



Research Article

BIOTOXIC EFFECT OF DICLOSULAM 84% WDG ON GROWTH, NODULATION AND NITROGEN CONTENT OF GREENGRAM

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Abstract- The effect of diclosulam WDG on plant growth, nodulation and crude protein content of greengram was studied during the kharif season of 2014 at Raichur (Karnataka). The pre-plant surface application of diclosulam @ 17.5 and 27g a.i. ha⁻¹ adversely affected the parameters because of its phytotoxic effect. Premergent application of pendimethalin 1.5 kg a.i. ha⁻¹ and diclosulam 17.5 g a.i. ha⁻¹ increased the total dry matter production (17.64 and 17 g/plant) among the herbicidal treatments. Pendimethalin 1.5 kg a.i. ha⁻¹ recorded increased the number of effective nodules formed per plant (22.93 and 59.63) and 22.06% of average maximum crude protein content compared to all the herbicide treated plots. In contrast, the pre-plant surface application of diclosulam 27g a.i. ha⁻¹ lower number of effective root nodules (12.47 & 44.80) @ 30 and 60 days respectively, and minimum crude protein content (21.54%). Among the different methods of application, diclosulam pre-plant surface application showed a large degree of phytotoxicity to the crop.

Keywords- Diclosulam, Preplant, Herbicides, Nodulation, Crude Protein.

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Introduction

The greengram grown in *kharif* season is severely infested by various grasses, sedges and broad-leaved weeds. Due to continuous rains in the monsoon adequate weed management measures cannot be carried out which further aggravate the weed problem. Hence, weeds emerge simultaneously with the crop plants and compete for essential nutrients, space and moisture causing substantial loss in yield depending upon the type of weed flora and weed density [1]. Several research results conducted elsewhere in India reported that full season association of weeds with crop resulted in 30-50 per cent reduction in yield [2-3]. The one of the choices for controlling weeds would be through herbicides at appropriate level. In recent years many new molecules have been synthesized which exhibit high level of activity at low dose of low shorter half-life, low mammalian toxicity and higher weed control efficiency. These herbicides are characterized by broad spectrum weed control with broad window of application, with an environmental advantage deriving from their very low application rates in grams rather than kg ha⁻¹ which markedly reduce the chemical load in the environment. In this aspect, an investigation was planned to study the effect on growth, nodulation and grain protein content of greengram of one such herbicide diclosulam 84 % WDG belonging to triazopyrimidine group of herbicides against weeds in greengram ecosystem.

Material and Methods

Field experiment was laid out at the Agronomy Field Unit, College of Agriculture, Raichur to know the efficacy of newer herbicide diclosulam 84 % WDG against weeds in greengram during *kharif* 2014 under irrigated condition. The experiment was laid out in a randomized block design with eleven treatments and three replications. The experimental soil was sandy loam in nature and the variety used

was BGS-9. The plot size was 3.3 m x 2.6 m with the spacing of 30 cm x 10 cm and treatment details

Application methods and dose variability studies of diclosulam 84 % WDG was evaluated with different treatments at two different doses (17.5 g and 27 g) and three methods of application (pre-plant surface, pre-emergence and post-emergence application). Pre-plant surface application was imposed by applying the herbicide to the soil surface 48 hours before sowing pre-emergent spray of herbicide was taken on the next day after sowing and post emergent application of the herbicide was taking between 2-26 days after sowing of the crop. All the agronomic practices were followed as per the recommendations of university package of practices except weed management measures.

The observations were recorded on the following parameters, plant height was measured from the ground level up to the base of node on which the first fully opened leaf from the top was borne on and expressed in centimeter, number of branches emerging directly from main stem was counted and the average of five plants was expressed as number of primary branches per plant and Plant samples for dry matter studies were collected and at each sampling, five plants were uprooted at random in each treatment and partitioned into stem, leaf and reproductive parts. These samples were oven dried at 65°C till a constant weight was recorded. The dry weight of different plant parts was recorded, the total dry matter production per plant was obtained with the summation of dry weight of all plant parts and was expressed on per plant basis (g plant⁻¹). The data on effective root nodules of the greengram was recorded from the five randomly selected plants 30 and 60 days after sowing and the nitrogen percentage in greengram seeds was estimated by modified Kjeldahl's method [4]. The protein content was calculated by multiplying the nitrogen percentage with factor 6.25[5].

