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Seedling vigour index and productivity of greengram as influenced by pre-and post-emergence herbicicdes applied to maize

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Abstract
A field experiment was conducted in greengram during rabi, 2016-17 at S.V. Agricultural college, Tirupati campus of Acharya N.G.Ranga Agricultural University, Andhra Pradesh, India, to know the residual effect of pre-and post-emergence herbicides applied to preceding maize crop on succeeding greengram in a randomized block design with ten weed management practices. Sequential ap***p***lication of pre-emergence herbicides (alachlor 1000 g ha^{-1} and atrazine 1000 g ha^{-1}) followed by post-emergence herbicides (Halosulfuron-methyl 67.5 g ha^{-1}**,** Tembotrione 100 g ha^{-1} and 2,4-D Sodium salt 800 *g* ha^{-1}) applied to maize did not show any residual / inhibitory effect on succeeding greengram. Among the different pre-and post-emergence herbicides applied to maize, pre-emergence application of alachlor 1000 g ha^{-1} fb post-emergence application of halosulfuron-methyl 67.5 g ha^{-1} + tembotrione 100 g ha^{-1} imposed to maize resulted in reduced dry weight of weeds associated with succeeding greengram at 15 DAS due to its extended weed control efficiency even in greengram.Root and shoot length including seedling vigour index and yield components and yield of succeding greengram recorded at their highest values with the above said weed management practice imposed to maize

Keywords: Greengram, root and shoot length, seedling vigour index, weed management

Introduction

Maize (*Zea mays* L.) is the most versatile and miracle food crop of global importance. Maize being a rainy season crop and sown at wider spacing coupled with slow initial growth resulted in heavy weed infestation**.** Purple nutsedge is one of the predominant and most troublesome perennial weeds during *kharif* and ranked as one of the world's worst weeds in 52 crops and in more than 90 tropical and sub-tropical countries (Bendixen and Nandihalli, 1987) [1]. The recommeded dose of atrazine as pre-emergence followed by post-emergence application of *2*, *4*-D sodium salt was not effective in controlling purple nutsedge. There is need to evaluate residual effect of pre-emergence application of alachlor followed by two new post-emergence herbicides, halosulfuron-methyl and tembotrione alone or in combination applied to maize on succeeding greengram. These herbicides may restrict the succeeding crops and causes environmental pollution**.** Robinson (2008) [6] reported that one year after pre-emergence application of mesotrione 280 g ha^{-1} + atrazine 1120 g ha^{-1} to maize crop recorded 33 per cent crop injury of succeeding cucumber on sandy loam soils of Ontario, Canada**.** In this context, there is need to evaluate the residual effect of pre-and post-emergence herbicides applied to maize on succceeding greengram**.**

Materials and Methods

Greengram variety WGG 42 was sown at a spacing of 30 cm x 10 cm in an undisturbed layout to know the residual effect of pre-and post-emergence herbicides applied to *kharif* maize as mentioned in table-2**.** A uniform dose of 20 kg N and 50 kg of P_2O_5 ha^{-1} was applied through urea and single super phosphate to all the plots. Totally, three irrigations were given to greengram crop each at 5 cm depth of water. All the agronomic practices were adopted as per the package of practices of Acharya N.G. Ranga Agricultural University except weed management practices. The residual effect of the pre-and post-emergence herbicides on germination, root and shoot length and dry matter production of greengram were estimated as per the standared procedures. Seedling vigour index was caluculated by multiplying the germination percentage with seedling length *i.e.* root length and shoot length. The dry weight of weeds associated with greengram at 15 DAS were estimated and data was subjected to square root transformation ($\sqrt{x+0.5}$), before subjecting to statistical analysis.

Results and Discussion

Among the different weed management practices imposed to maize did not show any residual / inhibitory effect on greengram interms of growth and development on succeeding greengram. However, these weed management practices imposed to maize exerted significant influence on weed dry weight obtained in succeeding greengram at 15 DAS (Table-1).

