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Effects of yield parameters in non-chemical weed management in bhendi hybrid CO_4 (*Abelmoschus esculentus* (L) Moench) in Coimbatore region

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Abstract
The goal of this study was to standardize non-chemical weed control techniques and their effects on the growth of hybrid okra. During the Rabi season of 2022, the study was carried out in the South farm of the School of Agricultural Sciences at the Karunya Institute of Technology and Sciences in Coimbatore. The experimental setup included a Randomized Block Design (RBD) with seven treatments that were reproduced three times. Treatments included unweed control, pre- emergence herbicide hand weeding and five non-chemical weed control methods. T_1 recorded the highest number of fruits plant^{-1} (20), highest total weight of fruits plant^{-1} (370.4 g) and highest fruit yield ha^{-1}. Second best method of weed management for higher yield in T_2 (hand weeding twice at 20 DAS and 40 DAS).

Keywords: Okra, yield attributes, intercrop

Introduction
Abelmoschus esculentus (L) Moench, sometimes known as okra, is one of India's most important vegetable crops. It is also known as a lady's finger in English, French, Spanish, and Hindi, as well as a qumgombo. Both tropical and warmer regions of temperate zones are used for its cultivation. Because there are no frosts or harsh winters in south India, bhendi can be cultivated all year round. One of the key vegetables farmed in Tamil Nadu is okra. Large volumes of chemical fertilizers, insecticides, and herbicides are used by farmers to cultivate it. Herbicides pollute the environment and harm the reproductive system, allergic sensitization, eyes, skin, diarrhea, vomiting, loss of consciousness, limb anomalies, and other organs. Okra farming hence necessitates the application of environmentally responsible and sustainable crop production techniques (Tylor and Francis, 2021) [3]. In this study, an effort is made to find an alternative, non- herbicide weed management method for okra. The major okra-producing areas in Tamil Nadu include Dindigul, Salem, Vellore, and Coimbatore. The okra hybrid Co (Bh) H1 was made using the Varsha Uphar selection and PA 4(T). It is highly market-preferred and immune to the disease brought on by the yellow vein mosaic virus (Kongala *et al*., 2020) [6]. The fruits are slender, less fibrous, dark green, and sparsely dispersed.

Materials and Methods
Study area location
An experiment was conducted on the impact of non-chemical weed management in okra at Karunya University in Coimbatore, Tamil Nadu in the 2022–2023 *Rabi* (Oct.–Jan.) season. The experiment was carried out in the south farm, School of Agricultural Sciences, Division of Agronomy, Karunya Institute of Technology and Sciences, Coimbatore. The farm is located at 10.9362° N latitude and 76.744° E longitude. Seven treatments were replicated thrice in the experiment is Randomized Block Design. The treatments are outlined below.

Experimental details
The treatment details are as show below. T1- Weed management as per package of practices and recommendations (Spray oxyfluorfen at 0.25 kg ha^{-1} as pre-emergence application on third day of sowing.) + one hand weeding at 30 DAS, T2 –Hand weeding twice at 20 DAS and 40 DAS, T3-Mechanical weeding by roto-weeder twice at 20 DAS and 40 DAS, T4- Mulching with black LDPE in the interspaces, T5- Intercropping with fodder cowpea and incorporation at flowering, T6- One hand weeding at 20 DAS + one weeding with roto-weeder at 40 DAS,

T7- Control- No weeding.

Statistical Analysis

Following the methodology of Gomez and Gomez (1984) [2], statistical analysis using a randomized block design was performed on the data gathered on the numerous characters evaluated during the experiment. Where treatments were significant, a critical difference was calculated at a 5% probability level. Treatment differences that were not statistically significant at 5% are designated as NS.

Results and Discussion

The data on yield and yield parameters are presented in Table 1 and Figure 1.

No. of fruits plant^{-1}

The number of fruits plant^{-1} was significantly influenced by the treatment. The number of fruits plant^{-1} was highest in T_1 (20) and was on par with T_2 and T_6 and it is significantly superior over T_3, T_4, T_5 and T_7. The lowest number of fruits plant^{-1} (13.2) was observed in T_4 and was on par with T_3, T_4, T_5 and T_7. Similar results have been reported by Hesinam *et al*. (2018) [4] in bhendi.

