Eco. Env. & Cons. 28 (3) : 2022; pp. (1390-1394)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2022.v28i03.041

Effect of herbicides on weed infestation, productivity of groundnut and their residual effect on sunflower

Shivanand N. Honnali[1] and D.G. Satihal[2]

[1]Agronomy, Agriculture Extension Education Centre, Bheemarayanagudi, Karnataka, India
[2]Agricultural Research Station, Bheemarayanagudi, Karnataka, India
University of Agricultural Sciences, Raichur, Karnataka, India

Received 6 October, 2021; Accepted 3 December, 2021)

ABSTRACT

Presently very few herbicides are available for groundnut cultivation, so field experiment was conducted to assess the efficacy of pre emeregent herbicide Diclosulam 84 % WDG on groundnut. Among the three levels higher dose of diclosulam 84% WDG @ 26 g *ai*/ha found effective in controlling the weeds, which recorded lower weed density and weed dry weight compared to lower levels of diclosulam, pendimethalin and oxyfluorfen. Diclosulam 84% WDG @ 26 g *ai*/ha recorded higher weed control efficiency (95.34%) and number of pods per plant (27), pod dry weight per plant (15.15 g) and pod yield (2470 kg/ha) compared to lower levels of diclosulam and other herbicides. Herbicide residual effect was studied on sunflower in the same plot, there was no effect of diclosulam 84% WDG @ 26 g *ai*/ha on germination, yield parameters and yield of sunflower.

Key words: *Groundnut, Herbicides, Pod yield, Residual effect*

Introduction

Groundnut is one of the most popular oilseed and important cash crops of our country. It is a low-priced commodity, but a valuable source of all the nutrients. Though India ranks first in acerage, but stands second in production after China. The area under groundnut fluctuating since last two decades and is reduced due to shifting of cropping system from groundnut to other remunerative crops. In India presently groundnut area was 55.0 lakh hectare with production of 101.1 tonnes, with a productivity of 1816 kg/ha during 2020-21 (Agricoop.nic.in), but crop is loosing its ground to other potential crops due to low productivity, high seed cost and drudgery associated with weeding and harvesting. The demand for edible oil is rising day by day and area as well as productivity of this crop declined drastically. Among the various factors responsible low yields of groundnut, severe infestation of weeds during the early crop growth period is one of the constraints. Among the three seasons 80 % area comes during *kharif* season. Groundnut is highly susceptible to weed infestation because of its slow growth at initial stages (upto 40 DAS) and short stature with underground pod bearing habit. Weeds compete with crop soil moisture, nutrients and light and reduce the yield. Weeds also act as alternate host for pest and diseases. The critical period of crop weed competition in groundnut was observed during initial four to eight weeks. The loss in yield of groundnut pods due to weed competition ranged from 30 to 40 %. Hand weeding and use of intercultural operations reduce the weed population consid-

([1]Assistant Professor, Agronomy, [2] Senior Farm Superintendents)

erably, but the timing and frequency is critical for effective weed control. The expensive and very limited availability of labour and in heavy soils difficulty in mechanical weeding due to rain creats problem in effective weed control in *kharif* crops is one of the factor, which does not permit hand weeding and interculturing. In such situation herbicidal application remains viable option for weed management (Nainwal *et al.*, 2010).

Presently very few herbicides are available for groundnut cultivation. So the present investigation on new molecule Diclosulam 84 %WDG was tested in groundnut weed management. In recent years, new generation low dose and high efficiency herbicide molecules such as diclosulam is available. which were found to exhibit broad-spectrum weed control with low mammalian toxicity compared to high volume herbicides like pendimethalin. In this context, there is a need to evaluate these low dose and high efficiency herbicides for control of weeds in groundnut.

Materials and Methods

The experiments were conducted at Agricultural Research Station, Bheemarayanagudi, University of Agricultural Sciences, Raichur. The first experiments laidout in randomised block design, consists of 7 treatments namely three levels of Diclosulam 84 % WDG (18, 22 and 26 g ai/ha), Pendimethalin 30% EC @ 1000 g ai/ha, Oxyfluorfen 23.5 % EC @ 150 g ai/ha as pre-emergence applications, two hand weeding at 30 and 45 DAS and Untreated Control (Weedy Check) with three replications, second experiment consists 3 treatments ie. two levels of Diclosulam 84% WDG (26 and 52 g ai/ha) and one untreated check with 3 replications followed by its residual effect on succeeding crop of sunflower in randomized block design (RBD). Groundnut variety Kadri -9 was selected for the evaluation of herbicide. The recommended agronomic practices were followed for crop. The volume of water 500 l./ha was used for the application of the herbicide. Pre emergence herbicides were sprayed immediately after sowing. Two hand weeding was taken up twice at 30 and 45 days after planting. The populations of dominant weeds were recorded separately at 60 Days After Application (DAA) of the test herbicide while the dry weights of dominant weeds were recorded separately. The density and dry weight of the weed flora was recorded by placing 50 cm x 50 cm quadrate thrice per plot for evaluating the relative efficacy of the products and the data were presented on number and g per square meter basis.

