COMPARATIVE EVALUATION OF PRE AND POST-EMERGENCE HERBIICDES IN GROUNDNUT (ARACHIS HYPOGAEA L.)

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Abstract

Background - Herbicides are generally used in agriculture to control weeds and to improve crop yield.Pendimethalin is contemporary pre-emergence herbicide used in groundnut and many other crops but it is not very effective against broadleaved weeds. Diclosulam is a novel herbicide belongs to class triazolopyrimidinesulphonamide, which is highly effective for the control of broadleaf weeds in a number of field crops.The current study aimed to improve the profitability of farmers by effectively and economically by controlling the targeted weeds.

Method: A field experiment was conducted during *Kharif*season of 2021at Zonal Agricultural and Horticultural Research Station, Hiriyurto evaluate the pre and post-emergence herbicides in groundnut.The experiment was laid out in randomized complete block design with ten treatments each replicated thrice. The treatments consisted of different pre-emergence herbicides with varying doses (Diclosulam 84 WDG at 20 and 25 g a.i. ha-1 and Pendimethalin 30% EC at 1.0 kg a.i. ha-1) followed by manual weeding at 30 DAS, post-emergence herbicide (Quizalofop-p-Ethyl 5 % EC 50 g a.i. ha-1) it has been compared with intercultural operations at 15 and 30 DAS *fb* manual weeding for intra rows and weedy check.

Results: Results revealed that significantly higher weed control efficiency and lower weed index was noticed with intercultural operations at 15 and 30 DAS *fb* manual weeding for intra rows(90.79 and 84.32% at 30 and 60DAS, 0.00%, respectively) and inturn it recorded significantly higher pod yield (2621 kg ha-1) compared to the other treatments. Among different herbicides with different doses, Diclosulam 84 WDG at 25 g a.i. ha-1*fb*hand weeding at 30DAS recorded higher weed control efficiency(85.75 and 81.11 % at 30 and 60 DAS, respectively) and lower weed index (0.81%), significantly higher pod yield(2602 kg ha-1) as compared with weedy check (1114 kg ha-1). Although higher gross returns (₹ 129147ha-1) and net returns (₹ 68138 ha-1) was realized with application of Diclosulam 84 WDG at 25 g a.i. ha-1 (PE) followed by hand weeding at 30 DAS, higher B:C ratio (2.21)was noticed in treatment Diclosulam 84 WDG at 25 g a.i. ha-1*fb*Quizalofop-p-Ethyl 5% EC 50 g a.i. ha-1 at 20 DAS.

I. INTRODUCTION

Groundnut is one of the most important oilseed crop of India with average productivity is about 1,703 kg ha-1. In karnataka, groundnut is grown in an area of 7.21 lakh ha with a production of 7.20 lakh tonnes and productivity of 999 kg ha-1 (Anon., 2021). The major groundnut growing districts are Chitradurga, Dharwad, Belgaum, Raichur, Bijapur, Bellary and Bidar. The productivity of groundnut in these districts is lower than national productivity. In recent years, many researchers shown that area under groundnut is decreasing gradually in dry lands, due to scanty and erratic rainfall and low moisture availability at critical stages and heavy weed infestation appears to be the most serious problem in groundnut production causing economic losses.

Weed infestation is an important limiting factor in achieving potential productivity of groundnut. Yield loss due to heavy weed infestation in groundnut ranged from 13-80 per cent in India.Early weeding is essential to avoid the competition with weeds and to establish slow growing crops and also groundnut.Weeds interfere with pegging, pod development and harvesting of groundnut during different stages of crop growth, besides competing for growth resources. Being a *kharif*crop and slow growth during initial stages, where groundnut encounters severe weed infestation problem especially in the early stages of their growth, as the crop seedling emerges seven to ten days after sowing coupled with the slow growth in the initial stages.The critical period for crop-weed competition in groundnut crop was reported to be, upto 45 days and by maintaining weed free condition during this period results in higher pod yield(Geetha*et al*., 2017).

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 1.0 kg ha-1 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 like *Cyperusrotundus.* However, new molecules that are more effective are being discovered and used as next-generation herbicides to

address early weed control and to reduce weeding costs. Diclosulam is a novel herbicide belongs to class triazolopyrimidinesulphonamide, which is highly effective for the control of broadleaf weeds in a number of field crops and forestry applications (Reddy, 2000; Singh *et al*., 2009). It inhibits the enzyme acetolactate synthase (ALS); stops the cell division and weed growth. 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 in groundnut.