Results and Discussion

Plant height indicates the weed suppressing ability of a crop. Greengram plants grown with different dose rates and methods of application of diclosulam herbicide showed a varied plant growth. At 60 DAS, the highest plant height was shown by pendimethalin @ 1.5 kg a.i ha⁻¹. Among the diclosulam treated plots, diclosulam 84% WDG @ 17.5 g a.i. ha⁻¹ as pre-emergent application recorded highest plant height which was statistically on par with pendimethalin. Observations on the number of branches followed the same trend. However, the shortest plant height and minimum number of branches was observed in imazethapyr @ 75 g a.i ha⁻¹ due to the phytotoxic effect on the crop.

The total dry matter production at various stages of the crop growth and its effective partitioning into the reproductive parts are the key factors contributing to the higher seed yield. The total dry matter produced by the greengram in all the treatments increased significantly compared to the unweeded check due to reduced weed competition significantly higher dry matter production was recorded in (T₁₀) weed free check (18.94 g plant⁻¹) but was on par with (T₈) pendimethalin @ 1.5 kg a.i. ha⁻¹ as a pre emergent spray (17.64 g plant⁻¹). The total dry matter produced in T₃ and T₈ recoded significantly higher than the unweeded check but on par with hand weeding. This clearly indicates the intense competition between crop and weeds for growth resources resulting in maximum reduction of dry matter

production in greengram in unweeded check and increased dry matter production under weed control treatments were also reported by earlier researchers' [6-7].

At 30 DAS, preplant surface application of diclosulam @ 17.5 g a.i. ha⁻¹(12.60) recorded significantly lower nodules number per plant compared to other treatments and all the treatments with diclosulam PRE at both the doses were on par with preplant surface application of diclosulam@ 17.5g a.i. ha⁻¹ because of the phytotoxic effect of the herbicide. While, significantly higher number of nodules per plant was observed in weedy check (25.77) but it was on par with farmers' practice (24.97), Weed free check and all the post emergent applications. The nodulation per plant of all the herbicide treatments were statistically on par with that of the treatments without herbicide application viz. weed free check, farmers' practice and weedy check except preplant surface applied treatments. Among the weed control treatments, weed free check recorded significantly higher number of effective nodules per plant and it was on par with premergent applied herbicides. This increase in number of effective nodules per plant in these treatments mainly attributed to complete or partial removal of weed competition in terms of allelopathic effect. While, diclosulam @ 27 g a.i. ha⁻¹ preplant surface application recorded significantly lower number of effective nodules per plant (12.60 and 45.10 at 30 and 60 DAS, respectively) due to phytotoxic effect of the herbicide which reduced the plant stand considerably.

Table-1 Plant height, Number of branches and total dry matter production at 60 DAS in greengram as influenced by weed control treatments

Treatment	Plant height (cm)	Number of branches per plant	Total dry matter production
T ₁ : Diclosulam 84% WDG @ 17.5g a.i. ha ⁻¹ as pre-plant surface application	38.95	8.10	16.18
T ₂ : Diclosulam 84% WDG @ 27g a.i. ha ⁻¹ as pre-plant surface application	37.07	7.30	15.83
T ₃ : Diclosulam 84% WDG @ 17.5 g a.i. ha ⁻¹ as pre-emergent application	40.78	8.47	17.00
T ₄ : Diclosulam 84% WDG @ 27g a.i. ha ⁻¹ as pre-emergent application	39.58	8.17	16.21
T ₅ : Diclosulam 84% WDG @ 17.5g a.i. ha ⁻¹ as post emergent application	27.52	7.20	15.23
T ₆ : Diclosulam 84% WDG @ 27g a.i. ha ⁻¹ as post emergent application	26.95	7.03	14.45
T ₇ : Imazethapyr 10%SL 75g a.i. ha ⁻¹ as post emergent application	25.95	6.45	11.80
T ₈ : Pendimethalin 30% EC @ 1.5kg a.i. ha ⁻¹ as pre-emergent application	42.77	8.97	17.64
T ₉ : Hand weeding (20 and 40 DAS)	43.10	8.76	18.31
T ₁₀ : Weed free check	44.17	9.47	18.94
T ₁₁ : Unweeded check	15.10	3.43	7.69
S.E.m.±	0.80	0.24	0.36
C.D. at 5%	3.25	1.00	1.46