Table 1. Weed dry weight (g m^{-2}) at 15 DAS of succeeding greengram as influenced by different weed management practices imposed in preceding maize

Treatments	Grasses	Sedges	BLWs	Total
W_1: Pre-emergence application of alachlor @ 1000 g *a.i* ha^{-1}	26.03 (5.15)	48.35 (6.99)	8.64 (3.02)	83.02 (9.14)
W_2: Post-emergence application of halosulfuron-methyl @ 67.5 g *a.i* ha^{-1}	25.83 (5.13)	47.23 (6.91)	8.13 (2.94)	81.28 (9.04)
W_3: Post-emergence application of tembotrione @ 100 g *a.i* ha^{-1}	17.20 (4.21)	52.46 (7.28)	7.61 (2.85)	77.27 (8.82)
W_4: Post-emergence application of halosulfuron-methyl @ 67.5 g *a.i* ha^{-1} + tembotrione @ 100 g *a.i* ha^{-1}	13.92 (3.80)	33.93 (5.87)	6.17 (2.58)	54.02 (7.38)
W_5: Pre-emergence application of alachlor @ 1000 g *a.i* ha^{-1} + Post-emergence application of halosulfuron-methyl @ 67.5 g *a.i* ha^{-1}	17.80 (4.28)	31.63 (5.67)	6.37 (2.62)	55.80 (7.50)
W_6: Pre-emergence application of alachlor @ 1000 g *a.i* ha^{-1} + Post-emergence application of tembotrione @ 100 g *a.i* ha^{-1}	14.34 (3.85)	56.55 (7.75)	6.28 (2.60)	80.17 (8.98)
W_7: Pre-emergence application of alachlor @ 1000 g *a.i* ha^{-1} + Post-emergence application of halosulfuron-methyl @ 67.5 g *a.i* ha^{-1} + tembotrione @ 100 g *a.i* ha^{-1}	12.16 (3.56)	20.00 (4.53)	5.63 (2.48)	37.79 (6.19)
W_8: Pre-emergence application of atrazine @ 1000 g *a.i* ha^{-1} + Post-emergence application of 2,4-D sodium salt @ 800 g *a.i* ha^{-1}	19.44 (4.47)	64.80 (8.08)	4.10 (2.14)	88.34 (9.43)
W_9: Two hand weeding at 20 and 40 DAS	12.07 (3.55)	12.30 (3.58)	5.48 (2.45)	29.85 (5.51)
W_{10}: Un-weeded check (Control)	26.23 (5.17)	66.97 (8.21)	9.12 (3.10)	102.32 (10.14)
CD (P = 0.05)	0.30	0.49	0.34	0.13

Figures in parenthesis indicates square root transformed ($\sqrt{X+0.5}$) values

Table 2. Germination percentage and growth parameters of succeeding greengram at 15 DAS as influenced by different weed management practices imposed to preceding maize

Treatments	Germination %	Root length (cm)	Shoot length (cm)	SVI	DMP (kg ha^{-1})	Pods/ plant	Seeds/ plant	Test weight (g)	Seed yield (kg ha^{-1})
W_1: Pre-emergence application of alachlor @ 1000 g *a.i* ha^{-1}	89.27	8.86	11.46	1814	227	6.62	9.46	21.90	334
W_2: Post-emergence application of halosulfuron-methyl @ 67.5 g *a.i* ha^{-1}	89.83	8.80	11.38	1813	207	6.60	9.46	22.14	344
W_3: Post-emergence application of tembotrione @ 100 g *a.i* ha^{-1}	90.83	8.84	11.34	1833	198	6.47	8.86	21.77	330
W_4: Post-emergence application of halosulfuron-methyl @ 67.5 g *a.i* ha^{-1} + tembotrione @ 100 g *a.i* ha^{-1}	88.77	8.74	11.74	1818	253	6.81	9.80	23.52	490
W_5: Pre-emergence application of alachlor @ 1000 g *a.i* ha^{-1} + Post-emergence application of halosulfuron-methyl @ 67.5 g *a.i* ha^{-1}	90.89	8.88	12.34	1928	267	8.24	9.93	25.46	744
W_6: Pre-emergence application of alachlor @ 1000 g *a.i* ha^{-1} + Post-emergence application of tembotrione @ 100 g *a.i* ha^{-1}	89.30	8.86	11.86	1850	263	7.88	9.84	25.30	560
W_7: Pre-emergence application of alachlor @ 1000 g *a.i* ha^{-1} + Post-emergence application of halosulfuron-methyl @ 67.5 g *a.i* ha^{-1} + tembotrione @ 100 g *a.i* ha^{-1}	89.27	9.26	12.74	1964	280	8.46	0.14	26.40	655
W_8: Pre-emergence application of atrazine @ 1000 g *a.i* ha^{-1} + Post-emergence application of 2,4-D sodium salt @ 800 g *a.i* ha^{-1}	89.98	8.87	11.52	1835	227	7.65	9.78	23.43	360
W_9: Two hand weeding at 20 and 40 DAS	91.62	9.14	12.24	1959	273	8.84	10.46	25.63	715
W_{10}: Un-weeded check (Control)	91.05	8.75	11.10	1807	191	6.29	8.60	20.96	320
CD (P = 0.05)	N.S.	0.32	0.54	131	5.70	0.16	1.89	2.50	46.0

