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# Integrated weed management in rainfed groundnut (*Arachis hypogaea*)

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## ABSTRACT

An experiment was conducted during the rainy season of 1996, 1997 and 1998 under rainfed conditions on integrated weed management in groundnut (*Arachis hypogaea* L.) in Alfisols of Triupati. Pre-emergence application of pendimethalin, metolachlor, oxadiazon either at higher or at lower concentration + hand-weeding at 30 days after sowing effectively controlled the weed population and reduced the weed density compared with the unweeded control. Among the herbicides tried, pendimethalin 0.75 kg al/ha applied at pre-emergence + 1 hand-weeding at 30 days after sowing had a pronounced effect on control of weeds, reduced the weed dry matter and led to higher yield attributes, pod yield, weed-control efficiency, lower benefit : cost ratio and higher and weed index and all these parameters were comparable to that of hand-weeding twice at 20 and 40 days after sowing

***Key words :*** Groundnut, Weed growth, Herbicide, Weed management, Yield

Groundnut is grown during monsoon season when the competition by weeds is quite severe. The first 3 to 4 weeks of crop-growth period are critical for weed control in groundnut (Kalaisevan *et al.*, 1991) and uncontrolled weeds reduce groundnut yield up to 76% (Gnanamurthy and Balasubramaniyan, 1998).

Chemical control of weeds forms an excellent alternative to manual weeding. However, pre-emergence application of herbicides may allow the emergence of weeds after some time. Hence the concept of integrated weed management by combining physical methods with herbicides is gaining importance. The present study was, therefore, initiated to find out an effective and economical integrated weed-control method in groundnut under rainfed conditions.

## MATERIALS AND METHODS

A field experiment was conducted in Alfisols during the rainy season of 1996, 1997 and 1998 at Regional Agricultural Research Station, Triupati, under rainfed

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conditions. The soil of the experimental site was red sandy loam, neutral in reaction (pH 7.4), low in available nitrogen (270.0 kg/ha), medium in available phosphorus (36.4 kg $P_2O_5$/ha) and potassium (194.9 kg $K_2O$/ha). The experiment had 8 treatments including pre-emergence application of herbicides, viz. pendimethalin, metolachlor and oxadiazon, in combination with hand-weeding compared with weed-free (2 hand-weedings, i.e. local practice) and unweeded check (Table 1). The experiment was laid out in randomized block design and replicated thrice. The groundnut variety 'TPT 1' was sown at 30 cm × 10 cm apart during first fortnight of July in each year by taking the advantage of monsoon rains. A basal dose of 20 kg N, 50 kg $P_2O_5$ and 40 kg $K_2O$/ha was applied through urea, single superphosphate and muriate of potash respectively. Gypsum @ 500 kg/ha was applied to the crop at 30–35 days after sowing. All the other package of practices were followed to raise good crops. Weed samples were collected from 1 $m^2$ quadrate at 30 days after sowing and at harvest for weed density and weed-dry matter. The weed index (WI) and weed-control efficiency (WCE) were computed as per Somani (1992).

A rainfall of 513.8 mm, 228.8 mm, 486.7 mm was received in 26,17 and 23 rainy days during the crop-growth period of 1996, 1997 and 1998 respectively. There were practically no dry spells in 1996 and 1998 during crop-growth period, adequate soil moisture was stored in the deeper layers for success of the crop production. However, in 1997, there was a severe drought during flowering, pegging and pod-formation stages and thus hampered the groundnut production.

## RESULTS AND DISCUSSION

### *Weed density*

The effect of weed-management practices on weed species were alike in all the 3 years. The predominant weed species observed were : *Sporobolus* spp., *Cyperus rotundus* L., *Chloris inflata* Link; syn. *barbata, Tragus biflorus* schult., and *Dactyloctenium aegyptium* (L.) Willd. among monocots; and *Digera* muricata (L.) Mart; *Borreria* articularis (L.f.) F.N. Williams, *Tridax procumbens Vernonia* spp., *Phyllanthus niruri, Cleome isocandra* L., *Euphorbia hirta* L. and *Achyranthes aspera* L. among the dicot weeds.

A marked reduction in weed density was observed by herbicides compared to unweeded control (Table 1). Increasing the concentration of all the herbicides resulted in increased weed control, however, lower concentration of herbicides, followed by 1 hand-weeding at 30 days had more effect on weeds and the effect of all these herbicide treatments were comparable with that of hand-weeding twice at 20 and 40 days compared to unweeded check. Among the herbicides, pendimethalin at 0.75 kg a.i/ha coupled with 1 hand-weeding at 30 days showed its superiority by recording lower density of weeds compared with the other herbicides. The excellent performance of pendimethalin can be attributed to the better control of broad-leaf weeds which constituted more than 70% of the total weed flora. Brar and Mehra (1989) also stated a very good control of weeds with the pendimethalin in groundnut. Although,

