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Efficacy of integrated weed management practices on growth and yield of sweet corn

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Abstract
Field experiment was carried out at Vangudi village of udaiyarpalayam taluk, Ariyalur district, Tamil Nadu during July to October, 2022. The treatments included of best combinations consisting of chemical and cultural method of weed control. The experiment was laid out in randomized block design with ten treatments and replicated thrice. Among the different treatments, pre-emergence application of metolachlor 50% EC @ 1 kg a.i. ha^{-1} on 3 DAS + Intercropping (Blackgram) (T_8) which helps in reducing weed density and ultimately reduced weed biomass which resulted in increase in crop growth and yield. Higher plant height, DMP and higher green cob yield were recorded under T_8-IWM practice might be due to maintenance of weed free environment, particularly throughout vital growth stages of crop, cut back crop weed competition helped in higher growth and development of sweet corn crop leading to higher green cob yield.

Keywords: IWM, sweet corn, metolachlor, blackgram and green cob yield

Introduction
Sweet corn (*Zea mays* var. *saccharata*) also called as sugar corn is a type of maize with high sugar content belongs to the family poaceae, it is one of the warm season crops. In India, maize occupies an area of 9.9 million hectares with a production of 32.50 million tonnes and with a productivity of 3.28 t ha^{-1} (USDA, 2022) [12]. In Tamil Nadu, it is cultivated in an area of 0.33 million hectares with a production of 2.61 million tonnes with a productivity of 7.06 t ha^{-1} and also it occupies the fourth position in India (Salient statistics on agriculture, 2022) [11]. Weeds compete with sweet corn plants for essential resources such as sunlight, water, and nutrients. This competition can lead to stunted growth of sweet corn, reduced ear size, and overall lower yields. Anil *et al*. (2015) [1] revealed that presence of weeds in maize reduced the maize yield by 27 to 60 percent depending upon the growth and persistence of weed population. IWM is an approach that emphasizes the use of a combination of different weed control methods to create a more sustainable and effective strategy. The goal is to integrate various practices and techniques to manage weeds while minimizing the reliance on any single method. This approach is particularly important in small farm holdings where resource optimization and sustainable farming practices are crucial. By adopting an IWM approach, farmers can achieve better weed control, enhance crop yields, and reduce the weed seed bank in the soil over time. This integrated and holistic approach aligns with sustainable farming practices, promoting long-term environmental and economic benefits. Maqsood *et al*. (2020) [8] stated that integrated approach entailing cultural, manual, mechanical and chemical control can be developed as a environmental and farmer friendly approach for weed control by reducing weed seed reserves which can potentially lead to higher economic returns through higher maize yield. Mishra *et al*. (2020) [9] concluded that critical period of crop weed competition in maize is between 15 to 45 DAS. Sweet corn is a medium plant type and provides green ears within 75 to 85 days after sowing. Sweet corn is consumed as raw or used as an ingredient in the preparation of soup, salad, Manchurians and Chinese dishes. In India, sweet corn is cultivated on very small area by some farmers and private sectors to meet the demands of many industries. Sweet corn is the recent form of grain vegetable. Presence of iron makes it highly suitable for women who suffer from anaemia.

The use of herbicides is an effective method for controlling weed infestation, which enables a quicker breakthrough and contributes to an increase in maize yield (Kantwa *et al*., 2020) [5]. Hence, the present study has been carried out to evaluate the best weed management practices on growth and yield attributes of sweet corn.

Materials and Methods

The experiment was carried out at the Vangudi village, Ariyalur district, Tamil Nadu during July to October, 2022. The experimental field was located at 11°25' North latitude and 79°45' East longitude with an altitude of +18.0 m above mean sea level. The crop season recorded a maximum temperature which ranged from 31.9 ºC to 36.2 ºC with a mean of 33.7 ºC. The minimum temperature ranged from 22.9 ºC to 24.7 ºC with a mean of 23.9 ºC. The relative humidity ranged from 67.2 to 79.7 percent with a mean of 74.21 percent. The crop period received a rain fall of 192.2 mm distributed over 18 rainy days during crop season The texture of the experimental field soil was sandy clay loam in with a pH of 7.8. The soil was low in available nitrogen, medium in available phosphorus and potassium. The study used the popular sweet corn hybrid Sugar-75. The experiment used randomised block design, with three replications and ten treatments.