Total weight of fruits plant^{-1} (g)

Total weight of fruits plant^{-1} was significantly influenced by the treatments. Total weight of fruits plant^{-1} was highest in T_1 (370.4 g) and was significantly superior over other treatments. The lowest weight of fruits plant^{-1} (173.05 g) was observed in T_3 and was on par with T_5. Number of fruits plant^{-1} and total weight of fruits plant^{-1} were observed in T_1. This is in confirmity with the findings by Hesinam *et al*. (2018) [4] in bhendi.

Length of fruits (cm)

The length of fruits was significantly influenced by the treatments. Length of fruits was highest in T_6 (14.70 cm) and was on par withT_3 and T_5 and it was significantly superior over other treatments. Treatment 6 consisted of one hand weeding at 20 DAS + one weeding by roto-weeder at 40 DAS. The lowest length of fruits (10.41 cm) was observed in T_7 was on par with T_1, T_2, and T_4. This is in conformity in the findings of Rose *et al*. (2022) [7] in bhendi.

Girth of fruits (cm)

The girth of fruits was significantly influenced by the treatments. Girth of fruits was highest in T_4 (7.20 cm) and it was on par withT_2, T_5, T_6 and T_7 and significantly superior over other treatments. Treatment 4 consists of mulching with black LDPE in the interspaces. The lowest (4.20 cm) was observed in T_3. Similar results have been reported by Awodoyin *et al*. (2007) [1].

Average fruit weight (g)

Average fruit weight was significantly influenced by the treatments. Average fruit was weight was highest in T_4 (19.12 g) and was on par withT_1 and T_7 and significantly superior over other treatments. Treatment 4 consists of mulching with black LDPE in the interspaces. The lowest average fruit weight (12.54 g) observed in T_3 was on par with T_5. Similar results have been reported by Awodoyin *et al*. (2007) [1].

Yield (t ha^{-1})

Yield of bhendi fruits ha^{-1} was significantly influenced by the treatments. Fruit yield ha^{-1} was highest in T_1 (27.4t) and was significantly superior over all other treatments. Treatment 1 consisted on Weed management as per package of practices and recommendations (Spray oxyfluorfen at 0.25 kg ha^{-1} as pre-emergence application on third day of sowing) + one hand weeding at 30 DAS. On yield wise, the combination of herbicide + hand weeding ranked first. Treatment 1 yielded 34 percent more yield than un-weeded control (T_7). Second best fruit yield was observed in T_2 (22.7 t ha^{-1}). Treatment 1 yielded 27.4 percent more yield over T_2 (hand weeding at 20 and 40 DAS). Third best yield was in T_6 (22.1 t ha^{-1}). Treatment 1 yielded 24 percent more yield over T6 (one hand weeding at 20 DAS + one weeding with roto-weeder at 40DAS). The lowest fruit yield (12.8t) was observed in T_3. Similar result has been reported by Shamla *et al*. (2017) [5] and Hesinam *et al*. (2018) [4] in bhendi. The result of the study indicated that non chemical weed management practices in bhendi are not economically viable as pre-emergence herbicide + one hand weeding at 30 DAS.

Table 1: Effects of non-chemical weed management methods on yield indicators

Treatments	Yield Parameters					
	No. of fruits Plant^{-1}	Total weight of fruits Plant^{-1}	Length of fruits (cm)	Girth of fruits (cm)	Average fruit weight (g)	Yield (tha^{-1})
T1	20	370.4	12.14	6.10	18.52	27.4
T2	19.5	307.32	11.87	6.90	15.76	22.7
T3	13.8	173.05	13.67	4.20	12.54	12.8
T4	13.2	252.38	12.44	7.20	19.12	18.6
T5	13.5	196.29	13.00	6.20	14.54	14.5
T6	18.6	299.46	14.70	6.40	16.10	22.1
T7	16.8	276.52	10.41	6.50	16.46	20.4
Mean	16.49	267.92	12.60	6.21	16.15	19.79
S.E. (m±)	0.96	16.39	0.63	0.35	0.90	1.21
CD (p=0.05)	2.95	50.50	1.93	1.07	2.77	3.73