Weed control efficiency was calculated based on the data recorded 60 DAA in groundnut as per the formula as given below:

$$\text{Weed Control Efficiency (\%)} = \frac{\text{WDC - WDT}}{\text{WDC}} \times 100$$

Where,

WDC = Weed dry weight in untreated control, g/m^2

WDT = Weed dry weight in treated plot, g/m^2

Statistical analysis was carried out for the observation by subjecting data to $\sqrt{x} + 0.5$ transformation

The effect of herbicide on the succeeding crops as some herbicides have phytotoxic effect on succeeding crop after groundnut, so sunflower is an important crop. Keeping this in view, the carry over study was conducted with the objective to determine the residual effect of Diclosulam 84 % WDG applied in groundnut on the succeeding crop of sunflower. After groundnut harvest, sunflower was grown as rotation crop under zero till condition in fixed plots to study the effect of herbicide on the succeeding crop sunflower.

Sunflower cultivar GK-202 was sown at a row spacing of 60 X 20 cm for recording germination and yield observations. Need based irrigation and fertilizer applications were done. Observations on the crop germination at 10 DAS and any symptoms of phytotoxicity were recorded at 15, 30 and 45 days after sowing. Sunflower crop was harvested, yield parameters and yield was recorded.

Results and Discussion

Weed flora

The dominant weed flora observed in experiment plot were grassy weeds like *Digitaria sanguinalis, Dactyloctenium aegyptium,* and the sedge weed flora was *Cyperus rotundus.* Among broadleaf weed flora *Tubulis terestries, Amaranthus sps* and *Solanum nigrum* were dominant.

Weed Density, weed dry weight and Weed Control Efficiency

The data on weed density, biomass and weed control efficiency (Table 1) during both the seasons indicated that, among the applied doses of the herbicide Diclosulam 84 % WDG at the rate of 18. 22 and

26 g *ai*/ha, along with pendimethalin @ 1.0 kg *ai*/ha and Oxyfluorfen @ 150 g ai/ha recorded lower weed density and weed dry weight at 60 DAA. Higher total weed density (128 and 154 m^{-2}) and dry weight of weeds (93.33 and 116.6 gm^{-2}) were observed in untreated control (weedy check) treatments in both the seasons and lowest total weed density and dry weight of weeds were observed in two hand weeding treatment. Among the herbicides lower total weed density (3.33 and 8.0 m^{-2}) and weed dry weight (4.33 and 5.66 gm^{-2}) was recorded in Diclosulam 84 % WDG @ 26 g *ai*/ha in both the seasons followed by Diclosulam 84 % WDG @ 18 and 22 g *ai*/ha and also pendimethalin and oxyfluorfen. Similar results were also reported by Price *et al.* (2002). Grichar *et al*. (2006) also reported higher weed control by application of diclosulam as pre plant incorporation or as pre emergence in peanut. Weed control efficiency was higher in Diclosulam 84 % WDG spray at 26 g *ai*/ha (95.34 and 95.03) during both the seasons respectively followed by Diclosulam 84 % WDG at 18 and 22 g *ai* ha and pendimethalin @ 1.0 kg *ai* /ha and oxyfluorfen @ 150 g *ai*/ha. The results indicates that the Diclosulam 84 % WDG @ 26 g *ai*/ha suppresses the all types of broad leaf weeds, grasses and sedge weeds. Diclosulam having higher half life period along with higher leaching potential index lead to increased concentration in deeper layer to control even sedges and broad leaf weeds, that leads to longer duration for management of dicot weeds (Naveenkumar *et al*. 2020). Weed flora associated with groundnut comprises diverse species, which reduce the yield upto 81 % groundnut pod yield (Jat *et al*., 2011).

Yield

The effect of weed management practices on groundnut productivity was found significant in both the seasons. Weed free treatment recorded significantly higher pods (29.33 and 32.67 per plant) and pod dry weight (16.6 and 19.6 g/plant) compared to all other treatments during both the seasons, but the number of pods and pod dry weight were on far with the different concentration of Diclosulam 84 % WDG. Among the herbicide treatments, Diclosulam 84 % WDG @ 26 g *ai*/ha has recorded significantly higher pods (27.0 and 30.33 per plant) and pod dry weight (15.17 and 18.20 g/plant) compared to lower doses of Diclosulam and all other herbicides during both the seasons. The positive relation exist between yield and levels of diclosulam was found in groundnut yield and it was curvilinear (Y= 406.66 + 216.255x – 4.506x2) and higher dose of diclosulam was 24 g *ai* per ha which yielded maximum *i.e.* 3, 001 kg/ha (Price and Wilcut, 2002). Similar effect of Diclosulam were observed in soyabean crop (Singh *et al.* 2009)