**Table 1.** Effect of weed control on total weed counts/m$^2$ and total weed dry weight (g/m$^2$) in groundnut

| Treatment | Total weeds | | | | | | Total weed dry weight (g/m$^2$) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | | 1997 | | 1998 | | 1996 | | 1997 | | 1998 | |
| | 30 days* | Harvest | 30 days* | Harvest | 30 days* | Harvest | 30 days* | Harvest | 30 days* | Harvest | 30 days* | Harvest |
| $T_1$, Control (no weeding) | 195.0 | 274.0 | 97.6 | 186.4 | 265.0 | 410.1 | 186.4 | 518.4 | 110.4 | 214.5 | 204.5 | 568.4 |
| $T_2$, Hand-weeding at 20 and 40 days* | 18.2 | 30.9 | 12.0 | 20.0 | 27.4 | 34.6 | 4.5 | 19.2 | 2.8 | 7.2 | 8.4 | 34.2 |
| $T_3$, Pendimethalin 1 kg a.i./ha | 18.4 | 29.2 | 6.0 | 18.2 | 26.1 | 33.4 | 5.2 | 36.0 | 2.1 | 8.4 | 20.4 | 26.8 |
| $T_4$, Metolachlor 1.5 kg a.i./ha | 23.6 | 57.4 | 9.4 | 20.9 | 64.5 | 82.5 | 6.9 | 43.5 | 3.4 | 11.9 | 36.2 | 51.0 |
| $T_5$, Oxadiazon 2 kg a.i./ha | 29.3 | 44.8 | 18.0 | 24.1 | 79.4 | 110.0 | 8.3 | 48.2 | 3.3 | 22.8 | 39.4 | 68.5 |
| $T_6$, Pendimethalin 0.75 kg a.i./ha + hand-weeding at 30 days* | 20.0 | 28.4 | 10.0 | 15.4 | 38.0 | 42.0 | 7.1 | 26.8 | 3.1 | 5.8 | 17.2 | 24.0 |
| $T_7$, Metolachlor 1 kg a.i./ha + hand-weeding at 30 days* | 36.5 | 49.2 | 13.4 | 17.4 | 69.4 | 79.5 | 9.5 | 38.9 | 3.6 | 6.4 | 29.5 | 38.0 |
| $T_8$, Oxadiazon 1 kg a.i./ha + hand-weeding at 30 days* | 58.0 | 49.0 | 16.0 | 19.6 | 101.4 | 94.6 | 16.4 | 41.6 | 3.2 | 21.2 | 40.3 | 52.5 |

*Days after sowing

metolachlor and oxadiazon either at lower or at higher doses were superior to the unweeded control, their effectiveness could not match with pendimethalin which may be due to the escape of some weed species.

### *Weed dry matter*

The dry-matter accumulation by weeds was 2 times more in 1996 and 1998 than that in 1997, due to less receipt of rainfall and more dry spells in 1997 season, resulting in less accumulation of rainwater in the soil for longer period and thus restricted the weed growth.

At 30 days after sowing and harvest stages all the herbicide treatments were alike in respect of dry weight of weeds, but the reduction in weed dry weight due to pendimethalin was more pronounced. Pre-emergent pendimethalin supplemented with 1 hand-weeding at 30 days further reduced the weed dry matter and showed high weed-control efficiency. Nimju (1992) also reported superiority of herbicides coupled with 1 manual weeding to check the weed growth effectively. Pre-emergent metolachlor with and without manual weeding at 30 days was also found effective in reducing the weed dry matter. However, pre-emergence application of oxadiazon at higher or lower concentration caused some injury to groundnut crop in the early stages but the crop recovered within 2–3 weeks. However, the weed dry matter recorded with this herbicide treatments was markedly higher than that of unweeded check.

### *Pod yield*

Hand-weeding at 20 and 40 days after sowing or chemical weed control with and without the manual weeding recorded significantly more filled pods/plant, higher pod weight, kernel weight and shelling (%) compared with unweeded control (Table 2). Among the herbicides tried, pre-emergence application of pendimethalin at 0.75 kg a.i./ha coupled with 1 hand-weeding at 30 days after sowing had a pronounced effect on the yield attributes as compared with other herbicides. Rathi *et al.,* (1986) and Guggari *et al.* (1995) also reported similar and beneficial effect of pendimethalin in the control of weeds in groundnut crop.

Significantly higher pod yields were obtained with pre-emergent pendimethalin at 0.75 kg a.i./ha, followed by 1 hand-weeding at 30 days after sowing over unweeded control, the increase in pod yield being 69.4% (Table 3) This might be due to the combined action of pre-emergence application of pendimethalin which suppressed the initial weed growth and manual removal of weeds which emerged later. Further, the high yields with this treatment might also be due to efficiency utilization of the available resources of the crop otherwise utilized by the weeds. This was supported by the lower weed density and lower dry weight of weeds and higher yield-attributing characters under this treatment, resulting in higher pod yields. Further, the pod yields obtained with hand-weeding ($T_2$) and pre-emergent pendimethalin at 0.75 kg a.i./ha + hand-weeding at 30 days ($T_6$) were at par with some difference but were significantly superior to $T_8$, $T_5$ and $T_4$ treatments.

