Indian Journal of Weed Science **50**(3): 298–301, 2018

Print ISSN 0253-8040 Online ISSN 0974-8164

Weed management in groundnut under rice-fallow

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Article information

DOI: 10.5958/0974-8164.2018.00064.3

Type of article: Research note

Received : 3 June 2018
Revised : 15 August 2018
Accepted : 22 August 2018

Key words
Imazethapyr
Pendimethalin
Quizalofop-ethyl
Rice fallow groundnut
Weed management

ABSTRACT

A field experiment was conducted at Agricultural Research Station, Utukur, Kadapa, Andhra Pradesh, India during *Rabi* seasons of 2016 and 2017 to test the efficacy of herbicides in rice-fallow groundnut. It is common that previous rice volunteer plants will come in the succeeding crops after rice. Keeping all this in view, the experiment was conducted with six weed control treatments arranged in a randomized block design (RBD) with four replications. Pre-emergence application of pendimethalin 1.5 kg/ha followed by post-emergence application of imazethapyr 75 g/ha at 18-20 DAS recorded lower density of both broad-leaved and grassy-weeds. Weed free throughout the crop period recorded higher pod yield (4.24 t/ha), which was at par with hand weeding twice at 20 and 40 DAS (4.19t/ha) and pendimethalin 1.5 kg/ha as pre-emergence followed by imazethapyr 75 g/ha as post-emergence at 18-20 DAS (3.91 t/ha). Higher benefit:cost ratio (2.20) was recorded with pre-emergence application of pendimethalin 1.5 kg/ha followed by post-emergence application of imazethapyr 75 g/ha at 18- 20 DAS.

Groundnut (*Arachis hypogaea* L.) is one of the most important edible oilseed crop extensively cultivated in the world. It is called the king of the oilseeds. Groundnut is also called as wonder nut and poor men's cashew nut. It is a low-priced commodity, but a valuable source of all the nutrients. India occupies the first place with regard to the area and the production in the world. About 7.5 million hectares are put under it annually and the production is about seven million tonnes (Anonymous 2016). But the country ranks eighth in productivity, which is lower by about 100 kg than the world average. It is grown throughout the year *i.e., Kharif, Rabi* and summer seasons. During *Rabi*, being a short duration crop and having biological nitrogen fixing capability, groundnut can be fit in different cropping systems.

Rice-groundnut cropping system is one of the predominant systems in south India. Among different constraints that limit the productivity of groundnut, weed menace is one of the serious bottlenecks as peanut is confronted with repeated flush of diverse broad-leaved, grassy and sedges throughout the growing season which cause substantial yield loss of 15-75% (Jat *et al.* 2011). The critical period of grass weed control was found to be from four to nine weeks after planting whereas, the critical period of broad-leaved weeds control was from two to eight weeks in groundnut (Wesley *et al*. 2008). Pre-emergence herbicide pendimethalin (Patel *et al.* 2013) and post-emergence herbicides imazethapyr (Kalhapure *et al.* 2013) and quizalofop-ethyl (Samant and Mishra 2014) were found effective to control weeds in groundnut in different parts of the country. Pendimethalin inhibits root and shoot growth. It controls weed population and prevents weeds from emerging, particularly during the crucial development phase of the crop. Its primary *mode of action* is to prevent plant cell division and elongation in susceptible species (Simerjeet Kaur *et al*. 2014). Quizalofop-ethyl effectively controls narrow leaf weeds in broad-leaved crops. Imazethapyr absorbed by plant roots and foliage, being translocated to meristematic regions where it inhibits the biosynthesis of valine, leucine and isoleucine preventing cell division. It controls both broad-leaved weeds and grasses. The field experiment was conducted to see any change in weed flora in groundnut under rice fallow situation and the effectiveness of common weedicides used in groundnut under rice fallow situation with suitable weed management practices.