Groundnut pod yield (Table 2) was highest in weed free treatment during first season (2570 kg ha^{-1}) and second season (2783 kg ha^{-1}) the pod yields were on par with the Diclosulam 84 % WDG @ 26 g *ai*/ha (2470 and 2710 kg ha^{-1}, respectively). Pod yield of groundnut in untreated check were 56 % lower compared to weed free treatment. Pod yields in weedy check (untreated control) were significantly

Table 1. Effect of different herbicides on weed density, dry weight and weed control efficiency in groundnut at 60 days after sowing.

Treatments	I Season			II Season		
	Total Weed Density per m^2	Dry weight of weeds (gm^{-2})	WCE (%)	Total Weed Density per m^2	Dry weight of weeds (gm^{-2})	WCE (%)
T_1: Diclosulam 84 % WDG @ 18 g *ai*/ha	4.77(22.3)	3.81(14.0)	84.95	6.03(36.0)	3.98(15.33)	86.76
T_2: Diclosulam 84 % WDG @ 22 g *ai*/ha	3.93(15.0)	3.39(11.0)	88.19	5.61(31.0)	3.63(12.66)	89.01
T_3: Diclosulam 84 % WDG @ 26 g *ai*/ha	1.80(3.33)	2.18(4.33)	95.34	2.88(8.00)	2.45(5.66)	95.03
T_4: Pendimethalin 30% EC @ 1000 g *ai*/ha	4.45(19.3)	4.34(18.33)	80.33	6.16(37.66)	4.67(21.33)	81.54
T_5: Oxyfluorfen 23.5 % EC @ 150 g *ai*/ha	6.75(45.3)	5.51(30.0)	67.99	8.13(65.66)	5.61(31.00)	73.39
T_6: Two hand weeding at 30 and 45 DAS	0.71(0.00)	0.71(0.00)	100.0	0.71(0.00)	0.71(0.00)	100.0
T_7: Untreated Control (Weedy Check)	11.3(128.0)	9.68(93.33)	-	12.44(154.0)	10.81(116.6)	-
CD (P=0.05)	1.05	0.46	-	0.57	0.62	-

* Data subjected to "x + 0.5 transformation and figures in the parentheses are original values

lowest when compared to herbicide treatments during both the seasons. Similarly Nainwal *et al.* 2010 reported pre emergence application of Diclosulam on soybean yield. This clearly indicates the infestation of weeds was higher and its impact on groundnut pod yield, this was mainly due to lower number of pods per plant and lower pod dry weight in untreated check. Higher groundnut pod yield were also reported by Naveekumar *et al*.(2020) by pre emergence application of diclosulam followed by one hand weeding at 40 DAS.

After harvest of groundnut, sunflower was grown to evaluate the herbicide carry over effect and the response is given in Table 3, Observations on phyto-toxicity was recorded at 15, 30 and 45 DAS on succeeding crop in those plots where Diclosulam 84 % WDG was applied on groundnut crop in the previous season at recommended (26 g a.i /ha) and double the recommended dose (52 g *ai* /ha) in comparison to control. The perusal of data indicates no adverse effect of Diclosulam 84 % WDG treatment @ 26 g ai/ha on sunflower as there was no injury on sunflower crop. But germination of sunflower was affected when Diclosulam 84 % WDG applied at double dose @ 52 g *ai*/ha. The germination count (62.54 and 57.54 %, respectively) was affected by higher dose during both the seasons. The germination of sunflower was not affected when Diclosulam 84 % WDG @ 26 g *ai*/ha (82.81 and 82.90 %, respectively) was applied to groundnut compared to untreated check (83.27 and 83.81 %, respectively) during the both seasons. The yield parameters like head diameter (13.20 and 14.35 cm), number of seeds/ head (680 and 784) and seed filling (81.3 and 87.2 %) were more in Diclosulam 84 % WDG applied at double dose @ 52 g *ai*/ha during both the seasons compared to Diclosulam 84 % WDG @ 26 g *ai*/ha and untreated check treatments, this was due to lower plant population used all resources efficiently like space and nutrients.