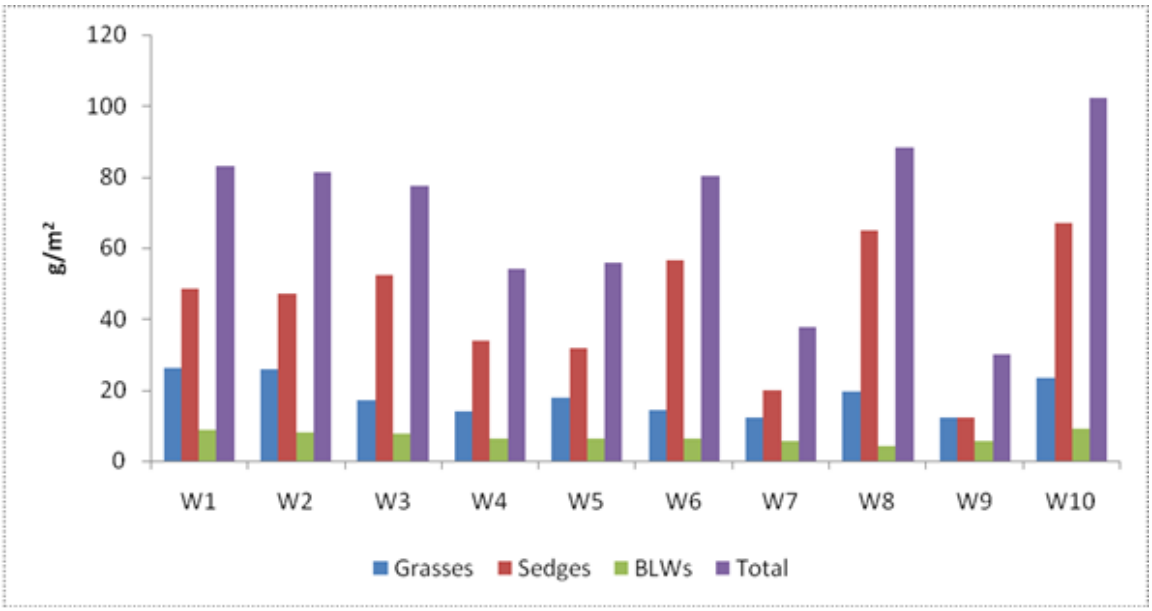

Fig 1: Weed dry weight (g m^{2-} at 15 DAS of succeeding greengram as influenced by different weed management practices imposed in preceding maize

