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Studies on the Effect of Weed Management Practices on Growth, Yield and Quality Parameters of Okra (*Abelmoschus esculentus* L. Moench.) c.v. Azad Bhindi-1

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation was conducted at Vegetable Research Farm, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur during kharif season 2023. The experiment was laid out in Randomized Block Design with eight different treatments viz. T_1: Weed check control. T_2: Pre-emergence application of pendimethalin @6ml/L**.** T_3: Postemergence application of metribuzin @525g/ha. T_4: Pre-emergence application of pendimethalin @6ml/L. + 1 hand weeding at 40 DAS T_5: Postemergence application of metribuzin @525g/ha at 25 DAS+ 1 hand weeding at 60 DAS. T_6: Pre-emergence application of pendimethalin @6ml/L.+ Postemergence application of metribuzin @525g/ha, T_7 Weed free check {three hand weeding} at 20,40,60 DAS respectively, T_8: Pre-emergence application of pendimethalin @6ml/L.+ Postemergence application of metribuzin @525g/ha+ One hand weeding 40 DAS replicated thrice. The okra variety 'Azad Bhindi-1' was used in experiment. The result of the study revealed that at 30 DAS maximum plant height (30.10cm) was reported in treatment T_6, and 60 and 90 DAS maximum plant height (76.50 and 110.00 cm) was reported in T_8 and at 30 days maximum number of nodes on main stem of plant (8.70) found in T_6, whereas at 60 and 90 DAS maximum number of nodes on main stem of plant (17.80 and 20.50) was reported in T_8 . At 30 days maximum diameter of stem(1.30 cm) was reported in treatment T_6 , and at 60 and 90 DAS maximum diameter of stem(1.90 and 2.50 cm) reported in T_8, at 30 days maximum number of leaves/plant (8.80) is reported in T_6 and at 60 and 90 days maximum number of leaves/plant (2.27 and 4.76) is was reported in T_8. At 60 and 90 DAS Maximum number of branches per plant (4.90 and 5.96) was found in T_8 Maximum Pod diameter (1.80 cm), fruit weight (13.55 gm), pod length (14.30 cm), number of pods per plant (25.74), pod yield per plant (285.00 gm) , pod yield per hectare (16.50 t), TSS (3.18 ^{0}Brix), crude fibre (8.65 %) and chlorophyll content (1.22 mg) were reported in T_8.

Keywords: Okra; Azad Bhindi-1; herbicides; weed control techniques.

1. INTRODUCTION

Okra or *Abelmoschus esculentus* (L.) is a plant native to Africa that is a member of the Malvaceae family and is also referred to as Lady's finger. It has a diploid chromosome number of 2n = 130. One of the most significant vegetables grown worldwide in tropical, subtropical, and warm temperate climates is okra. It is a warm-season crop because it is grown during the summer and rainy season. Okra is grown for its developing edible pods, or fruits. It is a fantastic vegetable that can be used in many stews and soups. For making gur, the root and stem are used to clarify the cane liquid. Fruit with a high iodine concentration aids in the treatment of goitre, while diarrhoea and inflammation are treated with leaves. Previous research have provided information on the makeup of the okra's edible section. The plant has the following biochemical components: Moisture 89.6g, Protein 1.9g, Fat 0.2 g, Fiber 1.2 g, Calories 35, Phosphorous 56 mg, Sodium 6.9 mg, Sulphur 30 mg, Riboflavin 0.1 mg, Oxalic acid 8 mg, Minerals 0.7mg, Carbohydrates 6.4g, Calcium 66 mg, Iron 0.3 5mg, Potassium 103 mg, Thiamine 0.07 mg, Nicotinic acid 0.6mg, Vitamin C 13 mg, Magnesium 53 mg and Copper 0.19 mg, [1].The fruit is also beneficial for leucorrhoea, overall weakness, and renal colic. The dry seed contains 13-22% good food oil and has numerous other uses. Protein, lipids, and ash are found in seeds in amounts of around 21, 14, and 5%, respectively [2].