There were ten treatment, *viz.*, T_1-Unweeded control, T_2-Two hand weeding on 15 and 30 DAS, T_3 -Pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS, T_4 -Metolachlor 50% EC @ 1 kg a.i. ha^{-1} on 3 DAS, T_5-Pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + One hand weeding on 30 DAS, T_6 - Metolachlor 50% EC @ 1 kg a.i. ha^{-1} on 3 DAS + One hand weeding on 30 DAS, T_7 - Pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + Intercropping (Blackgram), T_8 -Metolachlor 50% EC @ 1 kg a.i. ha^{-1} on 3 DAS + Intercropping (Blackgram), T_9 -Pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + Sugarcane trash mulching on 21 DAS and T_{10} - Metolachlor 50% EC @ 1 kg a.i. ha^{-1} on 3 DAS + Sugarcane trash mulching on 21 DAS. The sweet corn seeds were dibbled at the rate of 12.5 kg ha^{-1} with the spacing of 60 × 20 cm. Blackgram variety VBN 8 was sown at rate of 20 kg ha^{-1} with spacing of 30 × 10 cm. All other standard cultural practices were followed during the cropping season. Pre-emergence application of pendimethalin and metolachlor was done with the help of knapsack sprayer fitted with a flood fan nozzle with a spray volume of 500 L ha^{-1} as per treatment schedule. In manual weed control treatments, weeds are uprooted within the row and between the rows using with hand weeding as per days mentioned in each treatment. The weed count was taken from the tagged spot of 0.25 m^2 in the randomly selected each net plot and were calculated and converted into square meter basis for convenience. In order to draw a valid conclusion, the weed count data were subjected to ($\sqrt{X+0.5}$) as suggested by Gomez and Gomez (1984) [4] before statistical analysis. The green cob yield and green fodder yield

Results and Discussion

Efficacy of IWM on plant height

Among the integrated weed management practices, pre-emergence application of metolachlor 50% EC @ 1 kg a.i. ha^{-1} on 3 DAS + Intercropping (Blackgram) (T_8) was found to be advanced in plant height of 177.2 cm on 60 DAS. This might be due the better weed control at different growth stages of crop. This effective suppression of the weeds provided competition free condition and hence, the plant can utilize all the available resources *viz*., light, moisture, space and more nutrients at all stages which results in increased plant height. These findings were similarly related by Poddar *et al*. (2023) [10]. Unweeded control (T_1) showed significant reduction in plant height of 107.4 cm on 60 DAS and at all stages of the crop due to high competition by weeds and suppression of growth due to lesser availability of growth attributing factors to crop thus reduced the plant height to a greater extent.

Efficacy of IWM on dry matter production

The dry matter production is the result of cumulative and complementary effect of plant height, number of leaves and leaf area. Pre-emergence application of metolachlor 50% EC @ 1 kg a.i. ha^{-1} on 3 DAS + Intercropping (Blackgram) (T_8) recorded (7501 kg ha^{-1}) on 60 DAS has shown a better crop dry matter production. The increased crop dry matter production might be due to better control of weeds which resulted in increase in number of leaves and leaf area to better photosynthesis and reduction in weed competitiveness with the crop which ultimately favoured better environment for growth and development of crops. These findings were similar with Sharma *et al*. (2023) [12].

Efficacy of IWM on leaf area index

Pre-emergence application of metolachlor 50% EC @ 1 kg a.i. ha^{-1} on 3 DAS + Intercropping (Blackgram) (T_8) was recorded higher LAI of 6.96 on 60 DAS. High value of leaf area index is due to lesser weed competition resulting in higher availability of plant nutrients and moisture favouring increased growth characters and also improved nutrient uptake and vigour due to elimination of weed competition from the beginning of the crop might have contributed to higher leaf area index. From the experiment, it is evident that high competition of weed reduced the input availability and thus reduced the leaf area index in greater extent under unweeded control (T_1). Similar type of results was also reported by (Maitra *et al*., 2023) [7].

Efficacy of IWM on green cob yield

The higher green cob yield was recorded under the treatment pre-emergence application of metolachlor 50% EC @ 1 kg a.i. ha^{-1} ha on 3 DAS + Intercropping (Blackgram) (T_8) recorded (9548 kg ha^{-1}) (Fig.1). This treatment resulted in better control of weeds and provided weed free condition for longer period of crop growth and resulted in increase of all growth and yield parameters as well as it might be due to effective control of weeds, which cumulatively resulted in higher dry matter accumulation which helped in greater translocation of food materials to reproductive parts and reflected in terms of yield attributing characters such as number of grains cob^{-1}. All these parameters showed positive and significant relationship on green cob yield of sweet corn. Unweeded control (T_1) showed the real picture of the aggressive nature of weeds on the growth of sweet corn. The lowest green cob yield was recorded

5886 kg ha^{-1} in unweeded control. This was due to increased crop weed competition for different resources *viz*., light, moisture, space and nutrients. Yield losses of similar magnitude due to the weed competition reported by Chang *et al*. (2021) [2] and Deshmane *et al*. (2023) [3].

