Indian Journal of Weed Science **51**(3): 306–307, 2019

Print ISSN 0253-8040 Online ISSN 0974-8164

Weed management in groundnut with new herbicide molecules

B. Naveen Kumar, D. Subramanyam*, A.V. Nagavani, V. Umamahesh

Department of Agronomy, S.V. Agricultural College, Tirupati, Andhra Pradesh 517 502, India

**Email: subbuagro37@gmail.com*

Article information

DOI: 10.5958/0974-8164.2019.00065.0

Type of article: Research note

Received : 12 May 2019
Revised : 30 July 2019
Accepted : 2 August 2019

Key words
Economics, Groundnut, Weed, Yield

ABSTRACT

A field experiment was conducted to study the effect of different high efficiency herbicides as pre- and post-emergence application on weed growth, yield and economics of groundnut at Tirupati campus of Acharya N.G. Ranga Agricultural University during *Rabi*, 2018. Among all the weed management practices, the broad-spectrum weed control with higher pod yield and benefit-cost ratio were obtained with pre-emergence application of diclosulam 20 g/ha followed by hand weeding at 40 DAS and next best option could be the pre-emergence application of diclosulam 20 g/ha followed by cycloxydim 100 g/ha at 20 DAS in sandy loam soils.

Weed infestation is an important limiting factor in achieving potential productivity of groundnut (*Arachis hypogaea* L.), especially in bunch type of varieties with poor competitive ability. Yield loss due to heavy weed infestation in groundnut ranged from 13-80 % in India (Ghosh *et al.* 2000). Unlike other crops, weeds interfere with pegging, pod development and harvesting of groundnut during different stages of crop growth, besides competing for growth resources. Use of pre- and post-emergence herbicides offers an alternative viable option for effective and timely control of weeds in groundnut. But, each herbicide has its own spectrum of weed control. The timing of herbicide application also has much concern on weed control efficiency. At present, pendimethalin 1000 g/ha as pre-emergence is being used most commonly for the control of weeds in groundnut, but it is less effective on some of the broad-leaved weeds and perennial sedge *Cyperus rotundus*. Post-emergence application of imazethapyr 75 g/ha is recommended for control of weeds in groundnut, but the choice of succeeding crops is limited because imazethapyr persists in soil and plant for longer time with a half-life period of 33 months and is not effective against grasses (Sondhia *et al.* 2015). Further, pre-emergence herbicides have been proved remarkably effective upto 20-25 DAS, but late coming weeds interfere with pegging, pod development and harvesting. In this context, there is need to evaluate suitable pre-and post-emergence herbicides to control all the categories of weeds including perennial sedge, *Cyperus rotundus* in *Rabi* groundnut.

A field experiment was conducted during *Rabi* 2018-19 in sandy loam soil of dryland farm of S.V. Agricultural College, Tirupati, Andhra Pradesh. The soil was low in available nitrogen and phosphorous, medium in potassium and low in organic carbon content. Healthy and sound groundnut kernel of test variety '*Kadiri-6*' were sown on 13 December, 2018 at spacing of 22.5 x 10 cm by using seed rate of 150 kg/ha. The crop was harvested on 29 March 2019. Eleven weed management practices consisted of pre-emergence (PE) application of diclosulam 20 g/ha alone or supplemented with HW at 20 DAS or post-emergence (PoE) application of haloxyfop-p-ethyl 135 g/ha at 20 DAS or cycloxydim 100 g/ha at 20 DAS, PE application of pendimethalin 725 g/ha alone or supplemented with HW at 40 DAS or post-emergence application of haloxyfop-p-ethyl 135 g/ha at 20 DAS or cycloxydim 100 g/ha at 20 DAS, PE application of pendimethalin 1000 g/ha alone, two hand weeding at 20 and 40 DAS and unweeded check. The experiment was laid out in randomized block design with three replications. Pre-and post-emergence herbicides were applied at one and 20 DAS by using battery operated knapsack sprayer fitted with flat-fan nozzle with spray fluid of 500 L/ha. The crop was supplied with recommended fertilizer dose of fertilizers with 20 kg N, 40 kg P_2O_5 and 50 kg K_2O/ha through urea, single super phosphate and muriate of potash, respectively to all the plots as basal. Top dressing of 10kg of N was applied in form of urea at 25 DAS. The rest of the package of practices was adopted as per Acharya N. G. Ranga Agricultural University. The unweeded check plots were allowed to remain infested with weeds till harvesting of the crop. Density and dry weight of weeds were recorded at harvest and transformed to square root transformation ($\sqrt{x+0.5}$) to normalize their distribution. The number of filled pods/plant, pod and haulm yields of groundnut were recorded at harvest.

