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RESEARCH PAPER

Effect of Weed Management Practices on Growth and Yield of Sesame (*Sesamum indicum* L.)

G.S. Bhaumik[1*], R.S. Singh[1] and Debashish Sen[2]

[1]Department of Agronomy, Dr. Rajendra Prasad Central Agriculture University, Pusa, Samastipur, Bihar, India
[2]Department of Agronomy, College of Agriculture, Tripura, Lembucherra, Agartala, India

*Corresponding author: bhaumikgourisankar@gmail.com (**ORCID ID:** 0009-0006-0116-7509)

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ABSTRACT

The experiment was conducted at Research Farm of Tirhut College of Agriculture, Dholi, Dr. RPCAU, Bihar during *kharif* 2019 on sandy loam soil. The soil of the experimental field was calcareous in nature, testing low in Organic carbon, Nitrogen, Phosphorous and Potassium. The experiment was done by the layout of Randomized Block Design with three replications comprising of eight treatments i.e. T_1: Weedy check, T_2: Hand weeding at 30 DAS, T_3: Pre-emergence application of pendimethalin 1000 g ha^{-1}, T_4: Post-emergence application of quizalofop-p-ethyl 50 g ha^{-1} at 25 DAS, T_5: Post-emergence application of imazethapyr 67.5g ha^{-1} at 25 DAS, T_6: Pre-emergence application of pendimethalin 1000 g ha^{-1} + hand weeding at 30 DAS, T_7: Pre-emergence application of pendimethalin 1000 g ha^{-1} + post-emergence application of quizalofop-p-ethyl 50 g ha^{-1} at 25 DAS, T_8: Pre-emergence application of pendimethalin @1000g/ha + post-emergence application of imazethapyr 67.5 g ha^{-1} at 25 DAS. The data revealed that significant increase of plant height was recorded under pre-emergence application of pendimethalin 1000 g ha^{-1} + post-emergence application of quizalofop-p-ethyl 50 g ha^{-1} at 25 DAS (T_7). However, application of pendimethalin 1000 g ha^{-1} in pre-emergence + hand weeding at 30 DAS (T_6) resulted higher Plant dry weight, Crop growth rate, Number of capsules per plant, Grain yield, Straw yield and Harvest index.

HIGHLIGHTS

- Pendimethalin 1000 g ha^{-1} in pre-emergence with hand weeding at 30 DAS may be recommended, as it enhanced the growth and yield in sesame.

Keywords: Plant height, Crop growth rate, Grain yield, Straw yield, Harvest index

Sesame (*Sesamum indicum* L.) is known as Gingelly, Til (derived from a sanskrit word Taila). It is also called poor man's substitute of *ghee* as it provides large amount of oil. People used to say it as Rani of Tilhan. In India, it ranks 3rd in oilseed crop next to groundnut, rapeseed-mustard (Babu *et al.* 2016). It belongs to the order Tubiflorae, family Pedaliaceae having chromosome no. 2*n* = 26. Sesame is the oldest oilseed crop being used by the human being from ancient time (Babu *et al*. 2016). India is major consumer of edible oilseed crops and produces 7-8 percent of total oilseed production in world as well as 13-15 percent area occupied in world's oilseed cultivated area (Prem Narayan, 2016). Sesame contains 38-54% oil and also provides 18-25% protein. Around 592 calories energy is obtained from 100 g sesame seed. The oil of sesame is oxidative rancidity resistant. So, it can be stored for longer period due to its stability.

In World, the total area under sesame cultivation is 80000 hundred hectares with a production of 50 million quintals and productivity 5.65 quintals per hectare during 2016-17. In India, the total area under sesame cultivation is 1.98 million hectares with a

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production of 0.81 million tonnes and productivity 430.5 kg ha^{-1} during 2016-17. In Bihar, the total area under sesame cultivation is 3236 hectares having total yield of 25.47 thousand quintals and productivity 7.87 quintals per hectare (RAU. 2010. Agricultural Technology Module. 8p. RAU, Pusa, Bihar, India).