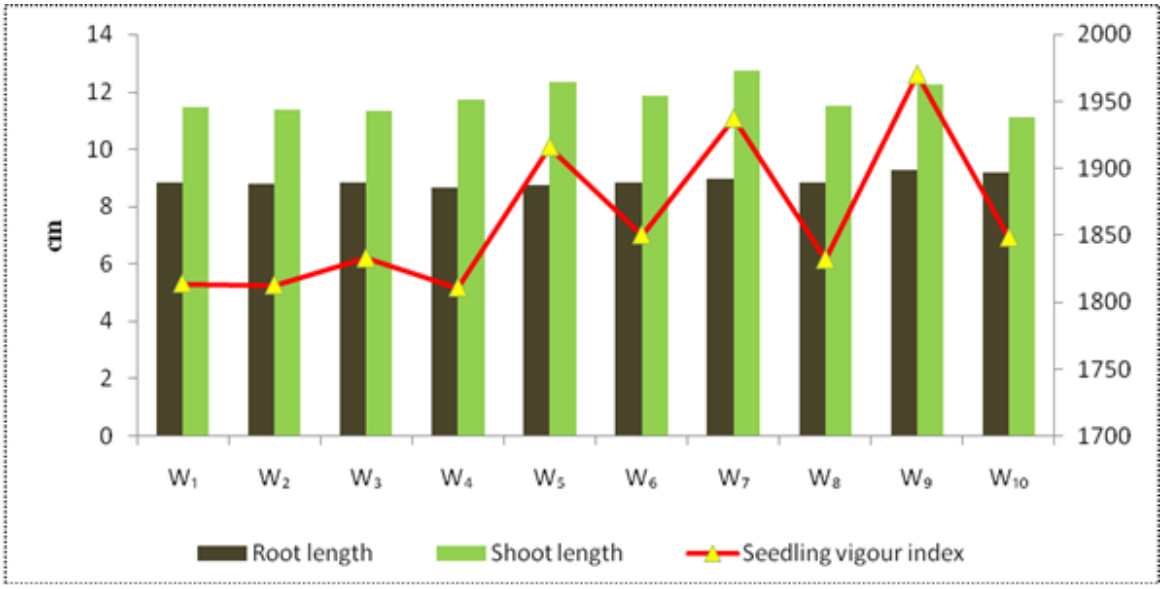

Fig 2: Root length & shoot length (cm) and seedling vigour index at 15 DAS of greengram as influenced by different weed management practices imposed to preceding maize

The lowest dry weight of all the categories of weeds associated with succeeding greengram was registerd with pre-emergence application of alachlor 100g ha^{-1} *fb* post-emergence application of halosulfuron-methyl 67.5g ha^{-1} + tembotrione 100g ha^{-1} imposed to preceding maize crop. The sequential application of above herbicides effectively controlled the weeds in maize and extended the weed control period upto early stage of succeeding greengram. These results are in agreement with the findings of Mehar Chand *et al.*, (2014). They found that halosulfuron-methyl *75* g ha^{-1} controlled purple nutsedge, *Cyperus rotundus* more than 90 percent at 58 days after planting and new shoots of *Cyperus rotundus* had emerged only after 120 days after planting in sugarcane.

Germination percent of greengram was not influenced by any of the weed management practices imposed to preceding maize crop. However, the highest root and shoot length including drymatter production of greengram were recorded with the plots treated with pre-emergence application of alachlor 1000 g ha^{-1} fb post-emergence application of halosulfuron-methyl 67.5 g ha^{-1} + tembotrione *100* g ha^{-1} (Table-2). Umesha et al., (2015) also stated that sequential application of pre-emergence application of atrazine 1000 g ha^{-1} and post-emergence application of tembotrione 100 g ha^{-1} to maize did not show any phytotoxicity symptoms on succeeding greengram. Seedling vigour index of grrengram was influenced by different weed management practices. The highest seedling vigour index was computed with pre-emergence application of alachlor 1000g ha^{-1} fb post-emergence application of halosulfuron-methyl 67.5 g ha^{-1} + tembotrione 100g ha^{-1} applied maize crop. The lowest root and shoot length including dry matter production of greengram was associated with unweeded control due to heavy weed infestation as result of increased weed seed bank. Mehar chand *et al.*, (2014) also reported that halosulfuron methyl at different doses from 52.5 to 150 g ha^{-1} applied to sugarcane did not show any phytotoxic effect on succeeding black gram and cucumber.

The highest values of yield components *viz.* number of pods plant^{-1}, number of seeds pod^{-1} and test weight including

higher seed yield of succeeding greengram were obtained with the best weed management practice *i.e.* pre-emergence application of alachlor 1000 g ha^{-1} *fb* post-emergence application of halosulfuron-methyl 67.5 g ha^{-1} + tembotrione 100 g ha^{-1} applied maize crop. This might be due to effcetive control of all the categories of weeds in general and in particular to *Cyperus rotundus*. Mehar Chand *et al.* (2014) reported that halosulfuron-methyl controlled the Cyperus rotundus more than 90% at 58 days after planting and new shoots of *Cyperus rotundus* had emerged only after 120 days after planting in sugarcane.

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