Okra (*Abelmoschus esculentus* also called as bhendi or lady's finger belongs to family Malvaceae. It is widely cultivated in warmer parts of the globe. it is grown during the summer and rainy season. Okra is a highly favoured vegetable across all demographic groups due to its abundant nutritional value, delicious flavour, and potential medical and industrial applications. Okra is grown for its spherical, round seeds found inside its fibrous fruits or pods. When still young, the fruits are harvested and consumed like vegetables. Okra typically takes 90 to 100 days to produce. Both *Kharif* and *Rabi* use okra production. An environment that is both warm and damp is ideal for the growth of okra. It is a good source of vitamins, minerals, calories, and amino acids present in seeds [3]. Okra, or lady finger, has several uses for all of its parts, including its fresh leaves, buds, flowers, pods, stems, and seeds. As such, it is a crop with many uses. [4] *Abelmoschus esculentus*" is the only

species that may be widely or favourably grown for commercial vegetable production. Furthermore, although okra is a self-pollinated crop, it is frequently cross-pollinated because to the 20 per cent out crossing that occurs by insects**,** [5].

Among the various factor responsible for the low yield of okra, weeds have been considered to be of prime importance. The losses caused by weeds exceed the losses from any other category of biotic factors like insects, nematodes, diseases, rodents, mites etc. A large number of weed species infest the crop during summer season declined production. Reduction in the yield due to weeds varies from 40 to 80 per cent depending upon the type of weeds, their intensity and tune of crop weed competition [6]. Presence of weeds in the crop decreases the yield through competing with them for space, moisture, light and plant nutrients and also increase cost of cultivation, reduce input efficiency, interfere with agricultural operations, impair quality, act as alternate hosts for several insect-pests, diseases, affect aesthetic look of the ecosystem, native biodiversity, as well as affect human and cattle health. Therefore, the weed management is the most important agronomic aspect that plays an important role in exploiting the yield potential of okra, provided other inputs are not limiting.

Okra currently makes over 60% of fresh vegetable exports and has tremendous potential as a crop for foreign exchange. With an area of 513 000 ha and a productivity of 12.0 mt. ha-1, India is the world's greatest producer of okra, with a production of 6,170 thousand tonnes. India's top states for okra production are Uttar Pradesh, Bihar, and Orissa. Okra is grown on 12,167 hectares of land in Telangana, with a production of 1,67,255 tonnes (National Horticulture Board 2018-19**).** Thus the following goals in mind the current study, Studies on the Effect of Weed Management Practices on Growth, Yield and Quality Parameters of Okra (*Abelmoschus esculentus* L. Moench.) c.v. Azad Bhindi-1 is started.

- ✓ To observe that impact of cultural practices and herbicides on the yield and growth of okra.
- ✓ To observe various weed control techniques of affect the quality of okra.
- ✓ To research on the costs and benefits of different weed management strategies.

2. MATERIALS AND METHODS

The trial was conducted at Department of Vegetable Science Chandra Shekhar Azad University of Agriculture and Technology in Kalyanpur Kanpur, Uttar Pradesh, India during the *Kharif* season of 2023. The experiment was set up in randomized block design with three replication consisting of 8 treatments viz; T_1 Weed check control, T_2 Pre-emergence application of pendimethalin @6ml/L , T_3 Postemergence application of metribuzin @525g/ha, T_4 Pre-emergence application of pendimethalin @ 6ml/L. + 1 hand weeding at 40 DAS, T_5 Postemergence application of metribuzin @525g/ha at 25 DAS+ 1 hand weeding at 60 DAS, T_6 Pre-emergence application of pendimethalin @6ml/L.+ Postemergence application of metribuzin @525g/ha , T_7 Weed free check (three hand weeding) at 20,40,60 days respectively, T_8 Pre-emergence application of pendimethalin @6ml/L.+ Postemergence application of metribuzin @525g/ha + One hand weeding at 40 DAS. and the observation were recorded in randomly taken and tagged plants from each replication on morphological traits viz; plant height (cm), Number of nodes on main stem per plant, Stem diameter (cm), number of leaves /plant, Number of branches per plant, Pod Diameter (cm), Fresh weight of pod (g), Pod length (cm), Number of pods / plant, Pod yield/ plant (g), Total pod yield (t/ha), Total soluble solids (TSS), Crude fibre (%) and Total chlorophyll content (mg 100-1 g).Biometrical Analysis Experimental data was subjected to biometrical analysis as per the standard as procedure given by Gomez and Gomez (1984). Significant difference between treatment means was tested through ‘F ’ test and critical difference (C.D.) was worked out wherever ‘F ’ value was found to be significant for treatment effect [7]