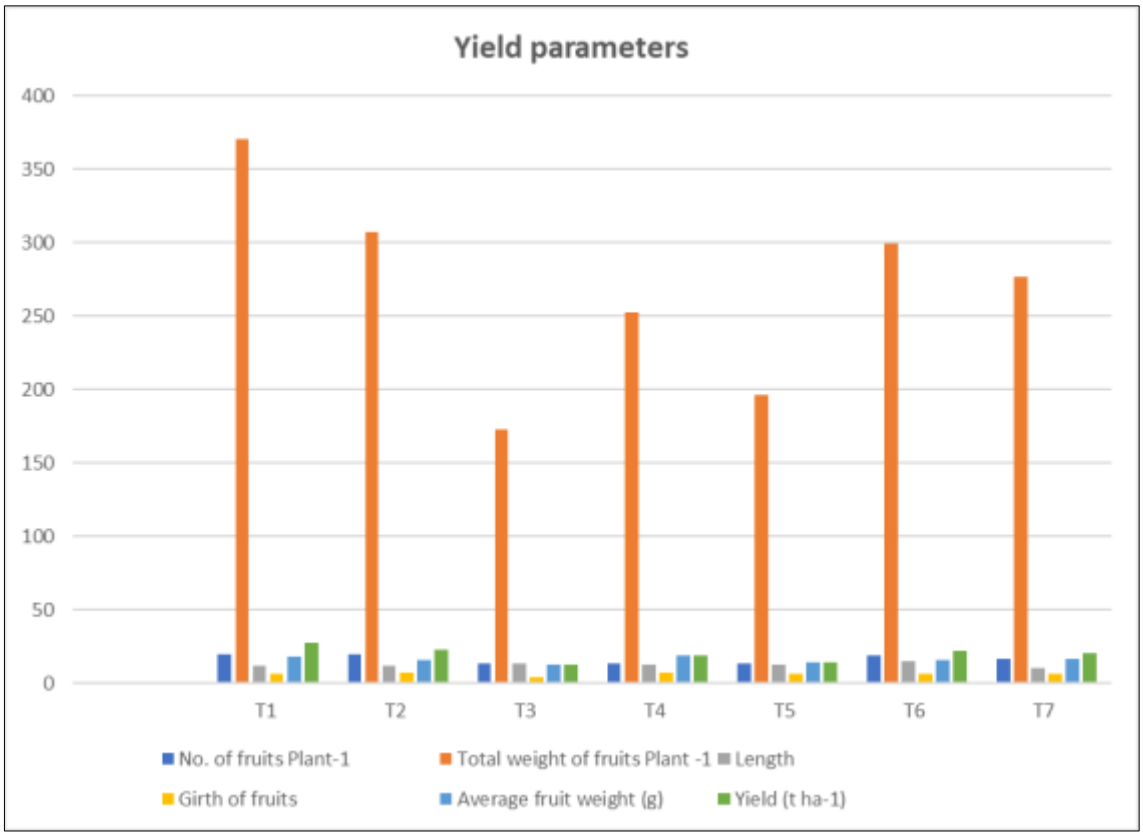

Fig 1: Yield parameters for non-chemical weed management in bhendi

Conclusion

From this research, we can study that (T1) weed management as per package of practices and recommendations (Spray oxyflourfen at 0.25 kg ha^{-1} as pre-emergence application on third day of sowing) recorded the highest number of fruits $plant^{-1}$ and weight of fruits $plant^{-1}$ and yield ha^{-1} in hybrid bhendi. The yield of bhendi fruits in non-chemical methods (T_2 to T_6) were significantly inferior to bhendi fruits was observed in T_2 (hand weeding at 20 and 40 DAS). If non-chemical weed management is the priority than T_2 can be followed.

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