II. MATERIAL AND METHODS

A field experiment was conducted during *kharif* season of 2021 at Zonal Agricultural and Horticultural Research Station, Babbur farm, Hiriyur, KSNUAHS, Shivamogga, Karnataka, India. The experimental site is situated between 13°57′32′′ N latitude and 70°37′38′′ E longitude with an altitude of 606.1 meters above mean sea level.

It comes under Central Dry Zone (Agro-climatic zone 4) of Karnataka. The soil was medium black with slightly alkaline in reaction, low in available nitrogen, medium in available phosphorus, medium in available potassium and low in organic carbon.The experiment was laid out in randomized complete block design with ten treatments each replicated thrice. The treatments consisted of different pre emergent with varying doses (Diclosulam 84 WDC at 20 and 25 g a.i. ha-1 and Pendimethalin 30 % EC at 1.0 kg a.i. ha-1) followed by manual weeding at 30 DAS and post emergent herbicide (Quizalofop-p-Ethyl 5% EC 50g a.i. ha-1) it has been compared with intercultural operations at 15 and 30 DAS *fb* manual weeding for intra rows and weedy check.Healthy and sound groundnut kernel of variety Dh 256 were sown on 7thjuly, 2021 at spacing of 30 cm × 10 cm. Recommended dose of fertilizer (25:50:25 kg of N:P:K ha-1) along with gypsum 500 kg ha-1, FeSo4 and ZnSo4 25kg ha-1 were applied at basal.

Pre-and post-emergence herbicides were applied at two and 20 DAS byhand operated knapsack sprayer fitted with flood jet nozzle WFN 72 using a spray volume of 750 and 500 l ha-1 respectively.Weed density and weed dry weight were recorded at 30 and 60 DAS and transformed to square root transformation $\sqrt{x + 0.5}$ to normalize their distribution. Yield were recorded at harvest from net plot area and computed to ha-1. Cost of cultivation, gross returns, net returns and B:C ratio were calculated based on the prevailing market price of inputs and outputs.

III. RESULTS AND DISCUSSION

WEED DENSITY

The predominant weed flora observed in the experimental field of groundnut consisted of grassy weeds viz., Dinebraretroflexa, Digitariaciliaris, Dactylocteniumaegyptium and Cynodondactylon. Among broad leaved weeds Parthenium Hysterophorus, Acanthospermumhispidium, Commelinabenghalensis, Polygonumaviculare and sedgesCyperusrotundus. Hence the weed flora in the experimental site was classified as grasses, sedges and broad leaved weeds (BLW).

The weed management practices had significantly influenced the weed growth and yield of groundnut. Significantly lowest total weed density was observed in treatment receiving pre-emergence application of Diclosulam 84 WDG at 25 g a.i. ha-1super imposed with hand weeding at 30DAS (3.86, 5.65and 2.64, 3.41 m-2 at 30 and 60 DAS, respectively) over all other weed management practices and it was found to be on par with treatment receiving intercultural operation at 15 and 30 DAS *fb* manual weeding for intra rows(2.87,5.13 and 2.16, 3.12 m-2 at 30 and 60 DAS, respectively) (Table 1). This was due to inhibition of acetolactate synthase (ALS) enzyme activity in germinating weed seeds which is responsible for biosynthesis branched chain amino acids *viz*., leucine, isoleucine and valine. Grey *et al*. (2004) also reported that pre-plant incorporation of diclosulam 26 g a.i. ha-1 controlled yellow nutsedge upto 90 per cent.While the combination of hand weeding at 30 DAS will completely eradicate all the left over weed species in the field, which resulted in lower total weed density over single application.

WEED DRY WEIGHT, WEED CONTROL EFFICIENCY AND WEED INDEX

In general, the dry matter accumulation of weeds increased with the increasing weed density as well as variation of weed species and their growth.Treatment receiving pre-emergence application of Diclosulam 84 WDG at 25 g a.i. ha-1super imposed with hand weeding at 30DASrecorded significantly lower weed dry weight (2.64 and3.41g m-2 at 30 and 60 DAS, respectively) and was found to be on par withtreatment receiving intercultural operation at 15 and 30 DAS *fb* manual weeding for intra rows (2.16 and 3.12 g m-2 at 30 and 60 DAS, respectively) (Table 1). This might be due lesser weed density in the respected treatment resulted in the lowest weed dry weight of weeds was recorded with PE application of diclosulam which was significantly superior over rest of the treatments due to effective control of all the categories of weeds including predominant weed, *Cyperusrotundus* more effectively, because of its longer half-life period and high leaching potential lead to increased availability

of herbicide to all the categories of weed seeds (Grey *et al*., 2004).