A field experiment was conducted during *Rabi* seasons of 2016 and 2017 at Agricultural Research Station, Utukur, Kadapa on Alfisols with sandy-clay-loam texture and spheroidal moderate structure. The experimental soil was low in available nitrogen (139 kg/ha), high in available phosphorus (57 kg/ha) and high potassium (460 kg/ha) with pH 8.27 and EC 0.06 dS/m. The experiment was laid out in randomized block design with four replications. The treatments comprised of un-weeded control, weed free, two hand weedings (20 and 40 DAS), pre-emergence application of pendimethalin 1.5 kg/ha followed by one hand weeding at 25 DAS, pre-emergence application of pendimethalin 1.5 kg/ha followed by post-emergence application of quizalofop-ethyl 50 g/ha at 20-30 DAS, pre-emergence application of pendimethalin 1.5 kg/ha followed by post-emergence application of imazethapyr 75 g/ha at 20-30 DAS. The test variety '*Dharani'* was sown on november 16th in 2016 and november 18th in 2017 with spacing of 22.5 × 10 cm in the plot of 4.5 × 3.6 m size.

All the cultural practices like seed rate (188 kg/ ha), spacing (22.5 × 10 cm), fertilizer application (30-40-50 kg NPK/ha) and irrigations were followed as per university recommendation except weeding. Pendimethalin was applied as pre-emergence at two days after sowing. While, the post-emergence herbicides were applied at 18- 20 DAS when the weeds were at 2-3 leaf stage. Data on weed density and dry weight were taken before and 20, 40 days after application of herbicide and at harvest by throwing 0.25 sqm. quadrate randomly at four places in a plot. At the end of cropping season, yield was recorded from net plot area and computed to per hectare. Cost of cultivation, gross returns and net returns were calculated based on the prevailing price of inputs and outputs. Benefit: cost ratio was calculated on the basis of gross returns divided by the cost of cultivation.

The most dominant broad-leaved weeds were *Digera arvensis, Eclipta alba, Phyllanthus maderaspatensis* and *Parthenium hysterophorus, w*hile the dominant grassy weeds include *Echinochloacolona* and *Panicum repens.*

Effect on weeds

Pre-emergence application of pendimethalin at 1.5 kg/ha effectively controlled both broad-leaved and grassy weeds in the initial stages up to twenty days compared to the unweeded check. Pendimethalin prevented the weeds from emerging, particularly during the initial twenty days of crucial development phases of the crop as reported by Jat *et al. (*2011) and Sathyapriya *et al.* (2013). But it did not control the paddy volunteer plants effectively. The data on weed density at 20 and 40 days after post-emergence application of herbicides showed significant reduction in both broad-leaved and grass weed population including volunteer paddy (grown from seeds fallen from previous crop) when imazethapyr was applied as post-emergence at 18-20 DAS (**Table 1**).

Imazethapyr was effective in reducing weed density significantly, it resulted in significant reduction of total weed biomass. However, application of quizalofop-ethyl as post-emergence controlled only grassy weeds leaving uncontrolled the broad-leaved weed population like *Eclipta alba* and *Digera arvensis* in both the years. Significant sedge population was not observed in the experimental plot in both the years. Higher total weed dry weight was recorded with unweeded check which reduced the pod yield by 78.5% over weed free situation. Significant reduction in weed dry weight was observed with weed management treatments. Lower weed index (1.17) was with hand weeding twice at 20 and 40 days after sowing. Among herbicide

Table 1. Weed density (no./m^2) at different stages as influenced by weed management in rice fallow groundnut (pooled of two years)

Treatment	Broad-leaved weeds			Narrow leaved weeds		
	Before spray	20 DAA	40 DAA	Before spray	20 DAA	40 DAA
Pendimethalin 1.5 kg/ha + one hand weeding at 25 DAS	2.52(9.0)	3.38(14)	3.20(11)	0.70(0)	1.43(2)	1.54(3)
Pendimethalin 1.5 kg/ha + quizalofop-ethyl 50 g/ha at 20-30 DAS	3.06(11)	5.57(34)	5.53(32)	0.83(0)	1.17(2)	1.14(1)
Pendimethalin 1.5 kg/ha + imazethapyr75 kg/ha at 20 - 30 DAS	2.11(7)	2.48(7)	3.0(9)	0.81(0)	0.70(0)	1.14(1)
Two hand weedings (20 and 40 DAS)	6.76(48)	2.76(20)	3.54(14)	8.32(81)	2.09(7)	3.63(10)
Unweeded control	7.17(55)	7.45(58)	8.59(7)	9.40(97)	10.4(124)	6.84(48)
Weed free	0.70(0)	0.70(0)	0.70(0)	0.70(0)	0.70(0)	0.70(0)
LSD (p=0.05)	1.36	1.29	1.42	1.52	1.37	0.97

Data were parentheses square root transformed

treatments, lower weed index (1.66) was with pre-emergence application of pendimethalin followed by post-emergence application of imazethapyr at 18-20 DAS.