3. RESULTS AND DISCUSSION

3.1 Studies on the effect of Weed Management Practices on Growth, Yield and Quality Parameters of Okra (*Abelmoschus esculentus* L. Moench.)

Plant height (cm): At 30 DAS, significantly highest plant height (30.1cm) was observed under treatment T_6 However, Weedy check control (T_1) recorded significantly the lowest plant height (18.10 cm).

At 60 DAS, During treatment T_8 the substantially highest plant height (76.50cm) was found. Followed by T_6 ,T_4, T_5 T_7 ,T_2 ,T_3

(74.2,72.1,70.3,68.2,67.5,65.9,) T_1 the weedy check control, had the lowest plant height (43.51 cm), by a substantial margin. At 90 DAS, Treatment T_8 produced the highest plant height (110 cm), Followed by T_6,T_4,T_5,T_7 ,T_2 andT_3 with plant height(105.003,101.9,99.00,97.99,95.00,87.00 cm) T_1, the weedy check control, had the lowest plant height (84.82 cm), by a substantial margin. Similar results were reported by Jain et al. [8], Patel et al. [9] and Pandey et al. [10].

3.2 Number of Nodes on Main Stem Per Plant

The significantly higher numbers of nodes per main stem (8.70) at 30 DAS were recorded under treatment T_6 but remain at par with treatment T_8, T_4, T_5, T_7, T_2 and T_3 (7.90,6.70,6.4,6.20,6.1and 5.9, respectively). Whereas, significantly the lowest numbers of nodes per main stem (5.60) were recorded under weedy check control treatment (T_1).

At 60 DAS, various weed control techniques had a substantial effect on the number of nodes per main stem and Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS (T_8) recorded maximum nodes per main stem (17.80) but remained statistically at par with other treatments T_6, T_4, and T_5 (16.900, 16.200 and 15.500, respectively) with respect to this character. However, treatment T1 (weedy check) had the fewest nodes per main stem (10.68) during the trial. At 90 DAS, the highest number of nodes per main stem (20.500) was reported with treatment (T_8) Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS and remained at par with treatments T_6 (Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS), Treatment T_1 (weedy check control) produced the lowest number of nodes per main stem (8.693). and during the study, it was comparable to treatments T_4 and T_5, with scores of 17.400 and 16.497, respectively, Singh et al. [11] and Patel et al. [12] and Pandey et al. [10].

3.3 Stem Diameter (cm)

The different treatments exhibited their significant effect on stem diameter at 30 DAS. Application of (Pre-emergence of pendimethalin @6ml+Postemergence application of metribuzin@525g/ha at 25 DAS (T_6) significantly recorded the maximum stem diameter (1.30 cm) and remain at par with treatment T_8 and T_4 (1.29 cm and 1.25 cm, respectively). While, treatment T_1 were recorded the lowest stem diameter (0.890 cm) during the observation.

