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Weed management in groundnut with diclosulam herbicide

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ABSTRACT

The efficacy of diclosulam herbicide in managing weeds and improve groundnut yield was tested in this study on weed management in groundnut (*Arachis hypogaea* L.). The diclosulam pre-plant incorporation (PPI) and pre-emergence application (PE) significantly reduced the sedges density. The diclosulam 27 g/ha PE followed by (*fb*) hand weeding (HW) at 50 days after seeding (DAS) recorded highest weed control efficiency (80.44%) and lowest (92) weed density (number /m^2) at 80 DAS. Number of groundnut pods per plant and pod yield was significantly higher with diclosulam 27 g/ha PE *fb* HW at 50 DAS and also gave the highest net return of ₹ 1,07,335/ha and B:C ratio of 2.32 followed by hand weeding twice at 30 DAS and 50 DAS and diclosulam 27 g/ha PPI *fb* HW at 50 DAS.

Groundnut is widely cultivated in the tropics and sub-tropics in between 40°N to 50°S latitudes. It is an important oilseed crop ranked 2nd with respect to production and 1st with respect to area in India (GOI 2020). In spite of this, India didn't achieve self-sufficiency in vegetable oils production and this leads to largest imported agricultural commodity in the country (DGCIS 2018). Among several factors for the reduction of productivity in groundnut, weed infestation play major role and reduces the yield up to 35.8% (Gharde *et al*. 2017, 2018). Therefore, an experiment was conducted to evaluate the efficacy of new herbicide, diclosulam, in managing weeds in groundnut.

The field experiment was conducted in the agronomy experiment research farm of School of Agricultural Sciences and Rural Development (SASRD), Nagaland University, Medziphema campus during *Kharif* season, of 2019.The climate of the experimental site lays in a humid subtropical zone with moderate temperature with medium to high rainfall. The soil of the field experimental field was having pH (4.8), organic carbon (1.09%), available N (228.8 kg/ha), P (19.96 kg/ha) and K (220.26 kg/ha). The experiment consisted of eight weed control treatments, *viz.* weedy check; hand weeding twice at 30 days after seeding (DAS) and 50 DAS; diclosulam 84% WDG (diclosulam) 17 g/ha pre-plant incorporation (PPI) followed by (*fb*) hand weeding (HW) at 50 DAS; diclosulam 27 g/ha PPI *fb* hand weeding at 50 DAS; diclosulam pre-emergence application (PE) 17 g/ha *fb* hand weeding at 50 DAS; diclosulam 27 g/ha PE *fb* hand weeding at 50 DAS; hand weeding at 30 DAS *fb* diclosulam 17 g/ha post-emergence application (PoE) at 50 DAS and hand weeding at 30 DAS fb diclosulam 27 g/ha PoE at 50 DAS. The experiment was laid out in randomized block design with three replications. Groundnut variety '*ICGV 87141* (*ICGS 76*)' was sown. The crop was fertilized with 20 kg N, 40 kg P and 30 kg K/ha through urea, single super phosphate and muriate of potash respectively. For spraying herbicides as per the treatment, hand sprayer is used by adopting a spray volume of 400 L/ha. Weed count (density) and dry weight (biomass) were recorded at 40 and 80 DAS at two spots using a quadrat of 50 × 50 cm and expressed as number/m^2 and g/m^2, respectively. The data on weed density and biomass were subjected to square root transformation $(\sqrt{x+1})$ before statistical analysis. Economics of the treatments was computed based upon prevalent prices.

The dominant weeds present in the experimental field were *Sonchus asper, Mimosa pudica, Marsilea quadrifolia, Leucas aspera, Amaranthus spinosus, Celosia argentea, Eleusine indica, Axonopus compressus, Digitaria sanguinalis, Cynodon dactylon, Fimbristylis miliacea* and *Cyperus iria.* The application of diclosulam herbicides resulted in lower density and biomass of all categories of weeds (**Table 1** and **Table 2**), which is due to its broad spectrum of action of herbicide. At 80 DAS, the diclosulam 27 g/ha PE *fb* hand weeding at 50 DAS resulted in effective control of grasses, broad-leaved weeds and sedges at 40 and 80 DAS and also recorded lower weed

Table1. Effect of weed management treatments on the density of grass, broad-leaved and sedge weeds and weed control efficiency in groundnut