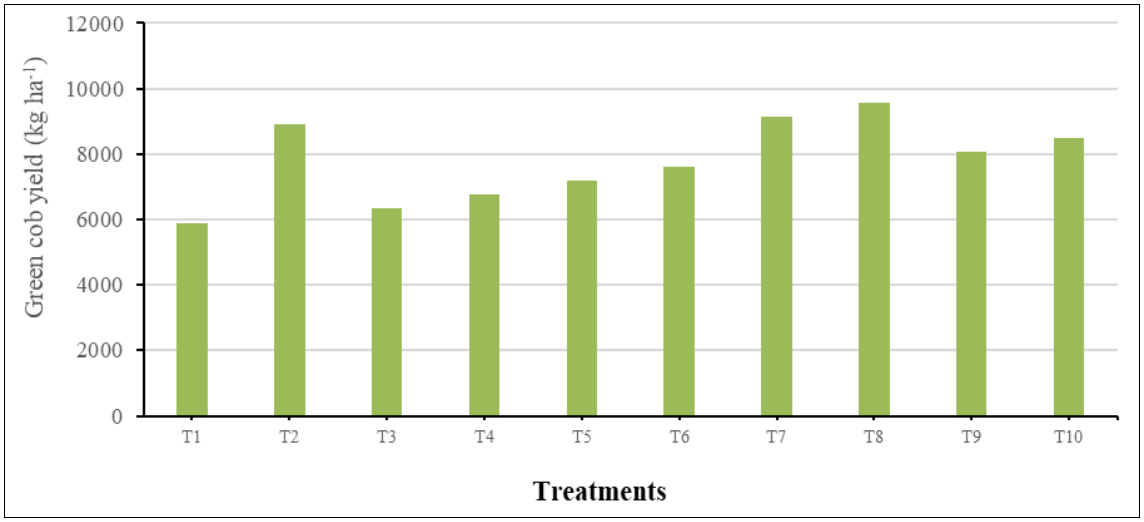

Fig 1: Green cob yield (kg ha^{-1})

Table 1: Efficacy of integrated weed management practices on plant height (cm), DMP (kg ha^{-1}), Leaf area index at 60 DAS and green cob yield (kg ha^{-1}) in sweet corn

Treatments	Plant height (cm)	DMP (kg ha^{-1})	Leaf area index	Green cob yield (kg ha^{-1})
T_1 - Unweeded control	107.4	4555	3.02	5886
T_2 - Two hand weeding on 15 and 30 DAS	165.8	7001	6.35	8918
T_3 - Pre-emergence application of pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS	116.9	4902	3.48	6326
T_4 - Pre-emergence application of metolachlor 50% EC @ 1 kg a.i. ha^{-1} on 3 DAS	125.1	5249	3.95	6754
T_5 - Pre-emergence application of pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + One hand weeding on 30 DAS	133.1	5604	4.42	7184
T_6 - Pre-emergence application of metolachlor 50% EC @ 1 kg a.i. ha^{-1} on 3 DAS + One hand weeding on 30 DAS	140.8	5946	4.92	7624
T_7 - Pre-emergence application of pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + Intercropping (Blackgram)	169.2	7159	6.49	9124
T_8 - Pre-emergence application of metolachlor 50% EC @ 1 kg a.i. ha^{-1} on 3 DAS + Intercropping (Blackgram)	177.2	7501	6.96	9548
T_9 - Pre-emergence application of pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + Sugarcane trash mulching on 21 DAS	149.2	6296	5.39	8056
T_{10} - Pre-emergence application of metolachlor 50% EC @ 1 kg a.i. ha^{-1} on 3 DAS + Sugarcane trash mulching on 21 DAS	157.3	6644	5.87	8487
S.Em+	2.48	106.07	0.09	135.57
CD (P=0.05)	7.46	315.16	0.27	402.82

Conclusion

Based on the result of field experiment, it concluded that pre-emergence application of metolachlor 50% EC @ 1 kg a.i. ha^{-1} on 3 DAS + Intercropping (Blackgram) (T_8) was effective integrated weed management practice for controlling weeds and increased growth and green cob yield of sweet corn.

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