At 60 DAS, significantly maximum stem diameter (1.900 cm) was recorded under treatment T_8 Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS and remained at par with treatments T_6 (Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS(1.850cm), T_4(Pre-emergence of pendimethalin @6ml+one hand weeding at 40 DAS(1.790 cm), T_5(Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS(1.650 cm) Treatment T_1 (weedy check control) resulted in a decreased stem diameter of 1.099 cm for okra plants. The examination of data revealed that different weed control treatments had a substantial impact on stem diameter at 90 DAS. Treatment (T_8) Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS & T_6 (Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS were equally effective and recorded higher stem diameter (2.503& 2.200 cm, respectively) as compared to remaining treatments of weed management. Furthermore, during treatment T_1 (weedy check control), the okra plant had a considerably reduced stem diameter (0.987 cm).

3.4 Number of Leaves Per Plant

Initially, throughout the 30 DAS, various weed control treatments had no significant effect on the quantity of leaves per plant in the okra experiment. However, it was considerable at 60 and 90 DAS.

At 60 DAS, several weed control techniques had a substantial impact on the number of leaves per plant (Table 1). The highest number of leaves (23.200) was reported during Treatment (T_8) Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS) But remained at par with

treatments T_6 (Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS, However, treatment T_1 (weedy check) produced the fewest leaves per plant (7.600). At 90 DAS, treatment T_8 Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS was recorded higher number of leaves per plant (49.50) followed by T_6 (Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS (47.00), T_4 Pre-emergence of pendimethalin @6ml+one hand weeding at 40 DAS (43.500), (T_5) Postemergence application of metribuzin@525g /ha at 25 DAS+ one hand weeding at 40 DAS(39.00), However, treatment T_1 (Weedy check) had the lowest number of leaves during the research was recorded(23.860). The above findings are in close with the results of Patel et al*.* [12] and Sharma et al. [13], Singh et al*.* [14].

3.5 Number of Branches Per Plant

At 60 DAS, various weed control methods significantly altered the number of branches per plant and, During treatment T_8 (Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS) the substantially highest branches (4.90) was found. Followed by T_6 (Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS),T_4(Pre-emergence of pendimethalin @6ml+one hand weeding at 40 DAS),T_5(Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS), T_7 (three hand weeding at respectively 20,40,60 DAS),T_2(Pre-emergence of pendimethalin @6ml),T_3(Postemergence application of metribuzin@525g/ha at 25 DAS),with branches respectively (4.700,4.500,4.200,3.900,3.500, 3.100) ,T_1 the weedy check, had the lowest number of branches (2.169) found, by a substantial margin. At 90 DAS, The maximum number of branches per plant (5.960) was recorded with treatment T_8(Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS). Followed by T_6 (Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS),T_4(Pre-emergence of pendimethalin @6ml+one hand weeding at 40 DAS),T_5(Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS), T_7 (three hand weeding at respectively 20,40,60 DAS), and it being at par with treatment T_6,T_4,T_5,and T_7(5.600,5.110,4.990 and 4.703) respectively during the investigation significantly the lowest number of branches (3.220)was recorded. The above findings are in close harmony with the results of Patel et al*.* [6] and Zinzala. et al*.* [15].

Yield Attributes: To explain the trend of treatments in terms of fresh fruit production/ha, yield components such as pod diameter (cm), fresh pod weight (g), pod length (cm), number of pod/plant, and pod yield/plant (g), Total pod yield(t/ha) were measured throughout the experiment. The necessary information for each of these yield-attributing characters is listed below.

3.6 Diameter of Pod (cm)

The diameter of the okra fruit was significantly impacted by weed control measures. Table 2's mean data made it evident that Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS (T_8) resulted in a bigger fruit diameter (1.80 cm), although this difference was statistically insignificant when compared to treatment T_6, T_4, and T_5. Under treatment weedy check, a significantly smaller fruit diameter (1.094 cm) was noted (T_1). These findings are supported by Manju*,* et al*.* [16]*,* Kumar et al*.* [17].

3.7 Fresh Weight of Pod (g)

Presented data indicating a strong relationship between weed management techniques and okra fruit weight. T_8, the treatment that got Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS, had the highest fruit weight (13.55 g), although it was still comparable to T_3, T_4, and T_5. With the weedy check, a significantly reduced fruit weight (7.63 g) was observed (T_1). These findings are supported by Manju. et al*.* [16] and Kumar et al*.* [17].

