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## Yield and nutrient uptake in *rabi* groundnut as influenced by different weed management practices

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**Abstract**

An field experiment was conducted to assess the effect of weed management practices on growth attributes and yield of *rabi* groundnut (*Arachis hypogaea* L.) during *rabi*, 2016 at the wetland farm of S.V. Agricultural College. The results of experiment indicated Two hand weedings at 20 and 40 DAS recorded highest weed control efficiency and yield attributes *viz.*, hundred pod weight, pod yield, oil yield and gross returns which was at par with pre-emergence application of pendimethalin @ 1000 g *a.i* ha<sup>-1</sup> *fb* one hand weeding at 20 DAS and post-emergence application of imazethapyr @ 37.5 g *a.i* ha<sup>-1</sup> + quizalofop-p-ethyl @ 25 g *a.i* ha<sup>-1</sup>. Among the different weed management practices tried, the highest uptake of nitrogen, phosphorus and potassium by groundnut was recorded with hand weeding twice at 20 and 40 DAS, which was on par with application of pendimethalin *fb* one hand weeding at 20 DAS and post-emergence application of imazethapyr + quizalofop-p-ethyl.

**Keywords:** Groundnut, herbicide mixtures, oil yield, weed control efficiency

**Introduction**

Groundnut (*Arachis hypogaea* L.) is considered to be one of the most important food legume and oilseed crop in India, cultivated over an area of 4.7 m ha, with a production of 7.4 m t and average productivity of 1552 kg ha<sup>-1</sup>. The productivity of crops under irrigated condition is not stable due to various reasons. Among them weed infestation is considered to be one of the major problems. Yield loss due to weed infestation amounts to 80 percent in groundnut. So weed infestation is one of the major constraints that limit the productivity of groundnut. Critical period of crop weed competition is ranged between 40 to 60 days after sowing. Though, groundnut is a hardy crop, but it is highly susceptible to weed preponderance due to small canopy and slow initial growth. In groundnut, weeds compete with crop plants for nutrients and remove 30-40% of applied nutrients resulting in significant yield reduction (Dryden and Krishnamurthy, 1997) [2]. In India, yield losses of groundnut due to weeds ranged from 24-70 percent (Jhala *et al.*, 2005) [3]. Generally weeds are controlled by hand weeding, which is very expensive, laborious and shortage of labours. It is therefore important to find out suitable herbicides that will control the weeds economically and safely. Use of pre-and post-emergence herbicides mixtures offers an alternative viable option for effective and timely control of all categories of weeds in groundnut. Hence, there is a need to evaluate the pre-and post-emergence herbicide mixtures for obtaining broad spectrum weed control in *rabi* groundnut.

**Material and Methods**

A field experiment was carried out during *rabi*, 2016 at the wetland farm of S.V. Agricultural College, Tirupati. The experimental soil was sandy loam in texture, slightly alkaline in reaction (pH 7.7), low in organic carbon (0.38 percent) and available nitrogen (158.0 kg ha<sup>-1</sup>), medium in available phosphorus (23.4 kg ha<sup>-1</sup>) and available potassium (211.3 kg ha<sup>-1</sup>). The experiment was laid out in a randomized block design with three replications. The treatment consisted of ten weed management practices *viz.*, pre-emergence application of pendimethalin 1000 g *a.i* ha<sup>-1</sup> (W<sub>1</sub>), pre-emergence application of pendimethalin 1000 g *a.i* ha<sup>-1</sup> + one hand weeding at 20 DAS (W<sub>2</sub>), pre-emergence application of pendimethalin + imazethapyr (pre-mix) 1000 g *a.i* ha<sup>-1</sup> (W<sub>3</sub>), post-emergence application of imazethapyr 75 g *a.i* ha<sup>-1</sup> (W<sub>4</sub>), post-emergence application of imazethapyr + imazamox (pre-mix) 70 g *a.i* ha<sup>-1</sup> (W<sub>5</sub>), post-emergence application of sodium salt of acifluorfen + cladinofop propargyl (pre-mix) 75 g *a.i* ha<sup>-1</sup> (W<sub>6</sub>), post-emergence application of imazethapyr 37.5 g *a.i* ha<sup>-1</sup> + quizalofop-p-ethyl 25 g ha<sup>-1</sup> (tank-mix) (W<sub>7</sub>), post-emergence application of imazethapyr 37.5 g *a.i* ha<sup>-1</sup> +

