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Studies on Impact of Weed Management Practices on Nutrient Removal by Weeds and Nutrient Uptake by Irrigated Sunflower (*Helianthus annuus* L.)

S. Kalaisudarson*[1], A. P. Srinivasaperumal[2], S. Srinivasan[3], T. Balakrishnan[4] and V. Balamurugan[5]

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ABSTRACT

Field experiment was conducted at Annamalai University experimental farm, Annamalainagar to find out the impact of weed management practices on weed control index, nutrient removal by weeds and nutrient uptake by irrigated sunflower. The experiment was laid out in randomized block design (RBD) with twelve treatments and replicated thrice viz., unweeded control (T_1), Hand weeding twice at 15 and 30 DAS (T_2), Pre-emergence application of pendimethalin 0.68 kg ai ha^{-1} (T_3), Pre-emergence application of pendimethalin 1 kg ai ha^{-1} (T_4), Pre-emergence application of pendimethalin 0.68 kg ai ha^{-1} + one hand weeding (30 DAS) (T_5), Pre-emergence application of pendimethalin 1 kg ai ha^{-1} + one hand weeding (30 DAS) (T_6), Pre-emergence application of pendimethalin 0.68kg ai ha^{-1} + Intercropping with blackgram (T_7), Pre-emergence application of pendimethalin 1 kg ai ha^{-1} + Intercropping with blackgram (T_8), Pre-emergence application of pendimethalin 0.68kg ai ha^{-1} + Mulching with sugarcane trash at 21DAS (T_9), Pre-emergence application of pendimethalin 1kg ai ha^{-1} + Mulching with sugarcane trash at 21 DAS (T_{10}), Intercropping alone (T_{11}), Mulching alone (T_{12}). Results of the experiment revealed that Hand weeding twice at 15 and 30 DAS was found to be superior in weed control index and nutrient uptake by crop. This was on par with Pre-emergence application of pendimethalin 1kg ai ha^{-1} + Intercropping with blackgram.

***Key words*:** Weed control index, Nutrient removal, Nutrient uptake, Weed management, Sunflower

Sunflower is an important oil seed crop of India and a major source of vegetable oil in the world. Its versatile nature is expected to play a crucial role in the oil seed economy of the country. Sunflower, a promising oil seed crop offers great opportunity on account of its wider adaptability to different agro climatic regions. Though this crop has high yield potential, its yield is very poor due to severe weed competition. Wider row spacing and slow initial growth of sunflower provide congenial environment for the growth of weeds. Among various factors responsible for low seed yield of sunflower, judicious weed management is the major aspect for limiting the seed production in sunflower. The losses caused by the weed exceed the losses from any other category agricultural pests. Weed competition is one of the biotic constrains in realizing higher sunflower productivity due to wider spacing and application of higher dose of fertilizers. Heavy weed infestation is the dominant reason for low yield of sunflower. Weeds which emerge and become established during early stage of sunflower growth can be very competitive and reduce the sunflower yield potential significantly. Weed competition during entire crop season resulted in yield reduction of 55.8 per cent [1]. Enormous loss of nutrients due to uncontrolled weed growth reduced the seed yield of sunflower up to an extent of 64 per cent [2]. Further weed problem becomes more serious on an account of unavailability of labours at proper time, resulting reduction in yield as well as net money return. Under such a situation adaptation of various weed management practices has been proved as the best method of weed control. Hence, the present investigation was under taken to know the

* S. Kalaisudarson
✉ agrikalai1976@gmail.com

[1-2] Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar - 608 002, Tamil Nadu, India

[3] Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalainagar - 608 002, Tamil Nadu

[4-5] Department of Agricultural Extension, Faculty of Agriculture, Annamalai University, Annamalainagar - 608 002, Tamil Nadu, India

impact of weed management practices on nutrient removal by weeds and nutrient uptake by irrigated sunflower.