In a crop season, weed control efficiency of herbicidal treatments normally decreases as the date of observation advances. For example, by application of herbicide, WCE obtained at initials days is usually the highest and then it gradually decreases as the crop growth advances towards maturity. This all happens due to an increase in weed population over time under herbicide-treated plots because the activity of herbicide goes on decrease at the later stages of crop (Vishwanath, 2017).Treatment receiving pre-emergence application of Diclosulam 84 WDG at 25 g a.i. ha-1super imposed with hand weeding at 30DAS recorded significantly higher weed control efficiency (2.64 and 3.41% at 30 and 60 DAS, respectively) and was found to be on par withtreatment receiving intercultural operation at 15 and 30 DAS *fb* manual weeding for intra rows (2.16 and 3.12 % at 30 and 60 DAS, respectively) (Table 1).While lower weed index was observed in treatment receiving pre-emergence application of Diclosulam 84 WDG at 25 g a.i. ha-1super imposed with hand weeding at 30DAS (0.81 %). The above result may be due to PE application of diclosulam found to be very effective in reducing total weed dry weight lead to increased weed control efficiency as a result of broad-spectrum weed control so that there is less crop-weed competition at initial stages and by one hand weeding at 30 DAS all the weeds are manually removed, correspondingly manual weeding improves the soil aeration and increase nutrient availability to the crop through active mineralization and decomposition (Aradhanabali*et al*., 2016), which favours peg initiation without any weed competition, in this case there is a higher WCE and lower weed index (WI) due to increases in yield through less weed density. These results were in line with the finding of Malligawad*et al*. (2000)and Kalhapure*et al*. (2013).

YIELD AND YIELD PARAMETERS

The yield level among the herbicide trials, significantly higher pod yield was recorded in application Diclosulam 84 WDG at 25 g a.i. ha-1 (PE) *fb* hand weeding at 30DAS (2602 kg ha-1) with increase in 36.80 per cent over Pendimethalin 30% EC at 1.0 kg a.i. ha-1(1902 kg ha-1) (Fig. 1). This might be due to minimum crop-weed competition and effective control of broad spectrum of weeds for a longer period in the early stage of crop and provided congenial environment for growth and development will improve the yield upon by about 20-30 per cent. This due to the application of herbicide along with cultural practice or post-emergent herbicide the weeds which are escaped or established later will be controlled by the succeeding method ofweed management and weeds which are resistance to herbicide will also be suppressed by the manual weeding which is done after the application of pre-emergence spray so that at early and later stages of crop growth weeds are reduced, thus it favours for better growth and development of reproductive parts *viz*., flowering, peg formation and pegging, pods per plant thus finally increases the pod yield. These findings were close conformity with Geetha*et al*. (2017) and Timsina*et al*. (2020).

The increase in the pod yield is contributed by the higher number of pods per plant, hundred kernel weight in treatment receiving PE application of Diclosulam 84 WDG at 25 g a.i. ha-1 (PE) *fb* hand weeding at 30DAS (27.70 and 52.10, respectively) and was found to be on par with Intercultural operation at 15 and 30 DAS *fb* manual weeding for intra rows (29.10 and 29.10, respectively) as a result of broad-spectrum weed control in these treatments leading to efficient translocation of assimilates from source to pods. Further, weed free environment facilitated better peg penetration and pod development which in turn increased the number of pod per plant and thereby higher pod yield. These results are in agreement with Sharma *et al*. (2015).

ECONOMICS

Unlike observed higher gross and net returns was realized with application of Diclosulam 84 WDG at 25 g a.i. ha-1 (PE) followed by hand weeding at 30 DAS(₹ 129147ha-1and ₹ 68138 ha-1, respectively). Significantly higher benefit: cost ratio was realized with application of both pre- and post-emergence herbicide Diclosulam 84 WDG at 25 g a.i. ha-1 (PE) followed by Quizalofop-p-ethyl 5% EC 50g a.i. ha-1 (PoE) at 20DAS (2.21) as compared to weed control plot (1.09).