The seed yield of sunflower was higher in untreated control (965 and 1288 kg ha^{-1}, respectively) compared to herbicide applied treatments in both the seasons. The seed yield of sunflower in recommended dose of diclosulam 84 % WDG @ 26 g *ai*/ha (958 and 1275 kg ha^{-1}, respectively) was almost equal

Table 2. Effect of different herbicides on groundnut productivity

Treatments	I Season			II Season		
	Number of pods/ plant	Dry weight of pods/ plant (g)	Groundnut pod yield (kg/ha)	Number of pods/ plant	Dry weight of pods/ plant (g)	Groundnut pod yield (kg/ha)
T_1: Diclosulam 84 % WDG @ 18 g *ai*/ha	22.33	12.60	2200	27.00	16.20	2298
T_2: Diclosulam 84 % WDG @ 22 g *ai*/ha	24.33	13.53	2227	28.33	17.00	2527
T_3: Diclosulam 84 % WDG @ 26 g *ai*/ha	27.00	15.17	2470	30.33	18.20	2710
T_4: Pendimethalin 30% EC @ 1000 g *ai*/ha	20.00	10.83	1730	23.00	13.80	2210
T_5: Oxyfluorfen 23.5 % EC @ 150 g *ai*/ha	19.00	11.00	1670	22.33	13.40	2010
T_6: Two hand weeding at 30 and 45 DAS	29.33	16.60	2570	32.67	19.60	2783
T_7: Untreated Control (Weedy Check)	13.33	7.57	1123	13.33	8.00	1233
CD (P=0.05)	7.32	3.66	238	6.28	3.77	326

Table 3. Effect on succeeding crop (Sunflower) for Diclosulam 84 % WDG weed control in groundnut

Treatments	Germination count (%)	Seed yield (kg/ha)	Head diameter (cm)	Number of seeds/ head	Seed filling (%)	100 seed weight (g)
I Season						
T_1: Diclosulam 84 % WDG @ 26 g ai/ha	82.81	958	12.90	655	79.8	3.86
T_2: Diclosulam 84 % WDG @ 52 g ai/ha	62,54	621	13.20	680	81.3	3.85
T_3: Untreated Check	83.27	965	12.85	658	81.0	3.90
II Season						
T_1: Diclosulam 84 % WDG @ 26 g ai/ha	82.90	1275	14.20	781	86.5	3.81
T_2: Diclosulam 84 % WDG @ 52 g ai/ha	57.54	890	14.35	784	87.2	3.77
T_3: Untreated Check	83.81	1288	14.22	773	86.7	3.82

to untreated check treatments during both the years, but when Diclosulam 84 % WDG applied at double dose @ 52 g *ai*/ha sunflower yield was reduced upto 30-35 % compared to recommended dose of diclosulam 84 % WDG @ 26 g *ai*/ha. This was due to less plant populations in higher than the recommended dose of recommended dose of diclosulam 84 % WDG @ 52 g *ai*/ha during both the seasons.

Conclusion

The application of Diclosulam 84 % WDG @ 26 g *ai*/ha found best in control of weeds in groundnut. The highest groundnut pods per plant, pod dry weight per plant and pod yield recorded by the application of Diclosulam 84 % WDG @ 26 g *ai*/ha as pre emergent herbicide and which was on par with hand weeding at 30 and 45 DAS. Diclosulam 84 % WDG @ 26 g *ai*/ha has no residual effect on germination, growth and yield of sunflower crop grown as sub sequent crop after the harvest of groundnut.

References

Grichar, W. J., Peter, D. A., Brent, B. A. and Vernon, L. B. 2006. Weed control programs in peanut (*Arachis hypogaea*) with diclosulam and ethalfluralin combinations. *The Texas Journal of Agriculture and Natural Resource.* 19: 62-71.

Jat R. S., Meena, H. N., Singh, A. L., Surya, N. J. and Mishra, J. B. 2011. Weed management in groundnut (*Arachis hypogaea* L.) in India - *A Review, Agricultural Reviews*. 32: 155-171.

Nainwal, R. C., Saxena, S. C. and Singh, V. P. 2010. Effect of pre-and post-emergence herbicides on weed infestation and productivity of soybean. *Indian Journal of Weed Science.* 42 (1&2) : 17-20.

Naveen Kumar, B., Subramanyam, D., Nagavani, A. V., Umamahesh, V. and Sagar, G. K. 2020. Performance of new herbicides in groundnut and their carryover effect on fodder sorghum. *Indian Journal of Weed Science.* 52(4): 396–399.

Price, A. J. and Wilcut, J. W. 2002. Weed Management with diclosulam in strip-tillage peanut (*Arachis hypogaea*). *Weed Technology.* 16 : 29–36.

Price, A. J., Wilcut, J. W. and Swann, C. W. 2002. Weed Management with Diclosulam in Peanut (*Arachis hypogaea). Weed Technology.* 16 : 724–730.

Singh, S. P., Singh, V. P., Nainwal, R.C., Tripathi, N. and Kumar, A. 2009. Efficacy of diclosulam on weeds and yield of soybean. *Indian Journal of Weed Science.* 41(3&4) : 170-173.

www.Agricoop.nic.in