MATERIALS AND METHODS

The field experiment was conducted at Experimental farm, Department of Agronomy, Annamalai University, Annamalainagar to study of impact of weed management practices on nutrient removal by weeds and nutrient uptake by irrigated sunflower. The experimental farm is situated at 11° 24' North Latitude, 79°44' East Longitude with an altitude of +5.79 m above mean sea level. The weather of Annamalainagar is moderately warm with hot summer months. The crop season recorded a maximum temperature which ranged from 29.1 to 33.7°C with mean of 31.49°C. The minimum temperature ranged from 18.6 to 23.6°C with a mean of 20.75°C. The relative humidity ranged from 83 to 93 per cent with a mean of 87.92 per cent. The crop received a rain fall distributed over five rainy days. The soil of the experimental field was sandy clay loam with pH of 7.80. Regarding fertility status of the soil were classified as low in available nitrogen, medium in available phosphorous and high in available potassium content. The experiment was laid out in randomized block design with twelve treatments and replicated thrice viz., unweeded control (T_1), Hand weeding twice at 15 and 30 DAS (T_2), Pre–emergence application of pendimethalin 0.68 kg ai ha^{-1} (T_3), Pre–emergence application of pendimethalin 1 kg ai ha^{-1} (T_4), Pre–emergence application of pendimethalin 0.68 kg ai ha^{-1} + one hand weeding (30 DAS) (T_5), Pre-emergence application of pendimethalin 1 kg ai ha^{-1} + one hand weeding (30 DAS) (T_6), Pre–emergence application of pendimethalin 0.68kg ai ha^{-1} + Intercropping with blackgram (T_7), Pre-emergence application of pendimethalin 1kg ai ha^{-1} + Intercropping with blackgram (T_8), Pre-emergence application of pendimethalin 0.68kg ai ha^{-1} + Mulching with sugarcane trash at 21 DAS (T_9), Pre-emergence application of pendimethalin 1kg ai ha^{-1} + Mulching with sugarcane trash at 21 DAS (T_{10}), Intercropping alone (T_{11}), Mulching alone (T_{12}). The observations on weed control index were recorded at 60 DAS. The weed control index for each was calculated by using the formula suggested by Misra and Josh [3] and recorded in percentage.

$$WCI = \frac{\text{Weed biomass in unweeded control plot} - \text{Weed biomass in treated plot}}{\text{Weed biomass in unweeded control plot}} \times 100$$

The plant samples collected at the time of harvest from outside the net plot were used for analysis of the nitrogen (Microkjeldhal digestion by Yoshida *et al.* [4]), phosphorus (Colorimetry-Triple acid digestion by Jackson [5]) and potassium (Flame Photometer by Jackson [5]) uptake by the crop. The values were represented in kg ha^{-1}.

RESULTS AND DISCUSSION

Impact on weed control index

Hand weeding twice at 15 and 30 DAS was effective in reducing the infection of all the dominant weed species namely *Echinochloa colonum*, *Trianthema portulacastrum* and *cyperus rotundus*. Among the treatments, hand weeding twice at 15and 30 DAS found to be superior as indicated by the weed control index of 93.37 per cent at 60 DAS. Followed by Pre-emergence application of pendimethalin 1 Kg ai ha^{-1} + Intercropping with blackgram recorded WCI of 93.40 per cent (Table 1). This might be due to effective weed control achieved under these weed management treatments in terms of reduced weed biomass of weeds [6-7].

Table 1 Studies on impact of weed management practices on weed control index and nutrient removal by weeds in irrigated sunflower

Treatments	WCI	Nitrogen (kg ha^{-1})	Phosphorus (kg ha^{-1})	Potassium (kg ha^{-1})
T_1	-	25.75	5.83	26.24
T_2	93.40	8.03	0.96	8.94
T_3	53.13	23.39	4.57	22.53
T_4	70.79	21.19	3.93	20.60
T_5	82.39	14.64	2.41	14.81
T_6	86.19	12.44	1.93	12.92
T_7	89.68	10.24	1.45	10.99
T_8	93.37	8.04	0.97	9.06
T_9	74.70	19.04	3.37	18.67
T_{10}	78.64	16.84	2.89	16.74
T_{11}	52.80	23.43	4.59	23.54
T_{12}	52.39	23.48	4.61	24.31
S.Ed		0.83	0.21	0.88
CD (p=0.05)		1.72	0.44	1.83

Impact on nutrient removal by weeds

Among the treatments, Hand weeding twice at 15and 30 DAS (T_2) excelled others by recording the least nutrient removal of 8.03, 0.96, 8.94 kg ha^{-1} of N, P and K respectively. This is on par with Pre-emergence application of pendimethalin 1 Kg ai ha^{-1} + Intercropping with blackgram (T_8). This was followed by Pre-emergence application of pendimethalin 0.68 Kg ai ha^{-1} + Intercropping with blackgram. The treatment unweeded control (T_1) recorded the highest nutrient removal of 25.75, 5.83 and 26.24 kg ha^{-1} of N, P and K respectively (Table 1). Crops under unweeded control utilized lower quantity of nutrients while, utilization by weed was highest. This was mainly due to unchecked weed growth and higher weed biomass.