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propaquizafop 25 g ha<sup>-1</sup> (tank-mix) (W<sub>8</sub>), two hand weedings at 20 and 40 DAS (W<sub>9</sub>) and unweeded check (W<sub>10</sub>). The recommended doses of nitrogen, phosphorous and potassium @ 30, 40 and 50 kg ha<sup>-1</sup> and gypsum @ 500 kg ha<sup>-1</sup> was applied at time of flowering stage. The test variety of groundnut 'Dharani' was used in the study by adopting spacing of 22.5cm x 10 cm.

## Results and Discussion

### Effect on weeds

The predominant weed species associated with groundnut are *Cyperus rotundus* (52.0%), *Digitaria sanguinalis* (10.0%) *Commelina benghalensis* (8.0%), *Phyllanthus niruri* (6.0%) *Cleome viscosa* (5.0%), *Boerhavia diffusa* (5.0%) and *Dactyloctenium aegyptium* (5.0%). Among the different weed management practices tested (Table 1), the highest WCE was recorded with hand weeding twice at 20 and 40 DAS (W<sub>9</sub>), which was however, comparable with pre-emergence application of pendimethalin 1000 g a.i ha<sup>-1</sup> + HW at 20 DAS (W<sub>2</sub>) and post-emergence application of imazethapyr + quizalofop (W<sub>7</sub>) at 40, 60 and at harvest. This might be due to the effective control of all the categories of weeds during the critical stages of crop to harness the growth resources more efficiently. These results are in accordance with those of Sharma *et al.* (2015) [6].

### Effect on crop

Among the different weed management practices tested (Table 2), the highest hundred pod weight, pod yield, kernel yield, oil yield and gross returns was recorded with hand weeding twice at 20 and 40 DAS (W<sub>9</sub>), which was on par with pre-emergence application of pendimethalin *fb* one hand weeding at 20 DAS (W<sub>2</sub>), or post-emergence application of imazethapyr + quizalofop-p-ethyl (W<sub>7</sub>). This might be due to

minimizing the competition of weeds with the crop for resources *viz.*, space, light, nutrients and moisture, especially during critical stages of crop growth. Application of imazethapyr + quizalofop-p-ethyl (tank mix) controlled broad spectrum of weeds effectively for a longer period provide congenial environment for growth and development as evident from increase in plant height, leaf area index and dry matter production, improvement in growth parameters obviously increases the yield attributes like number of filled pods plant<sup>-1</sup>, hundred pod and kernel weight as well as shelling percentage and ultimately the pod yield. These results were corroborating the findings of Kalhapure *et al.* (2013) [4] and Sandil *et al.* (2015) [6]. Weed free environment during the critical stages of the groundnut leading to better availability of nutrients thereby higher nutrient uptake by crop and consequently higher oil yield. These results are in conformity with the findings of Zid (2006) [8] and Sharma *et al.* (2015) [7].

### Nutrient uptake by crop:

Among the different weed management practices tried (Table 3), the highest uptake of nitrogen, phosphorus and potassium by groundnut was recorded with hand weeding twice at 20 and 40 DAS, which was on par with application of pendimethalin *fb* one hand weeding at 20 DAS and post-emergence application of imazethapyr + quizalofop-p-ethyl, might be due to higher dry matter accumulation and higher nutrient content in the tissues of the plant in corresponding treatments. The lower nutrient uptake *i.e.* nitrogen, phosphorus and potassium by groundnut was recorded with unweeded check (W<sub>10</sub>) due to poor dry matter production and reduced nutrient content as a result of heavy weed competition. These results are in conformity with the findings of Chaudhari *et al.* (2007) [1] and Kiroriwal *et al.* (2012) [5].

