @ 63 g a.i. ha$^{-1}$ as POST at 20 DAS | 37985 | 99571 | 61586 | 1.62 |
| $T_7$-Pendimethalin as PRE fb Propaquizafop @ 63 g a.i. ha$^{-1}$ as POST at 20 DAS | 37859 | 85101 | 47242 | 1.25 |
| $T_8$ -Weedy check | 34231 | 51096 | 16865 | 0.49 |

| Input costs | | | Out put price | | |
|---|---|---|---|---|---|
| Seed | : | Rs. 100.00 /- kg | Pods | : | Rs.45.00 /- kg |
| Urea | : | Rs. 5.62/- kg | Haulm | : | Rs.1.2 /- kg |
| SSP | : | Rs. 17.64 /- kg | | | |
| MOP | : | Rs. 7.8/- kg | | | |
| Pendimethalin | : | Rs. 400 /- L | | | |
| Propaquizafop | : | Rs. 1600/- L | | | |

Imazethapyr Labour cost : Rs. 1800 /- LRs. 147 per day per women

were comparable with $T_1$. The per cent increase in pod yield with $T_6$, $T_5$, $T_7$, $T_3$, $T_2$ and $T_4$ were 48.9, 47.4, 40.0, 36.7, 26.4 and 17.7 respectively, over the weedy check. Improvement in growth parameters obviously increases the yield attributes which in turn increased pod yield. Higher haulm yield and shelling per cent was recorded with hand weeding at 20 and 40 DAS which was on a par with $T_6$, $T_7$ and $T_5$ treatments. A yield reduction of 51.6 per cent was recorded with the weedy check. Similar findings were stated by Srinivasa Rao *et al*. (2011).

**Economics**

The maximum net returns (Rs. 61,586 /- ha$^{-1}$) was recorded with pendimethalin fb imazethapyr @ 63 g a.i. ha$^{-1}$ at 20 DAS ($T_6$) followed by handweeding at 20 and 40 DAS and application of pendimethalin fb hand weeding at 40 DAS ($T_5$), this might be due to higher pod yield recorded with these treatments. These results were in agreement with the findings of Srinivasa Rao *et al*. (2011). Despite the highest pod yield and gross returns, the net returns and benefit cost ratio worked out was lower (1.28) with hand weeding at 20 and 40 DAS ($T_1$). This might be due to higher labour wages involved in performing hand weeding twice. The higher benefit cost ratio with $T_6$ treatment might be due to higher pod yield coupled with lower cost of chemical control.

From the above study it is evident that, Pendimethalin @ 1.0 kg a.i. ha$^{-1}$ as pre-emergence fb imazethapyr @ 63 g a.i. ha$^{-1}$ at 20 DAS and pendimethalin @ 1.0 kg a.i. ha$^{-1}$ fb handweeding at 40 DAS were effective in managing weed in rice-fallow groundnut and found most profitable compared to other treatments.

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