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Evaluation of suitable pre emergence herbicide for Sunnhemp seed production

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Abstract
The investigation was directed to evaluation of suitable pre emergence herbicide for sunnhemp seed production. A field experiment was conducted at Eastern Block farm of Tamil Nadu Agricultural University, Coimbatore during February, 2018. The experiment consisted of six treatments *viz.* T_1 - PE pendimethalin @ 1.0 kg *a.i.* /ha + HW (30 DAS), T_2 - PE pendimethalin @ 0.75 kg *a.i.* /ha + HW (30 DAS), T_3 - PE Oxyfluorfen 23.5 EC @ 0.3 kg *a.i.* /ha + HW (30 DAS), T_4 - PE Oxyfluorfen 23.5 EC @ 0.4 kg *a.i.* /ha + HW (30 DAS), T_5 - weed free check (20 & 40 DAS) and T_6-un weeded control with four replications and laid out in randomized block design. The results revealed that Pre emergence application of pendimethalin @ 1.0 kg *a.i*/ha followed by one hand weeding at 30 DAS recorded good germination, better crop growth with significantly higher DMP and higher weed control efficiency in sunnhemp. It could be concluded that Pre emergence application of pendimethalin @ 1.0 kg *a.i*/ha is suitable for quality seed production in sunnhemp.

Keywords: Sunnhemp, weed management, pre emergency herbicide

Introduction
Sunn hemp (*Crotalaria juncea*) is a leguminous crop adapted to tropical or subtropical areas which serves as green manure crop generating much biomass. Green manure is a crop used primarily as a soil amendment and a nutrient source for subsequent crops and it will increase the soil organic matter and in turn crop productivity. When sunnhemp is incorporated into the soil, its amendments also enhance the soil nutrient content, organic matter, and cation exchange capacity, especially in soils low in organic matter (Marshall, 2002) [1]. Since the last century, agriculture sector faces vulnerable changes in farm holding size, strategies in marketing and diversity in biological and economical sections. It also led to increased utilization of external non-renewable resources and vulnerability to climate change and urbanization. In order to achieve higher yield of crops with and good quality, a crop needs sufficient plant available nitrogen (N) during key periods of crop development, yet caution must be practiced to avoid an excessive accumulation of N to the point that it becomes an environmental contaminant.

Green manuring can improve soil physical, chemical, and biological properties and consequently crop yields. Unlike synthetic N fertilizers, legumes utilized as GM represent a potentially renewable source of on-farm, biologically fixed N and may also fix and add large amounts of C to cropping systems (Hargrove, 1986 [2]; Sharma and Mittra, 1988 [3]). Furthermore, potential benefits of green manuring are reduced nitrate (NO_3^-) leaching risk and lower fertilizer N requirements for succeeding crops. However, there are several limitations of using sunnhemp in a conventional cropping system. Availability of quality seed materials is the one of the limiting factors for using sunnhemp in a conventional cropping system. When cultivation o fsunnhemp is meant for green manuring *in-situ*, there is no concern of weed management options, as the crop is incorporated along with weeds if any present. When it grown for seed production it is very essential to control the weeds in seed production field to produce quality seed material without admixture of weed seeds, to avoid weed seed bank development in the seed production field and to avoid yield losses due to weed infestation.

Weed competition is one of the major biotic constraints in reducing productivity under irrigated conditions due to wider spacing and application of fertilizers. Farmers control the weeds effectively by adopting cultural methods but it also poses limitations like labor intensity,

unfavorable soil and climatic conditions for effective weed control. Further, non-availability of labour with high rate of wages during peak periods of agricultural operations are the problems in cultural methods of weed control. In this context, the chemical method of weed management is gaining importance. Use of herbicides will provide completely weed free condition to the crop from its early growth period whereas, manual or mechanical weeding can be done only after the emergence of weeds (Selvakumar *et al*., 2018) [4]. As there are only limited studies on weed management options for sunnhemp seed production and in this view, the present study was undertaken to evaluate the pre emergence herbicides in sunnhemp seed production.

Materials and methods

A field experiment was conducted at Eastern block farm of Tamil Nadu Agricultural University, Coimbatore during February, 2018. The experiment consisted of six treatments *viz*. T_1 - PE pendimethalin @ 1.0 kg *a.i*. /ha + HW (30 DAS), T_2 - PE pendimethalin @ 0.75 kg *a.i*. /ha + HW (30 DAS), T_3 - PE Oxyfluorfen 23.5 EC @ 0.3 kg *a.i*. /ha + HW (30 DAS), T_4 - PE Oxyfluorfen 23.5 EC @ 0.4 kg *a.i*. /ha + HW (30 DAS), T_5 - weed free check (20 & 40 DAS) and T_6 - unweeded control with four replications and laid out in randomized block design. The crop was irrigated as and when required for better growth and development. Herbicides were applied as per treatments with manually operated knapsack sprayer delivering a spray volume of 500 lit/ha using flat-fan nozzle to the respective plots. The experimental soil was sandy clay loamy soil with 8.2 pH, 0.6 dS/m electrical conductivity, 0.5% organic carbon content, low in available nitrogen (275 kg/ha), low in available phosphorus (9.4 kg/ha) and high in available potassium (407 kg/ha). The gross plot size was 3.6 × 3 m with net plot of 2.7 × 2.2 m. Seeds of sunnhemp were sown in the ridges at 45 x 20 cm spacing @ two seeds per hill and later it was thinned leaving one healthy seedling per hill to maintain 100 percent population. Weed density and weed dry weight at 30 and 60 days after sowing were recorded from pre marked quadrants of 1 m^2 area. The weed data were subjected to square root transformation ($\sqrt{x+0.5}$) to normalize the distribution. Weed control efficiency (Mani *et al.*, 1973) [5] was worked out to assess the efficacy of different weed control treatments. Growth parameters and biomass were also recorded. The data collected were analyzed as per the analysis of variance (ANOVA) for randomized block design at 0.05 probability.