Weeds are the plants which are undesirable, troublesome, difficult to control and growing almost everywhere and in all the seasons. Competition is the struggle for survival and existence. The total loss due to weeds is around 45%, for insects around 30%, for disease around 20% and for other pests around 5%. Yield loss in sesame is around 50-75% due to weed infestation (Dungarwal *et al.* 2003). The main reason in low productivity in sesame is due to weed competition. Sesame is mostly cultivated in *kharif* season and in this season more weed infestation is found. The major weeds found during sesame cultivation were – *Cynodon dactylon, Dactyloctenium aegyptium, Digera arvensis, Cyperus rotundus, Eleusine indica, Physalis minima, Corchorus aestuans, Parthenium hysterophorus, Leucas aspera, Sorghum halepense, Phyllanthus niruri, Euphorbia hirta etc.*

Maximum competition between crop and weed that can be considered is between 15 and 45 DAS, (Duary *et al.* 2013). So, the farmers should be careful about weeds from the sowing to knee-high stage of the crop. The main advantage in sesame cultivation is that it has fast initial growth, so it faces less weed competition at the initial stages. The cultural methods play an important role in weed management. The mostly used cultural practice by the farmer is hand weeding. At 30 Days after sowing, one hand weeding is necessary for controlling various weed species growing in sesame cultivation. But the main disadvantage of hand weeding is that it is much time consuming as well as labour expensive method. Herbicides have introduced as they are efficient, practical and cost effective (Ganai *et al*. 2018). For that reason, farmers are adapting the chemical weed management practices over hand weeding. Various types of herbicides such as pre-emergence herbicide (Pendimethalin) or its combination with hand weeding and post-emergence herbicides such as Quizalofop-p-ethyl, Imazethapyr can be applied during sesame cultivation. Pre-emergence herbicide controls only the initial emerging weeds and in later stage growing weeds remain unaffected. So, the use of post emergence herbicides becomes necessary for controlling those unaffected weeds. Hence, the present research entitled "Effect of Weed Management Practices on Growth and Yield of Sesame (*Sesamum indicum* L.)" was conducted to find out most suitable weed management practice for sesame cultivation at Dr. Rajendra Prasad Central Agriculture University, Bihar.

MATERIALS AND METHODS

Experimental Details: The experiment was conducted at Research Farm of Tirhut College of Agriculture, Dholi, RPCAU, Bihar (latitude 25°39′ N and longitude 85^{0}40′ E and 52.18 meter of altitude above mean level of sea on the southern and western coast of Burhi Gandak river). The site falls under sub-tropical and sub-humid climate. During crop season, the average per week maximum temperature was 31.56 °C, minimum temperature was 24.80 °C, maximum relative humidity 96.88% (at 7 AM), minimum relative humidity 81.26% (at 2 PM) and total rainfall of 814.4 mm. The study was done during *kharif* season 2019 on sandy loamy texture soil, which was calcareous in nature (pH 8.3), low Organic carbon (0.37%), EC (0.38 m. mhos cm^{-1}), low in Nitrogen (194.2 kg ha^{-1}), Phosphorous (17.3 kg ha^{-1}) and Potassium (122.6 kg ha^{-1}).

Treatments: The experiment was done by the layout of Randomized Block Design with three replications comprising of eight treatments *viz*. T_1: Weedy check, T_2: Hand weeding at 30 days after sowing, T_3: Pre-emergence application of pendimethalin 1000 g ha^{-1}, T_4: Post-emergence application of quizalofop-p-ethyl 50 g ha^{-1} at 25 days after sowing, T_5: Post-emergence application of imazethapyr 67.5 g ha^{-1} at 25 days after sowing, T_6: Pre-emergence application of pendimethalin 1000 g ha^{-1} + hand weeding at 30 days after sowing, T_7: Pre-emergence application of pendimethalin 1000 g ha^{-1} + post-emergence application of quizalofop-p-ethyl 50 g ha^{-1} at 25 days after sowing, T_8: Pre-emergence application of pendimethalin @1000 g ha^{-1} + post-emergence application of imazethapyr 67.5 g ha^{-1} at 25 days after sowing. The sesame variety 'Krishna' was sown on 6th July 2019 at seed rate of 4 kg ha^{-1} maintaining spacing of 30 × 10 cm in the plots (Gross plot size 4.2 × 4.8 m and Net plot size of 3 × 4 m).