Effect on crop

Plant height was not significantly influenced by the weed management treatments. Higher number of pods/plant (18.75) was registered with weed free treatment which was on par with hand weeding twice at 20 and 40 DAS and pre-emergence application of pendimethalin1.5 kg/ha followed by post-emergence application of imazethapyr 75g/ha at 20- 30 DAS. Patra and Naik (2001) also reported increased pod number due to weed control treatments. The differential contribution of yield components towards pod yield was obtained with different treatments. Effective control of weeds by herbicides might have resulted in better availability of soil moisture and nutrients as evidenced by the beneficial effect on crop growth. Higher level of these parameters could be attributed to low crop-weed competition. Shelling percentage and 100 kernel weight were not significantly influenced by the weed management treatments (**Table 3**).

All the weed management practices significantly enhanced pod and haulm yield over weedy check and highest pod yield (4.24 t/ha) was obtained in weed free treatment throughout the crop period, which was however at par with hand weeding twice at 20 and 40 DAS (4.19 t/ha) and pre-emergence application of pendimethalin 1.5 kg/ha followed by post-emergence application of imazethapyr 75 g/ha at 18-20 DAS (3.91 t/ha). While, the lowest pod yield of 0.91 t/ha was observed in unweeded control. Higher haulm yield was registered with weed free treatment which was significantly superior over pre-emergence application of pendimethalin 1.5 kg/ha followed by post-emergence application of quizalofop-ethyl 50g/ ha at 18-20 DAS and weedy check. This might be due to the fact that weed free environment in crop facilitated better peg initiation and development at the critical growth stages of groundnut which ends to increase in number of pods/plant and pod yield. Singh *et al.* (2017) also reported the beneficial effect of pre-emergence application of pendimethalin 1000 g/ha followed by post-emergence application of imazethapyr 75 g/ha in lowering weed density and weed biomass of both broad-leaved and grassy-weeds and significantly increasing dry matter accumulation, number of pods/plant, pod yield, haulm yield and biological yield in groundnut over all other herbicidal treatments.

All the weed control treatments recorded higher gross returns and B: C ratio over weedy check (**Table 3**). Highest gross returns was registered with weed free treatment (` 1,58,925/) followed by two hand weedings at 20 and 40 DAS (` 1,57,050) and pre-emergence application of pendimethalin followed by post-emergence application of imazethapyr at 18-20 DAS (` 1,46,737). While the lowest gross returns were observed in unweeded check. Pre-emergence application of pendimethalin 1.5 kg/ha followed by post-emergence application of imazethapyr 75 g/ha at18-20 DAS recorded higher benefit-cost ratio (2.20) due to higher pod yield and subsequently lower cost of cultivation of groundnut crop. To maintain weed free throughout the crop growth period more number of labour was engaged which increased the cost of cultivation and the same was reduced in herbicide treatments. Rao *et al.* (2011) also reported higher net returns and benefit-cost ratio with pre- and post-emergence application of herbicides in groundnut.

Table 2. Weed biomass, weed control efficiency and weed index as influenced by weed management in rice fallow groundnut (pooled of two years)

Treatment	Weed biomass (g/m^2)		Weed control efficiency (%)		Weed index (%)
	20 DAA	40 DAA	20 DAA	40 DAA	
Pendimethalin 1.5kg/ha + one hand weeding at 25 DAS	2.12	11.61	95.52	80.44	7.91
Pendimethalin 1.5kg/ha + quizalofop-ethyl 50 g/ha at 20-30 DAS	4.19	18.69	91.15	68.51	20.38
Pendimethalin 1.5kg/ha + imazethapyr75 kg/ha at 20 - 30 DAS	0.35	8.125	99.26	86.31	1.66
Two hand weedings (20 and 40 DAS)	2.75	18	94.19	69.68	1.17
Unweeded control	47.37	59.37	-		78.5
Weed free	0	0	100	100	-
LSD (p=0.05)	18.5	9.0	-	-	-