Table 1. Effect of different pre-and post-emergence herbicides on weed growth, yield and economics of *Rabi* groundnut

Treatment	Dose (g/ha)	Time of application (DAS)	Weed density (no./m^2)	Weed dry weight (g/m^2)	Plant height (cm)	Pod yield (t/ha)	Haulm yield (t/ha)	Net returns (x10^3 `/ha)	B:C ratio
Pendimethalin (CS)	725	1	7.16(50.3)	6.64 (43.6)	26.68	1.55	2.57	34.62	2.04
Diclosulam	20	1	4.33(18.0)	3.36(10.3)	25.41	1.76	2.80	44.03	2.35
Pendimethalin *fb* hand weeding	725	1 *fb* 40	5.91(34.0)	5.53(29.7)	27.64	1.60	2.61	34.40	1.97
Diclosulam *fb* hand weeding	20	1 *fb* 40	2.99(8.0)	2.57(5.6)	25.85	2.10	3.05	56.48	2.62
Pendimethalin *fb* haloxyfop-p-ethyl	725 *fb*135	1 *fb* 20	7.50(55.3)	6.83(45.7)	27.87	1.65	2.68	36.22	2.02
Diclosulam *fb* haloxyfop-p-ethyl	20 *fb*135	1 *fb* 20	4.19(16.7)	3.13(8.9)	25.93	1.86	2.85	46.06	2.32
Pendimethalin *fb* cycloxydim	725 *fb*100	1 *fb* 20	7.04(48.7)	6.54(41.9)	28.45	1.70	2.73	39.49	2.14
Diclosulam *fb* cycloxydim	20 *fb*100	1 *fb* 20	3.86(14.0)	2.82(7.0)	26.59	1.93	2.91	49.92	2.47
Pendimethalin (EC)	1000	1	8.99(80.0)	6.72(44.6)	27.29	1.61	2.62	37.24	2.12
Hand weeding	-	20 *fb* 40	5.39(28.3)	4.71(21.6)	29.53	1.80	2.81	41.13	2.10
Unweeded check (control)			15.0(224.3)	10.4(108.7)	20.73	1.07	1.95	15.63	1.50
LSD (p=0.05)			0.64	0.69	3.81	0.24	0.31	5.42	0.14

The figures in parentheses are original values; CS= Capsulated suspension, EC= Emulsifiable concentrate; *fb*= followed by

The predominant weed species observed in the experimental field were *Cyperus rotundus*, *Boerhavia erecta*, *Commelina bengalensis*, *Celosia argentea*, *Cleome viscosa*, *Dactyloctenium aegyptium*, *Phyllanthus niruri* and *Trichodesma indicum.* All the weed management practices significantly influenced the weed growth and yield of *Rabi* groundnut (**Table 1**). The lowest density and dry weight of total weeds were recorded with pre-emergence application of diclosulam 20 g/ha supplemented with HW at 40 DAS, which was significantly superior than rest of treatments with respect to weed density and comparable with pre-emergence application of diclosulam 20 g/ha *fb* cycloxydim 100 g/ha with respect to weed dry weight. Both the weed management practices were significantly superior in reducing density and dry weight of total weeds than two hand weedings at 20 and 40 DAS. Pre-emergence application of diclosulam 20 g/ha found to be very effective in controlling all the categories of weeds compared to pre-emergence application of both the formulations (CS and EC) of pendimethalin including predominant perennial sedge, *Cyperus rotundus* in the experimental field. Price and Wilcut (2002) also stated that diclosulam 27 g/ha found to be very effective in controlling yellow nutsedge upto 65-100 per cent when it was applied alone or in combination with dimethenamide. Diclosulam inhibits the acetolactate synthase, a key enzyme responsible for biosynthesis of branched chain amino acids, which are necessary for cell division at meristematic region of target plants.

Hand weeding twice at 20 and 40 DAS produced the tallest plants due to maintenance of weed free environment and better soil physical condition which might have enhanced the inter nodal length and it was at par with sequential application of pendimethalin *fb* cycloxydim 100 g/ha at 20 DAS. The highest pod yield (2.10 t/ha) and haulm yield (3.05 t/ha) of groundnut was obtained with pre-emergence application of diclosulam 20 g/ha supplemented with hand weeding at 40 DAS, which was closely followed by sequential application of diclosulam 20 g/ha *fb* cycloxydim 100 g/ha. Application of diclosulam as pre-emergence and cycloxydim as post-emergence controlled all the categories of weeds, which in turn increased the yield components and yield of groundnut. Similar results were also reported earlier by Grey *et al.* (2001). The reduction in pod and haulm yield of groundnut in unweeded check plots of *Rabi* groundnut was 48.8 and 36.1%, respectively compared to the best weed management practice *i.e* pre-emergence application of diclosulam *fb* hand weeding. These results are in conformity with those of Clewis and Wilcut (2004). The highest net returns and benefit-cost ratio were obtained with pre-emergence application of diclosulam *fb* hand weeding at 40 DAS, which were significantly higher than with pre-emergence application of diclosulam 20 g/ha *fb* cycloxydim 100 g/ha at 20 DAS due to increased yield. The highest weed density and dry weight with lower pod and haulm yield were registered with unweeded check due to heavy weed competition.

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