Table 1: Effect of Weed Management Practices on Growth and Yield attributes of Sesame

Treatments	Plant height (cm)				Plant dry weight (g)				Crop growth rate (g m^{-2} day^{-1})				Number of capsules per plant	Length of capsule (cm)	Number of seeds per capsule	1000- seeds weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)
	30 DAS	60 DAS	90 DAS	At Harvest	30 DAS	60 DAS	90 DAS	At Harvest	0-30 DAS	30-60 DAS	60-90 DAS	90 DAS -At Harvest							
T_1	17.19	56.10	78.80	81.60	1.11	3.71	6.97	7.24	1.23	2.89	3.62	0.56	14.86	1.88	42.12	2.18	298.00	1110.90	21.15
T_2	18.46	60.90	83.40	86.90	1.2	12.56	17.28	18.33	1.31	12.64	5.24	2.19	28.79	2.16	44.80	2.22	676.80	2241.30	23.19
T_3	19.23	59.50	80.20	83.70	1.24	9.46	13.81	14.45	1.38	9.12	4.33	1.33	21.13	2.05	44.01	2.21	451.30	1643.40	21.54
T_4	18.83	61.80	84.70	88.80	1.21	11.68	16.35	17.08	1.35	11.62	5.18	1.52	28.07	2.08	44.36	2.23	570.00	1999.50	22.18
T_5	14.35	47.20	62.40	65.10	1.03	4.79	8.49	9.01	1.15	4.17	4.11	1.08	18.40	2.00	43.78	2.20	347.70	1263.00	21.59
T_6	19.27	62.10	85.90	89.40	1.26	12.71	17.47	18.58	1.40	12.71	5.28	2.31	29.07	2.17	45.90	2.24	693.60	2277.00	23.35
T_7	19.45	62.40	86.80	90.50	1.29	12.65	17.24	18.25	1.43	12.61	5.09	2.10	28.98	2.16	45.46	2.23	663.90	2204.10	23.15
T_8	16.68	49.70	66.50	69.30	1.17	5.17	9.03	9.66	1.30	4.44	4.28	1.30	19.88	2.02	43.96	2.22	366.50	1320.90	21.72
CD (P=.05)	3.01	8.17	11.26	11.67	NS	1.34	1.97	2.09	NS	1.30	0.72	0.26	3.61	NS	NS	NS	78.90	263.97	0.06
SEm (±)	0.98	2.67	3.68	3.81	0.06	0.44	0.64	0.68	0.07	0.43	0.24	0.09	1.18	0.10	2.14	0.11	25.76	86.19	0.02
CV (%)	9.49	8.04	8.10	8.06	8.58	8.34	8.35	8.41	8.57	8.38	8.66	9.49	8.64	8.40	8.37	8.31	8.77	8.49	0.17

The fertilizer dose was applied 40-30-20-20 kg ha^{-1} of nitrogen (half dose of nitrogen at basal and rest half dose by top dressing at 30 days after sowing), phosphorus, potassium and sulphur. The statistical analysis was done by analysis of variance of RBD and the CD was tested by applying F-test at 0.05 percent of probability.

Growth Parameters: The parameters taken for analysis of plant growth were such as, Plant height (cm), Plant dry weight (g plant^{-1}), Crop growth rate (g m^{-2} day^{-1}) = (W_2-W_1) /A × (T_2-T_1) (W_2 and W_1= Plant dry mass in gram, $T_2 - T_1$ = Time interval, A=Land area in m^2).

Yield Parameters: The parameters taken for analysis of yield were such as, Number of capsules per plant, Length of capsule (cm), Number of seeds per capsule, Grain yield (kg ha^{-1}) and Straw yield (kg ha^{-1}), Harvest index (%) and 1000-seeds weight (g).

RESULTS AND DISCUSSION

Plant height: Higher plant height (Table 1 and Fig. 1) was found at 30, 60, 90 days after sowing and also during the time of harvesting under application of pendimethalin 1000 g ha^{-1} in pre-emergence + application of quizalofop-p-ethyl 50 g ha^{-1} in post-emergence application at 25 days after sowing (T_7). The increase in plant height might be due to application of both the pre-emergence as well as post emergence herbicide that helped to decrease the weed population. Similar result related to plant height was observed by Sujithra *et al.* (2018). Similarly, pendimethalin 1000g/ha + hand weeding at 30 days after sowing (T_6) also found effective for enhancing the plant height.