Treatment	Weed density (no./m^2)						WCE (%) at 80 DAS
	Grassy weeds		Broad-leaved weeds		Sedges		
	40 DAS	80 DAS	40 DAS	80 DAS	40 DAS	80 DAS	
Diclosulam 17g/ha PPI *fb* HW at 50 DAS	12.75 (162)	7.46 (58)	7.03 (56)	6.44 (46)	4.51 (20)	3.75 (14)	73.15
Diclosulam 27 g/ha PPI *fb* HW at 50 DAS	11.25 (126)	6.75 (48)	6.62 (46)	5.87 (42)	3.23 (10)	3.39 (12)	77.18
Diclosulam 17g/ha PE *fb* HW at 50 DAS	12.10 (146)	7.23 (52)	5.80 (38)	6.87 (50)	4.04 (16)	3.75 (14)	75.06
Diclosulam 27 g/ha PE *fb* HW at 50 DAS	10.12 (102)	6.55 (44)	5.63 (32)	5.92 (38)	2.86 (8)	3.23 (10)	80.44
HW at 30 DAS *fb* diclosulam 17g/ha PoE at 50 DAS	9.51 (90)	11.73 (138)	9.40 (88)	9.73 (98)	6.52 (42)	7.47 (56)	42.90
HW at 30 DAS *fb* diclosulam 27 g/ha PoE at 50 DAS	9.30 (86)	11.30 (128)	9.29 (86)	9.58 (92)	6.04 (36)	7.38 (54)	46.56
HW twice at 30 DAS and 50 DAS	9.16 (84)	7.06 (50)	9.08 (82)	6.15 (40)	5.87 (34)	4.26 (18)	74.95
Weedy check	14.67 (215)	14.16 (200)	9.82 (96)	10.22 (104)	8.74 (76)	10.02 (100)	0.00
LSD (p=0.05)	0.47	2.28	2.57	1.77	0.49	0.81	5.59

Table 2. Effect of weed management treatments on weed biomass at harvest, groundnut pod yield, and economics

Treatment	Grassy weeds biomass (g/m^2)	Broad-leaved weeds biomass (g/m^2)	Sedge weeds biomass (g/m^2)	Groundnut pod yield (t/ha)	Economics		
					Cost of cultivation (x103 `/ha)	Net returns (x103 `/ha)	B:C ratio
Diclosulam 17g/ha PPI *fb* HW at 50 DAS	5.52(30)	5.41(29)	4.52(20)	2.23	45.58	68.48	1.50
Diclosulam 27 g/ha PPI *fb* HW at 50 DAS	5.29(27)	5.22(27)	3.71(13)	2.63	46.11	88.20	1.91
Diclosulam 17g/ha PE *fb* HW at 50 DAS	5.41(29)	5.52(30)	4.27(18)	2.42	45.58	77.99	1.71
Diclosulam 27 g/ha PE *fb* HW at 50 DAS	4.61(21)	4.87(24)	3.71(13)	3.00	46.11	107.33	2.32
HW at 30 DAS *fb* diclosulam 7g/ha PoE at 50 DAS	8.54(72)	5.92(35)	6.53(43)	2.04	45.58	58.74	1.28
HW at 30 DAS *fb* diclosulam 27 g/ha PoE at 50 DAS	8.17(66)	5.71(32)	6.17(38)	2.01	46.11	56.81	1.23
HW twice at 30 DAS and 50 DAS	4.52(22)	5.12(25)	5.62(31)	2.75	49.76	90.53	1.81
Weedy check	10.48(109)	7.94(63)	8.12(67)	1.27	37.76	27.34	0.72
LSD (p=0.05)	1.15	072	1.34	0.89			

Figures in the parentheses indicated original values which are subjected to square root transformation; HW: Hand weeding; PPI: Pre-plant Incorporation; PE: Pre-emergence application; PoE: Post-emergence application; DAS = days after seeding; *fb* = followed by

biomass. Highest weed control efficiency achieved at 80 DAS of observation with hand weeding at 30 and 50 DAS and diclosulam 27 g/ha PE *fb* hand weeding at 50 DAS respectively. Application of diclosulam either as a pre-plant incorporation or pre-emergence is more effective on broad-leaved weeds and sedges as it resulted in lowest weed biomass with this treatment. The greater efficacy of higher dose (20 and 26 g/ha) of diclosulam, in controlling all type of weeds, when compared to low dose (18 g/ha) was reported earlier (Singh *et al.* 2009, Naveen *et al.* 2019).

The highest pod yield was recorded with diclosulam 27 g/ha PE *fb* hand weeding at 50 DAS (**Table 2)** which may be attributed due to low crop-weed competition throughout crop growth. Price *et al.* (2002) reported that among different doses diclosulam herbicides, 17.5, 27 and 52 g/ha PE recorded highest groundnut pod yield (3.50-5.25 t/ha). The cost of cultivation was maximum of ₹ 49,765/ha with hand weeding twice at 30 DAS and 50 DAS. The net return (₹ 1,07,335) and B:C ratio (2.32) were maximum with diclosulam 27 g/ha (PE*) fb* hand weeding at 50 DAS, due to higher pod and haulm yields.

The results of the study indicated that pre-emergence application of diclosulam at 27 g/ha recorded higher groundnut yield attributes and seed yield with lower weed density and biomass; higher weed control efficiency and higher B:C ratio.

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