3.8 Length of Pod (cm)

Weed management techniques have a substantial effect on okra fruit length. The mean data clearly indicates that the weed was handled

Table 1. Variation in plant parameters against different treatments

Treatment details	Plant height (cm)			Number of nodes on main stem of plant			Stem diameter (cm)			Number of leaves per plant			Number of branches per plant	
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	60 DAS	90 DAS
T_1: Weed check control.	18.10	43.51	84.82	5.60	10.68	8.69	0.89	1.09	0.98	6.90	7.60	23.86	2.16	3.22
T_2: Pre-emergence application of pendimethalin @6ml/L.	22.70	67.50	95.00	6.10	14.50	13.50	1.10	1.42	1.55	7.30	13.90	32.50	3.50	4.11
T_3: Postemergence application of metribuzin @525g/ha.	20.45	65.90	87.00	5.90	13.90	13.00	1.05	1.36	1.47	7.10	12.56	27.58	3.10	3.55
T_4: Pre-emergence application of pendimethalin @6ml/L. + 1 hand weeding at 40 DAS	27.67	72.10	101.99	6.70	16.20	17.40	1.25	1.79	1.90	8.30	18.50	43.50	4.50	5.11
T_5: Postemergence application of metribuzin @525g/ha at 25 DAS+ 1 hand weeding at 60 DAS.	25.99	70.30	99.00	6.40	15.50	16.49	1.20	1.65	1.70	7.90	16.90	39.00	4.20	4.99
T_6: Pre-emergence application of pendimethalin @6ml/L.+ Postemergence application of metribuzin @525g/ha.	30.10	74.20	105.00	8.70	16.90	18.20	1.30	1.85	2.20	8.80	21.19	47.00	4.70	5.60
T_7: Weed free check {three hand weeding} at 20,40,60 DAS respectively.	24.34	68.20	97.99	6.20	14.90	15.00	1.15	1.55	1.67	7.50	14.33	34.00	3.90	4.70
T_8: Pre-emergence application of pendimethalin @6ml/L.+ Postemergence application of metribuzin @525g/ha+ One hand	28.99	76.50	110.00	7.90	17.80	20.50	1.29	1.90	2.50	8.50	23.20	49.50	4.90	5.96

Treatment details	Plant height (cm)			Number of nodes on main stem of plant			Stem diameter (cm)			Number of leaves per plant			Number of branches per plant	
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	60 DAS	90 DAS
weeding 40 DAS.														
CD at 5%	3.47	8.67	11.12	0.28	2.82	2.21	0.05	0.21	0.21	0.45	2.27	4.76	0.58	0.58
C.V.%	6.78	7.29	7.36	8.45	10.62	8.17	7.54	7.53	6.94	5.28	8.03	7.26	8.53	7.12

Table 2. Variation in pod parameters against different treatments

Treatment details	Pod diameter (cm)	Fresh weight of pod (gm)	Pod length (cm)	Number of pods per plant	Pod yield per plant (gm)	Total pod yield (ton/ha)	TSS (^{O}brix)	Crude fibre (%)	Total chlorophyll content in pods (mg /100 g)
$T_{1:}$ Weed check control.	1.09	7.63	6.75	13.22	170.35	9.13	0.95	5.40	0.62
$T_{2:}$ Pre-emergence application of pendimethalin @6ml/L.	1.49	10.48	10.02	18.70	190.00	11.30	1.90	7.55	0.95
$T_{3:}$ Postemergence application of metribuzin @525g/ha.	1.45	10.10	9.20	17.20	175.00	10.00	1.88	7.33	0.92
$T_{4:}$ Pre-emergence application of pendimethalin @6ml/L. + 1 hand weeding at 40 DAS	1.73	12.77	13.50	23.50	230.00	13.99	2.70	8.33	1.00
$T_{5:}$ Postemergence application of metribuzin @525g/ha at 25 DAS+ 1 hand weeding at 60 DAS.	1.65	12.10	12.19	21.20	215.00	13.20	2.20	8.11	0.99
$T_{6:}$ Pre-emergence application of pendimethalin @6ml/L.+ Postemergence application of metribuzin @525g/ha.	1.77	12.99	13.99	24.20	250.00	15.20	2.99	8.55	1.15
$T_{7:}$ Weed free check {three hand weeding} at 20,40,60 DAS respectively.	1.55	11.55	11.50	19.50	199.00	12.40	1.99	7.99	0.95
$T_{8:}$ Pre-emergence application of pendimethalin @6ml/L.+ Postemergence application of metribuzin	1.80	13.55	14.30	25.74	285.00	16.50	3.18	8.65	1.22