**Table 1:** Effect of different weed management practices on weed control efficiency (%) in groundnut.

Treatments		40 DAS	60 DAS	At harvest
W1	: Pre-emergence application of pendimethalin @ 1000 g a.i ha <sup>-1</sup>	44.55 (41.85)	50.91 (45.50)	40.94 (39.35)
W2	: Pre-emergence application of pendimethalin @ 1000 g a.i ha <sup>-1</sup> + one hand weeding at 20 DAS	67.59 (55.28)	71.87 (57.96)	61.13 (51.53)
W3	: Pre-emergence application of pendimethalin + imazethapyr (pre-mix) @ 1000 g a.i ha <sup>-1</sup>	35.34 (36.44)	45.64 (42.47)	37.45 (37.01)
W4	: Post-emergence application of imazethapyr @ 75 g a.i ha <sup>-1</sup>	40.16 (39.30)	40.02 (39.21)	31.07 (33.86)
W5	: Post-emergence application of imazethapyr + imazamox (pre-mix) @ 70 g a.i ha <sup>-1</sup>	51.40 (45.78)	49.24 (44.54)	40.22 (38.86)
W6	: Post-emergence application of sodium salt of acifluorfen + clodinafop propargyl (pre-mix) @ 75 g a.i ha <sup>-1</sup>	37.96 (37.99)	27.44 (31.56)	16.45 (23.91)
W7	: Post-emergence application of imazethapyr @ 37.5 g a.i ha <sup>-1</sup> + quizalofop-p-ethyl @ 25 g a.i ha <sup>-1</sup> (tank-mix)	65.05 (53.74)	70.55 (57.11)	60.20 (50.96)
W8	: Post-emergence application of imazethapyr @ 37.5 g a.i ha <sup>-1</sup> + propaquizafop @ 32 g a.i ha <sup>-1</sup> (tank-mix)	46.71 (43.09)	47.59 (43.06)	38.57 (37.84)
W9	: Two hand weedings at 20 and 40 DAS	68.53 (55.86)	74.42 (59.60)	62.50 (52.33)
W10	: Unweeded check (control)	-	-	-
S.Em ±		0.457	0.906	2.876
CD (P = 0.05)		1.38	2.74	8.67

**Table 2:** Hundred pod weight, pod yield, kernel yield, oil yield (kg ha<sup>-1</sup>) and gross returns of groundnut as influenced by different weed management practices

Treatments		Hundred pod weight (g)	Pod yield (kg ha <sup>-1</sup> )	Kernel yield (kg ha <sup>-1</sup> )	Oil yield (kg ha <sup>-1</sup> )	Gross returns (₹ ha <sup>-1</sup> )
W <sub>1</sub>	Pre-emergence application of pendimethalin @ 1000 g a.i ha <sup>-1</sup>	106.33	1452	991	453	89546
W <sub>2</sub>	Pre-emergence application of pendimethalin @ 1000 g a.i ha <sup>-1</sup> + one hand weeding at 20 DAS	111.10	1633	1157	537	100460
W <sub>3</sub>	Pre-emergence application of pendimethalin + imazethapyr (pre-mix) @ 1000 g a.i ha <sup>-1</sup>	104.21	1373	919	415	84800
W <sub>4</sub>	Post-emergence application of imazethapyr @ 75 g a.i ha <sup>-1</sup>	103.80	1359	902	407	83960
W <sub>5</sub>	Post-emergence application of imazethapyr + imazamox (pre-mix) @ 70 g a.i ha <sup>-1</sup>	105.60	1439	979	444	88768
W <sub>6</sub>	Post-emergence application of sodium salt of acifluorfen + clodinofof propargyl (pre-mix) @ 75 g a.i ha <sup>-1</sup>	98.40	1248	802	350	77110
W <sub>7</sub>	Post-emergence application of imazethapyr @ 37.5 g a.i ha <sup>-1</sup> + quizalofop-p-ethyl @ 25 g a.i ha <sup>-1</sup> (tank-mix)	110.00	1623	1141	527	99886
W <sub>8</sub>	Post-emergence application of imazethapyr @ 37.5 g a.i ha <sup>-1</sup> + propaquizafop @ 32 g a.i ha <sup>-1</sup> (tank-mix)	104.69	1404	947	427	86683
W <sub>9</sub>	Two hand weedings at 20 and 40 DAS	112.30	1654	1175	548	101793
W <sub>10</sub>	Unweeded check (control)	92.13	1133	686	288	70134
S.Em ±		0.94	31.02	30.2	15.89	1859.44
CD (P = 0.05)		2.84	94	90	48	5639