IV. CONCLUSION

Significantly lowest total weed density was observed in treatment receiving pre-emergence application of Diclosulam 84 WDG at 25 g a.i. ha-1super imposed with hand weeding at 30DAS (3.86, 5.65 and 2.64, 3.41 m-2 at 30 and 60 DAS, respectively). In weed dry weight, Diclosulam 84 WDG at 25 g a.i. ha-1super imposed with hand weeding at 30DAS recorded significantly lower weed dry weight (2.64 and 3.41g m-2 at 30 and 60 DAS, respectively) and was found to be on par withtreatment receiving intercultural operation at 15 and 30 DAS *fb* manual weeding for intra rows (2.16 and 3.12 g m-2 at 30 and 60 DAS, respectively). Treatment receiving pre-emergence application of Diclosulam 84 WDG at 25 g a.i. ha-1super imposed with hand weeding at 30DAS recorded significantly higher weed control efficiency (2.64 and 3.41 % at 30 and 60 DAS, respectively). While lower weed index was observed in treatment receiving pre-emergence application of

Diclosulam 84 WDG at 25 g a.i. ha-1super imposed with hand weeding at 30DAS (0.81 %). The yield level among the herbicide trials, significantly higher pod yield was recorded in application Diclosulam 84 WDG at 25 g a.i. ha-1 (PE) *fb* hand weeding at 30DAS (2602 kg ha-1) with increase in 36.80 per cent over Pendimethalin 30% EC at 1.0 kg a.i. ha-1(1902 kg ha-1).

Tr. No.	Treatment Details	Weed density (m^{-2})		Weed dry matter (g m^{-2})		Weed control efficiency(%)		Weed index (%)
		30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS	
T_1	Diclosulam 84 WDG at 20 g a.i. ha^{-1}	6.65 (46.20)	7.96(63.3)	3.50* (12.3)	4.65 (21.3)	74.12	64.08	21.01
T_2	Diclosulam 84 WDG at 25 g a.i. ha^{-1}	6.37 (42.30)	7.71(59.3)	3.45 (11.2)	4.50 (19.9)	74.78	66.44	17.57
T_3	Diclosulam 84 WDG at 20 g a.i. ha^{-1} (PE)*fb* hand weeding at 30DAS	4.39 (19.33)	5.99(35.6)	2.97 (9.7)	3.81 (14.1)	81.58	76.22	4.11
T_4	Diclosulam 84 WDG at 25 g a.i. ha^{-1} (PE)*fb* hand weeding at 30DAS	3.86 (14.93)	5.65(31.63)	2.64 (6.5)	3.41 (11.2)	85.75	81.11	0.81
T_5	Diclosulam 84 WDG at 20 g a.i. ha^{-1} (PE) *fb*Quizalofop-p-ethyl 5% EC 50g a.i. ha^{-1} (PoE) at 20DAS	4.63 (22.17)	6.18(37.9)	3.32 (10.6)	4.09 (16.3)	76.75	72.51	11.53
T_6	Diclosulam 84 WDG at 25 g a.i. ha^{-1}(PE) *fb*Quizalofop-p-ethyl 5% EC 50g a.i. ha^{-1} (PoE) at 20DAS	4.46 (20.50)	6.15(37.6)	3.18 (8.4)	4.01 (15.7)	78.73	73.52	7.29
T_7	Pendimethalin 30% EC at 1.0 kg a.i. ha^{-1}	6.94 (50.2)	8.01(64.13)	3.57 (11.8)	4.79 (22.6)	73.03	61.89	27.65
T_8	Pendimethalin 30% EC at 1.0 kg a.i. ha^{-1}*fb*Quizalofop-p-ethyl 5% EC 50g a.i. ha^{-1} (PoE) at 20DAS	5.19 (26.96)	6.47 (41.6)	3.41 (11.5)	4.10 (16.4)	75.44	72.34	11.87
T_9	Intercultural operation at 15 and 30 DAS *fb* manual weeding for intra rows.	2.87 (9.00)	5.13(26)	2.16 (4.2)	3.12 (9.3)	90.79	84.32	0.00
T_{10}	Weedy check	8.33 (72.60)	9.07(82.3)	6.77 (45.6)	7.71 (59.3)	0.00	0.00	57.42
S.Em ±		**0.34**	**0.22**	**0.19**	**0.19**	**3.37**	**3.70**	**1.64**
C.D @ 5%		**1.01**	**0.65**	**0.57**	**0.56**	**10.03**	**11.00**	**4.87**

Table 1: Weed density, weed dry matter, Weed control efficiency and weed index as influenced by different weed management practicesin groundnut