Results and Discussion

Weed flora

Weed flora of the experimental field predominantly consisted of broad-leaved weeds over grasses and sedges. Among the broad-leaved weeds *Trianthema portulacastrum* (L.), *Digera arvensis* (Forsk.) *Parthenium hysterophorus* (L.) and *Amaranthus viridis* were the dominant ones. Predominant grassy weeds were *Cyanadon dactylon* (L.), *Dactyloctenium aegyptium* (L.), and *Echinochloa colona* (L.). *Cyperus rotundus* (L.) was the only sedge weed observed in the study.

Effect of different management practices on weed control

All the weed management treatments significantly reduced the weed density and weed dry weight over unweeded control [Table1]. Weed free check had recorded significantly lowest weed density, and weed dry weight which was closely followed by pendimethalin @ 1.0 kg/ha as pre emergence + HW on 30 DAS. However, unweeded control recorded the maximum values of total weed density and weed dry weight. Weed free check recorded higher WCE and followed by pendimethalin @ 1.0 kg/ha as pre emergence + HW on 30 DAS. Higher WCE might be attributed to the effective weed control resulting in lower weed density. Selvakumar *et al*. (2018) [4] reported that weed free plot recorded higher WCE followed by pendimethalin + one hand weeding over weedy check. These are in line with the findings of Yadav (1983) [6] who had reported that the highest weed control efficiency was recorded under weed free check.

Table 1: Effect of weed management on weed and weed control efficiency in sunnhemp

Treatments	Weed density (No./m^2)		Weed DMP (kg/ ha)		WCE (%)	
	30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS
T_1 - PE pendimethalin 30 EC @ 1.0 kg *a.i*. /ha + HW (30 DAS)	2.87 (8)	3.98 (16)	9.18 (84)	10.95 (120)	80	77
T_2 - PE pendimethalin 30 EC @ 0.75 kg *a.i*. /ha + HW (30 DAS)	3.38 (12)	5.29 (28)	10.29 (106)	12.40 (154)	70	60
T_3 - PE Oxyfluorfen 23.5 EC @ 0.3 kg *a.i*. /ha + HW (30 DAS)	3.43 (12)	4.43 (20)	9.54 (91)	11.48 (132)	70	71
T_4 - PE Oxyfluorfen 23.5 EC @ 0.4 kg *a.i*. /ha + HW (30 DAS)	4.05 (16)	4.46 (20)	10.70 (114)	11.88 (141)	60	71
T_5 - weed free check (20 & 40 DAS)	3.49 (12)	3.16 (10)	8.79 (77)	8.90 (79)	70	86
T_6 - Unweeded control	6.31 (40)	8.28 (70)	36.74 (1350)	43.25 (1872)	-	-
SEm (±)	0.61	0.75	0.58	0.76		
LSD (0.05)	1.30	1.60	1.24	1.61		

(Figures in parenthesis are original values) [Data transformed to $\sqrt{(x+0.5)}$]

Effect on crop growth

Germination of sunnhemp was reduced due to pre emergence herbicide application in general. However pendimethalin did not show any significant reduction in germination, but oxyfluorfen showed poor germination significantly. It shows the suitability of pre emergence herbicide for sunnhemp sown field. Growth of sunnhemp also was significantly affected in Oxyfluorfen sprayed treatment plot and it was evident in plant height at 30 & 60 DAS (Table 2). With respect to DMP, Pre emergence application of pendimethalin @ 1.0 kg ai/ha followed by one hand weeding at 30 DAS recorded significantly higher DMP and the performance were significantly lower in Pre emergence application of Oxyfluorfen. Reduced weeds competition at the early growth stages as well as at later growth stages of sunnhemp provided amicable atmosphere for the better utilization of available

natural resources and cost incurred for external inputs by the crop for producing more photosynthates. This might have amplified the absorption of nutrient and moisture from the soil without competition resulting in higher yield. It might be due to managing of weeds from the early growth of sunnhemp and it accordance with findings of Singh and singh, 2006 [7].

Table 2: Effect of weed management on growth parameters of sunnhemp

Treatments	Germination (%)	Plant height (cm)		DMP (kg/ ha)	
		(30 DAS)	(60 DAS)	(30 DAS)	(60 DAS)
T_1 - PE pendimethalin 30 EC @ 1.0 kg a.i. /ha + HW (30 DAS)	87	55	151	248	1752
T_2 - PE pendimethalin 30 EC @ 0.75 kg a.i. /ha + HW (30 DAS)	92	54	146	223	1674
T_3 - PE Oxyfluorfen 23.5 EC @ 0.3 kg a.i. /ha + HW (30 DAS)	52	40	131	135	763
T_4 - PE Oxyfluorfen 23.5 EC @ 0.4 kg a.i. /ha + HW (30 DAS)	36	38	126	110	634
T_5 - weed free check (20 & 40 DAS)	95	56	140	214	1729
T_6 - Unweeded control	94	50	138	168	1341
SEm (±)	3.1	3.5	8.8	12.3	54.9
LSD (0.05)	6.5	7.4	18.7	26.2	117.0

Conclusion

In conclusion, pre emergence application of pendimethalin @ 1.0 kg a.i/ha followed by one hand weeding at 30 DAS recorded good germination, better growth, significantly higher DMP with higher weed control efficiency. From the results it could be concluded that pre emergence application of pendimethalin @ 1.0 kg a.i/ha is suitable for quality seed production in sunnhemp.

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