**Table 3:** Nutrient uptake (kg ha<sup>-1</sup>) by groundnut as influenced by different weed management practices

Treatments		Nitrogen	Phosphorous	Potassium
W <sub>1</sub>	Pre-emergence application of pendimethalin @ 1000 g a.i ha <sup>-1</sup>	77.60	23.53	76.33
W <sub>2</sub>	Pre-emergence application of pendimethalin @ 1000 g a.i ha <sup>-1</sup> + one hand weeding at 20 DAS	88.27	28.27	91.67
W <sub>3</sub>	Pre-emergence application of pendimethalin + imazethapyr (pre-mix) @ 1000 g a.i ha <sup>-1</sup>	73.33	22.60	74.00
W <sub>4</sub>	Post-emergence application of imazethapyr @ 75 g a.i ha <sup>-1</sup>	72.47	22.13	73.33
W <sub>5</sub>	Post-emergence application of imazethapyr + imazamox (pre-mix) @ 70 g a.i ha <sup>-1</sup>	76.57	23.20	75.33
W <sub>6</sub>	Post-emergence application of sodium salt of acifluorfen + clodinofof propargyl (pre-mix) @ 75 g a.i ha <sup>-1</sup>	64.00	18.62	64.00
W <sub>7</sub>	Post-emergence application of imazethapyr @ 37.5 g a.i ha <sup>-1</sup> + quizalofop-p-ethyl @ 25 g a.i ha <sup>-1</sup> (tank-mix)	86.20	28.07	91.27
W <sub>8</sub>	Post-emergence application of imazethapyr @ 37.5 g a.i ha <sup>-1</sup> + propaquizafop @ 32 g a.i ha <sup>-1</sup> (tank-mix)	74.33	22.83	74.47
W <sub>9</sub>	Two hand weedings at 20 and 40 DAS	90.60	28.53	92.67
W <sub>10</sub>	Unweeded check (control)	39.33	8.47	37.53
S.Em ±		2.11	0.60	1.78
CD (P = 0.05)		6.40	1.81	5.41

## Conclusion

In conclusion highest weed control efficiency and yield attributes was recorded with hand weeding twice at 20 and 40 DAS (W<sub>9</sub>), which was on par with pre-emergence application of pendimethalin *fb* one hand weeding at 20 DAS (W<sub>2</sub>), or post-emergence application of imazethapyr + quizalofop-p-ethyl (W<sub>7</sub>). The highest gross returns were realized with hand weeding twice at 20 and 40 DAS, while the highest net returns and benefit-cost ratio were recorded with pre-emergence application of pendimethalin *fb* hand weeding at 20 DAS, which was closely followed by post-emergence application of imazethapyr @ 37.5 g a.i ha<sup>-1</sup> and quizalofop-p-ethyl @ 25 g a.i ha<sup>-1</sup>.

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