DAA- Days after application

Table 3. Growth, yield and economics of groundnut as influenced by weed management (pooled of two years)

Treatment	Plant height (cm)	No. of pods / plant	Shelling percentage	100 kernel weight (g)	Pod yield (t/ha)	Haulm yield (t/ha)	Gross returns (x10^3 `/ha)	Cost of cultivation (x10^3 `/ha)	B:C ratio
Pendimethalin 1.5kg/ha + one hand weeding at 25 DAS	21.75	16.50	67.79	45.91	3.90	6.179	146.21	69.05	2.11
Pendimethalint 1.5 kg/ha + quizalofop – ethyl50 g/ha at 20-30 DAS	23.25	16.56	69.16	45.42	3.37	5.603	126.52	66.45	1.90
Pendimethalin 1.5 kg/ha+ imazethapyr 75 kg/ha at 20 - 30 DAS	21.40	18.40	69.87	46.56	3.91	6.300	146.74	66.66	2.20
Two hand weedings (20 and 40 DAS)	21.85	18.03	68.12	46.63	4.19	6.334	157.05	72.00	2.18
Unweeded control	22.76	10.52	69.52	45.90	0.91	2.247	34.05	64.00	-0.53
Weed free	22.30	18.75	76.64	46.53	4.24	6.339	158.92	85.00	1.86
LSD (p=0.05)	NS	1.97	NS	NS	2.89	1.93	-	-	-

Price of groundnut – ` 37,500/tonne

It can be concluded that, pre-emergence application of pendimethalin 1.5 kg/ha followed by post-emergence application of imazethapyr 75 g/ha at 18-20 DAS was effective in controlling both broad-leaved weeds and grasses in groundnut under rice fallow.

REFERENCES

Anonymous. 2016. *Agriculture At a Glance*. Ministry of Agriculture and Cooperation, Government of India, New Delhi.

Jat RS, Meena HN, Singh AL, Jaya NS and Misra JB. 2011. Weed management in groundnut (*Arachis hypogaea* L.) in India-A review. *Agricultural Reviews* **32**(3): 155–171.

Kalhapure AH, Shete BT and Bodake PS. 2013. Integration of chemical and cultural methods for weed management in groundnut. *Indian Journal of Weed Science* **45**(2): 116–119.

Patel HF, Patel JC, Maheriya VD and Patel BB. 2013. Integrated weed management in *Kharif* groundnut (*Arachis hypogaea* L.). *A Quarterly Journal of Life Sciences* **10**(1b): 320–321.

Patra AK and Naik BC. 2001. Integrated weed management in rainy season groundnut. *Indian Journal of Agricultural Sciences* **71**: 378–380.

Rao SS, Madhavi M and Reddy CR. 2011. Integrated approach for weed control in *Rabi* groundnut (*Arachis hypogaea* L.). *Journal of Research ANGRAU* **39**(1): 60–63.

Singh SP, Yadav RS, Kumawat A,Bairwa RC and Reager ML. 2017**.** Groundnut productivity and profitability as influenced by weed control measures. *Indian Journal of Weed Science* **49**(4): 360–363.

Samant TK and Mishra KN. 2014.Efficacy of post-emergence herbicide quizalofop - ethyl for controlling grassy weeds in groundnut. *Indian Journal of Agricultural Research* **48**(6): 488–492.

Sathyapriya R, Chinnusamy C, Manickasundaram P and Babu C. 2013. A review on weed management in groundnut (*Arachis hypogaea* L.). *International Journal of AgriculturalScience and Research* **3**(1): 163–172.

Simerjeet Kaur, Tarundeep Kaur and Bhullar MS. 2014. Bio-efficacy of brand formulations of pendimethalin - penda 30 EC and markpendi 30 EC for Control of Phalaris minor Retz. in Wheat. *Journal of Krishi Vigyan 2014* **3**(1): 10–12

Wesley JV, Burke IC, Clewis SB, Thomas WE and Wilcut JW. 2008. Critical period of grass vs. broad-leaf weed interference in peanut. *Weed Technolgy* **22**: 68–73.