The weed-control efficiency was higher with hand-weeding twice at 20 and 40 days

**Table 2.** Effect of weed control on yield attributes of groundnut

| Treatment | Filled pods/plant | | | 100-pod weight (g) | | | 100-kernel weight (g) | | | Shelling (%) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1996 | 1997 | 1998 | 1996 | 1997 | 1998 | 1996 | 1997 | 1998 |
| $T_1$, Control (no weeding) | 6.2 | 4.1 | 2.3 | 61.4 | 57.3 | 56.9 | 26.4 | 26.1 | 27.6 | 65.2 | 62.1 | 66.7 |
| $T_2$, Hand-weeding at 20 and 40 days* | 16.1 | 8.9 | 15.0 | 69.9 | 66.4 | 68.8 | 33.5 | 31.8 | 32.5 | 74.4 | 73.1 | 75.7 |
| $T_3$, Pendimethalin 1 kg a.i./ha | 12.1 | 11.4 | 12.9 | 68.6 | 64.9 | 66.9 | 32.2 | 30.7 | 31.8 | 74.5 | 72.8 | 74.4 |
| $T_4$, Metolachlor 1.5 kg a.i./ha | 12.4 | 10.8 | 11.2 | 69.6 | 63.7 | 65.7 | 33.4 | 30.2 | 32.7 | 74.6 | 73.0 | 73.9 |
| $T_5$, Oxadiazon 2 kg a.i./ha | 14.2 | 10.8 | 12.6 | 63.0 | 64.0 | 64.4 | 29.9 | 31.0 | 30.0 | 72.9 | 71.0 | 72.1 |
| $T_6$, Pendimethalin 0.75 kg a.i./ha + hand-weedding at 30 days* | 14.8 | 13.9 | 14.9 | 68.9 | 67.1 | 69.8 | 32.4 | 33.2 | 32.4 | 74.1 | 74.8 | 76.4 |
| $T_7$, Metolachlor 1 kg a.i./ha + hand-weeding at 30 days* | 10.6 | 17.4 | 12.5 | 66.4 | 65.0 | 67.1 | 31.4 | 32.8 | 32.0 | 75.1 | 73.9 | 73.9 |
| $T_8$, Oxadiazon 1 kg a.i./ha + hand-weeding at 30 days* | 11.4 | 13.8 | 11.8 | 64.2 | 63.7 | 65.2 | 29.7 | 30.9 | 30.6 | 73.8 | 73.4 | 74.5 |
| CD (P = 0.05) | 3.07 | 3.59 | 3.14 | 1.39 | 1.27 | 1.54 | 1.38 | 1.80 | 2.27 | 0.94 | 2.25 | 2.03 |

*Day safter sowing

**Table 3.** Effect of weed control on pod yield (kg/ha), weed-control efficiency (WCE), weed index (WI) and benefit : cost ratio (BCR)

| Treatment | Pod yield (kg/ha) | | | | WCE (%) | WI (%) | BCR |
|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | Mean | | | |
| $T_1$, Control (no weeding) | 762 | 310 | 183 | 418 | | 69.44 | |
| $T_2$, Hand-weeding at 20 and 40 days* | 1,588 | 934 | 1,520 | 1,347 | 95.64 | 1.54 | 1.42 |
| $T_3$, Pendimethalin 1 kg a.i./ha | 1,432 | 816 | 1,360 | 1,203 | 94.40 | 12.86 | 1.24 |
| $T_4$, Metolachlor 1.5 kg a.i./ha | 1,419 | 821 | 1,116 | 1,119 | 92.36 | 18.20 | 1.12 |
| $T_5$, Oxadiazon at 2 kg a.i./ha | 1,018 | 743 | 1,279 | 1,013 | 89.35 | 25.95 | 1.04 |
| $T_6$, Pendimethalin 0.75 kg a.i./ha + hand-weeding at 30 days* | 1,585 | 941 | 1,578 | 1,368 | 95.34 | | 1.41 |
| $T_7$, Metolachlor 1 kg a.i./ha + hand-weeding at 30 days* | 1,602 | 886 | 1,409 | 1,299 | 94.27 | 5.05 | 1.37 |
| $T_8$, Oxadiazon 1 kg a.i./ha + hand-weeding at 30 days* | 1,075 | 764 | 1,367 | 1,069 | 90.95 | 21.19 | 1.29 |
| CD (P = 0.05) | 390 | 197 | 154 | 214 | | | |

*Days after sowing

(Table 3) or with pre-emergent pendimethalin at 0.75 kg a.i./ha coupled with 1 hand-weeding at 30 days. The results are in conformity with the reports of Gnanamurthy and Balasubramaniyan (1998). The weed index was maximum with unweeded control compared with pre-emergent pendimethalin at 0.75 kg a.i./ha, followed by hand-weeding which recorded higher pod yield with minimum weed competition. Hand-weeding twice and pre-emergence spray of pendimethalin at 0.75 kg a.i./ha + hand-weeding at 30 days gave higher benefit : cost ratio compared with other weed-control treatments.

Thus chemical weed control with pendimethalin in groundnut fields is economically viable method whenever the labour scarcity arises during the peak seasons.

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