Treatment details	Pod diameter (cm)	Fresh weight of pod (gm)	Pod length (cm)	Number of pods per plant	Pod yield per plant (gm)	Total pod yield (ton/ha)	TSS (^{O}brix)	Crude fibre (%)	Total chlorophyll content in pods (mg /100 g)
@525g/ha+ One hand weeding 40 DAS									
CD at 5%	0.23	1.54	1.65	3.15	7.32	1.93	0.27	1.08	0.15
C.V%	8.54	7.65	8.19	8.74	6.94	8.61	7.04	7.93	8.76

by the treatment that Pre-emergence application of pendimethalin at 6ml/ha, followed by post-emergence application of metribuzin at 525g/ha at 25 DAS and one-handed weeding at 40 DAS, significantly enhanced fruit length T_8 (14.30 cm), which remained comparable to treatments T_6, T_4, and T_5. The shortest fruit length (6.78 cm) was reported with treatment T_1 (weedy check control). These findings are supported by Singh et al., Kumar et al. and Sharma et al. [13] and Dash. S et al. [18].

3.9 Number of Pods / Plant

The mean quantity of okra pods/plants was significantly impacted by various weed control techniques. The treatment T_8 produced the most pods per plant (25.74) Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS, followed by T_6 (Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS,(T_4) Pre-emergence of pendimethalin @6ml+one hand weeding at 40 DAS, (T_5) Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS, T_7 (three hand weeding at respectively 20,40,60 DAS), T_2(Pre-emergence of pendimethalin @6ml),T_3 (Postemergence application of metribuzin@525g/ha at 25 DAS. However, the lowest quantity of fruit per plant (13.22) was seen following treatment T_1 (weed check control). These findings are supported by Singh et al. (2022)., Kumar et al. (2015) and Sharma et al (2000). and Dash.S et al.(2017).

3.10 Pod Production / Plant (g)

Different weed control methods had a substantial effect on the mean pod output per plant for okra. Treatment T_8 (pre-emergence of pendimethalin at 6ml/ha, post-emergence application of metribuzin at 525g/ha at 25 DAS, and one-handed weeding at 40 DAS) resulted in the highest pod output per plant (285.0 g). followed by T_6 (Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS,(T4) Pre-emergence of pendimethalin @6ml+one hand weeding at 40 DAS, (T_5) Postemergence application of metribuzin@525g/ha at 25 DAS+ one hand weeding at 40 DAS, T_7 (three hand weeding at respectively 20,40,60 DAS), T_2 (Pre-emergence of pendimethalin @6ml),T_3 (Postemergence application of metribuzin @ 525g/ha at 25 DAS, The lowest fruit output per plant (170.35 g) was seen with treatment T_1 (weedy check control). The findings corroborate the observations made earlier more or less by by Patel et al. [6], Khalid et al. [19] and Sharma et al. [13].

3.11 Total Pod Yield (t/ha)

Different weed control methods had a substantial impact on overall okra pod yields. T_8 (pre-emergence of pendimethalin @6ml+post-emergence application of metribuzin @525g/ha at 25 DAS+ one-handed weeding at 40 DAS) reported the highest okra fruit output (16.5 t/ha), and being on par with treatments T_6 and T_4. The lowest okra green fruit production (9.13 t/ha) was obtained under weedy check control (T1). The fruit production of okra under different weed control treatments was as follows: $T_8 < T_6 < T_4 < T_5 < T_7 < T_2 < T_3 < T_1$. These findings are accordance with those obtained by Khadar et al. [20] and Khalid et al. [19] and Sharma et al. [13].