WDG: Water dispersible granules EC: Emulsifiable concentrates SL: Soluble liquids DAS: Days after sowing

Table-2 Effective root nodules and crude protein content of greengram as influenced by weed control treatments

Treatment	Effective root nodules		Crude protein content
	30 DAS	60 DAS	
T ₁ : Diclosulam 84% WDG @ 17.5g a.i. ha ⁻¹ as pre-plant surface application	12.60	45.10	21.64
T ₂ : Diclosulam 84% WDG @ 27g a.i. ha ⁻¹ as pre-plant surface application	12.47	44.80	21.54
T ₃ : Diclosulam 84% WDG @ 17.5 g a.i. ha ⁻¹ as pre-emergent application	21.40	56.13	21.89
T ₄ : Diclosulam 84% WDG @ 27g a.i. ha ⁻¹ as pre-emergent application	21.70	55.03	21.77
T ₅ : Diclosulam 84% WDG @ 17.5g a.i. ha ⁻¹ as post emergent application	24.00	52.17	21.64
T ₆ : Diclosulam 84% WDG @ 27g a.i. ha ⁻¹ as post emergent application	23.43	51.13	21.67
T ₇ : Imazethapyr 10%SL 75g a.i. ha ⁻¹ as post emergent application	22.50	56.33	21.94
T ₈ : Pendimethalin 30% EC @ 1.5kg a.i. ha ⁻¹ as pre-emergent application	22.93	59.63	22.06
T ₉ : Hand weeding (20 and 40 DAS)	24.97	61.13	22.13
T ₁₀ : Weed free check	23.53	58.13	23.00
T ₁₁ : Unweeded check	25.77	62.83	19.43
S.E.m.±	0.85	0.97	0.31
C.D. at 5%	3.43	3.90	1.26

WDG: Water dispersible granules EC: Emulsifiable concentrates SL: Soluble liquids DAS: Days after sowing

Among the herbicide treatments, crude protein content in grain was significantly higher in pre-emergent application of pendimethalin 2 1.5 kg a.i. ha⁻¹(T₈) (22.06 %), post emergent application of imazethapyr (T₇) @ 75 g a.i. ha⁻¹(21.94 %), pre-emergent application of diclosulam @ 17.5 g a.i. ha⁻¹(T₃) (21.89 %) and diclosulam @ 27 g a.i. ha⁻¹ (T₄) (21.77%). These treatments were found on par with weed free check (23.00%). Whereas, unweeded check (T₁₁) recorded significantly lower crude protein content in grain (19.43 %). Increased uptake of nutrients especially nitrogen by the crop resulted in nitrogen concentration in the seeds and finally resulted in significantly higher crude protein content in the seeds and finally resulted in significantly higher crude protein content in the

seeds in above said treatments.

Conclusion

Herbicides play pivotal role in the weed management arena of modern day agriculture. However, their consideration for the real ground practices depends upon their biotoxic and eco toxicological impacts. This study allows us to select the diclosulam herbicide @ 17.5 g a.i. ha⁻¹ as per plant surface application for the safe usage without affecting the nodulation and greengram growth negatively. The residual studies of diclosulam herbicide consists the future line of work.

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Abbreviations:

WDG : Water dispersible granules

DAS : Days after sowing

PRE : Pre emergent application

Conflict of Interest: None declared

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