Tr. No.	Treatment Details	Yield parameters				Economics		
		No. of pods $plant^{-1}$	100 kernel weight (g)	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Gross returns (□ ha^{-1})	Net returns (□ ha^{-1})	B:C
T_1	Diclosulam 84 WDG at 20 g a.i. ha^{-1}	20.70	46.30	2075	2485	102917	50221	1.95
T_2	Diclosulam 84 WDG at 25 g a.i. ha^{-1}	20.90	46.80	2159	2713	107148	54139	2.02
T_3	Diclosulam 84 WDG at 20 g a.i. ha^{-1} (PE)*fb* hand weeding at 30DAS	25.60	51.80	2505	3219	122693	61997	2.05
T_4	Diclosulam 84 WDG at 25 g a.i. ha^{-1} (PE)*fb* hand weeding at 30DAS	27.70	52.10	2602	3365	129147	68138	2.12
T_5	Diclosulam 84 WDG at 20 g a.i. ha^{-1} (PE) *fb*Quizalofop-p-ethyl 5% EC 50g a.i. ha^{-1} (PoE) at 20DAS	22.50	50.30	2330	3077	115692	61646	2.14
T_6	Diclosulam 84 WDG at 25 g a.i. ha^{-1}(PE) *fb*Quizalofop-p-ethyl 5% EC 50g a.i. ha^{-1} (PoE) at 20DAS	24.30	51.10	2425	3189	120369	66011	2.21
T_7	Pendimethalin 30% EC at 1.0 kg a.i. ha^{-1}	20.30	45.20	1902	2423	94425	40901	1.76
T_8	Pendimethalin 30% EC at 1.0 kg a.i. ha^{-1}*fb*Quizalofop-p-ethyl 5% EC 50g a.i. ha^{-1} (PoE) at 20DAS	22.00	48.60	2307	2905	114511	59826	2.09
T_9	Intercultural operation at 15 and 30 DAS *fb* manual weeding for intra rows.	29.10	53.20	2621	3476	130200	55854	1.75
T_{10}	Weedy check	17.00	43.90	1114	2182	55694	4748	1.09
S.Em ±		**1.44**	**1.76**	**136**	**190**	**5392**	**4500**	**0.10**
C.D @ 5%		**4.28**	**5.23**	**404**	**566**	**16021**	**12181**	**0.29**

Table 2: Yield parameters and economics of groundnut as influenced by weed management practicesin groundnut

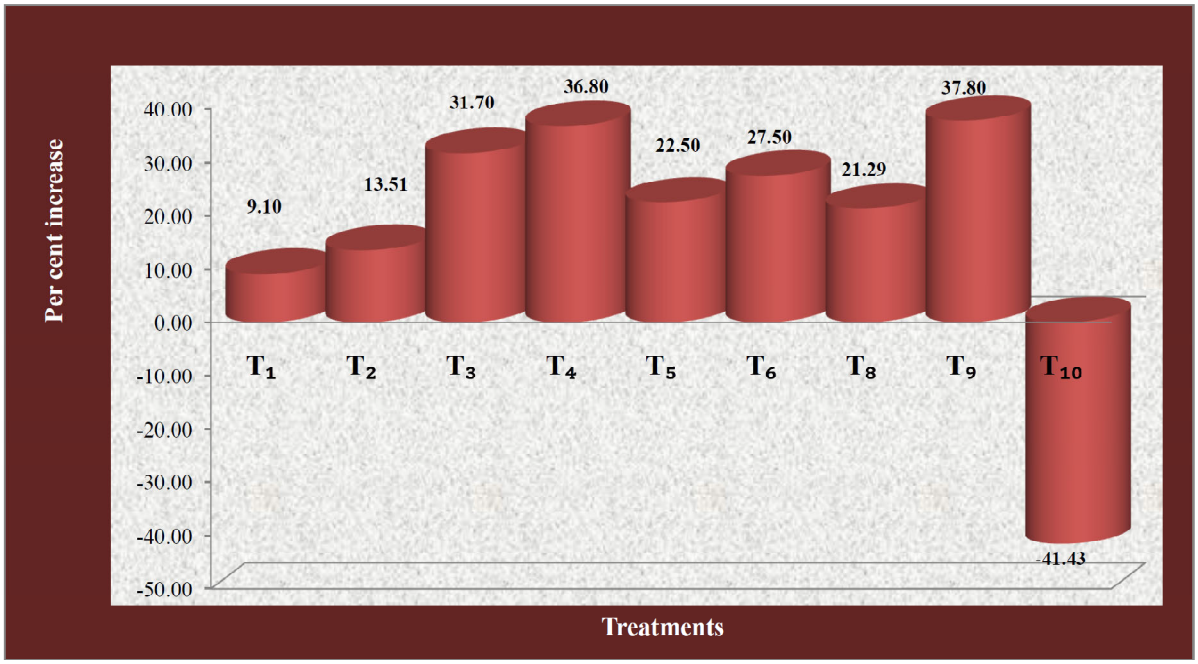


Fig. 1: Per cent increase in yield of groundnut as influenced by different weed management practices

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