Hand weeding twice at 15 and 30 DAS was on par with Pre-emergence application of pendimethalin 1 Kg ai ha^{-1} + Intercropping with blackgram. which reduced the uptake of nutrients by weeds. It may be due to the reason that inter cultivation can suppress the weeds, which ultimately result in reduced competition of weeds from nutrients [8]. Hand weeding twice at 15 and 30 DAS reduced the uptake of the nutrients by weeds can also be due to the decreased weed

population and weed biomass for longer period of crop growth [9].

Impact on nutrient uptake by crop

The data recording the nutrient uptake are furnished in (Table 2). Among the treatments, hand weeding twice at 15 and 30 DAS (T_2) favored the crop with highest nutrient uptake of 88.50 kg ha^{-1} N, 18.05 kg ha^{-1} P and 88.70 kg ha^{-1} K. However, it was on par with Pre-emergence application of pendimethalin 1 Kg ai ha^{-1} + Intercropping with blackgram (T_8). It may be due to the reason that inter cultivation can suppress the weeds, which ultimately result in reduced competition of weeds from nutrients [10]. Unweeded control (T_1) registered the least nutrient uptake of 59.85 kg ha^{-1} N, 8.95 kg ha^{-1} P and 47.78 kg ha^{-1} K (Table 2). Higher density of weeds coupled with higher weed biomass in unweeded control might have resulted greater depletion of nutrients and moisture. Enormous loss of nutrients due to uncontrolled weed growth reduced seed yield of sunflower [11].

Table 2 Studies on impact of weed management practices on nutrient uptake by irrigated sunflower

Treatments	Nitrogen (kg ha^{-1})	Phosphorus (kg ha^{-1})	Potassium (kg ha^{-1})
T_1- Unweeded control	59.85	8.95	47.78
T_2- Hand weeding twice at 15 & 30 DAS	88.50	18.05	88.70
T_3- Pre-emergence application of pendimethalin 0.68 kg ai ha^{-1}	65.59	11.20	57.45
T_4- Pre-emergence application of pendimethalin 1 kg ai ha^{-1}	68.59	12.14	63.93
T_5- Pre-emergence application of pendimethalin 0.68 kg ai ha^{-1} + one hand weeding (30DAS)	78.69	14.97	75.23
T_6- Pre-emergence application of pendimethalin 1 kg ai ha^{-1} + one hand weeding (30DAS)	81.99	15.91	79.41
T_7- Pre-emergence application of pendimethalin 0.68 kg ai ha^{-1} + Intercropping with blackgram	85.19	16.86	84.55
T_8- Pre-emergence application of pendimethalin 1 kg ai ha^{-1} + Intercropping with blackgram	88.29	17.80	82.93
T_9- Pre-emergence application of pendimethalin 0.68 kg ai ha^{-1} + Mulching with sugarcane trash (21DAS)	71.89	13.08	66.84
T_{10}- Pre-emergence application of pendimethalin 1 kg ai ha^{-1} + Mulching with sugarcane trash (21DAS)	75.29	14.03	71.65
T_{11} - Intercropping alone	65.37	10.93	56.61
T_{12} - Mulching alone	64.75	10.66	56.09
S.Ed	0.49	0.32	1.27
CD (p=0.05)	1.01	0.67	2.63

CONCLUSION

Based on the field experiment, it might be inferred that hand weeding twice at 15 and 30 DAS was found to be superior in weed control index and nutrient uptake by crop. In the view of inadequate labour for weeding and high labour cost, pre-emergence application pendimethalin 1 kg ai ha^{-1} + Inter cropping with black gram was efficient and economical weed management practice in irrigated sunflower.

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