3.12 Quality Parameters

Total soluble solids (^{O}brix): The mean total soluble solids of okra were significantly impacted by various weed management techniques. Treatment T_8 (pre-emergence of pendimethalin @6ml+post-emergence application of metribuzin @525g/ha at 25 DAS+ one-handed weeding at 40 DAS) produced the greatest total soluble solids (3.18 ^{o}Brix), followed by T_6 (Pre-emergence of pendimethalin @6ml/ha+Postemergence application of metribuzin@525g/ha at 25 DAS,(T_4) Pre-emergence of pendimethalin @6ml+one hand weeding at 40 DAS, (T5) Postemergence application of metribuzin @ 525g/ha at 25 DAS+ one hand weeding at 40 DAS, T_7 (three hand weeding at respectively 20,40,60 DAS), T_2(Pre-emergence of pendimethalin @6ml),T_3(Postemergence application of metribuzin@525g/ha at 25 DAS. However, treatment T_1 (weedy check) produced the lowest total soluble solids (0.95^{o}Brix). These findings are accordance with those obtained by , Khalid et al. [19] and Sharma et al.(2000).

3.13 Crude Fiber (%)

The minimum and greatest crude fiber levels (5.4 and 8.65% respectively) were reported under treatments T_1 weedy check control and T_8

(pre-emergence of pendimethalin @6ml+post-emergence application of metribuzin @525g/ha at 25 DAS+ one-handed weeding at 40 DAS). The above findings are in close harmony with the results of Narayan, S et al. [21] and Adeyemi, O et al. [22].

3.14 Total Chlorophyll Content (mg 100^{-1} g)

Weed management techniques significantly influenced chlorophyll content in okra pods. The mean results clearly showed that greater chlorophyll content in pod (1.22 mg 100-1 g) was noted when pre-emergence treatment of pendimethalin @6ml + post-emergence application of metribuzin @525g/ha at 25 DAS + one-handed weeding at 40 DAS (T_8).but it was statistically at par with treatment T_6,T_4,T_5,T_7,T_2 and T_3. However, treatment T_1 (weedy check control) produced the lowest total chlorophyll content (0.623 mg 100-1 g). The results are in propinquity with the result of Minal S et al. [23], Narayan, S et al [21] and Adeyemi, O et al. [22].

3.15 Benefit Cost Ratio (B:C)

A maximum B:C ratio of 1:27 was obtained with treatment T_8 (Pre-emergence application of pendimethalin @6ml/L.+ Postemergence application of metribuzin @525g/ha+ One hand weeding 40 DAS), followed by T_6 (Pre-emergence application of pendimethalin @6ml/L.+ Postemergence application of metribuzin @525g/ha) with 1:2.64, which are almost same data. However, the pod production of okra was highest in treatment T_8 Pre-emergence application of pendimethalin @6ml/L.+ Postemergence application of metribuzin @525g/ha+ One hand weeding 40 DAS). And Treatment T_1 (weedy check control) had the lowest B:C ratio at 1:1.29 were reported the data [24-26].

5. CONCLUSION

On the basis of present investigation, it concluded that minimum weed density/m^2 were obtained in the T_8 and followed by T_6, T_4 and T_5 .T_7 ,T_2 ,T_3, and T_1 . On the basis of this field trail, it can be concluded that the okra variety (Azad Bhindi-1) responded favourably with growth, quality and yield with weed management practices. Treatment T_8 in Pre-emergence application of pendimethalin @6ml/L.+ Postemergence application of metribuzin @525g/ha+ One hand weeding 40 DAS was found best treatment among all. It may be recommended for farmers of the central plain zone of Uttar Pradesh for better growth, quality and yield in Okra.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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