Plant dry weight: Pendimethalin 1000 g ha^{-1} in pre-emergence application + hand weeding at 30 days after sowing (T_6) accumulated remarkably

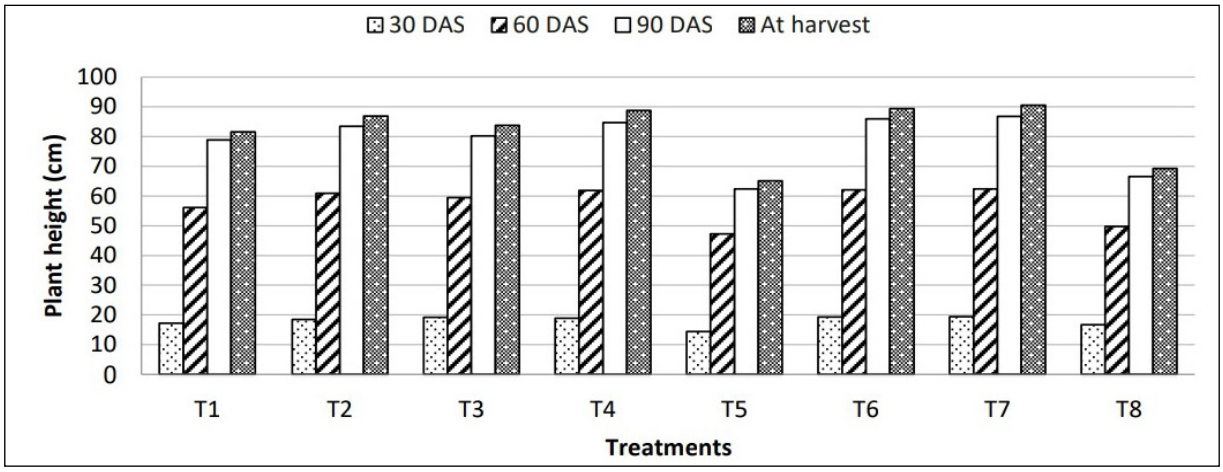

Fig. 1: Effect of weed management practices on plant height of Sesame

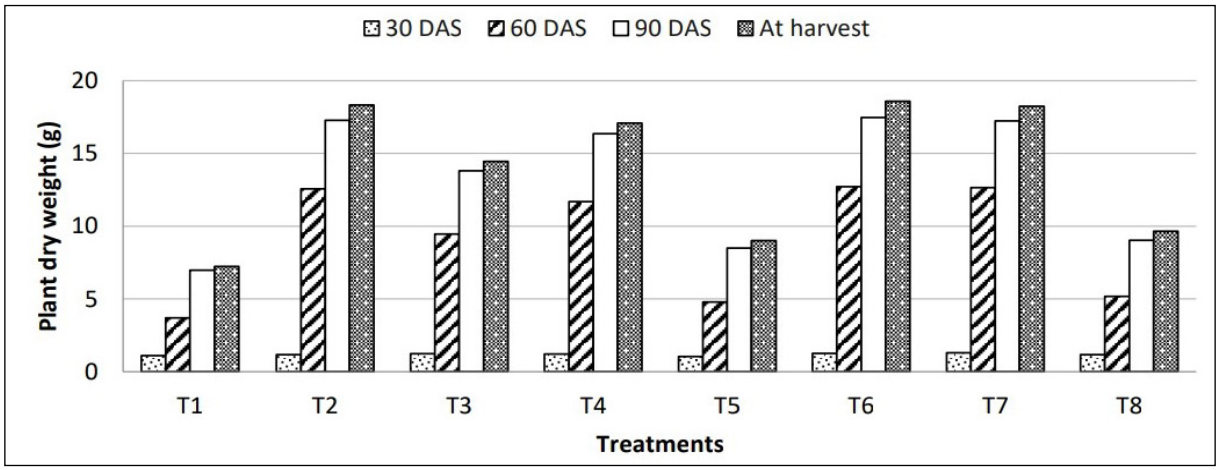

Fig. 2: Effect of weed management practices on plant dry weight of Sesame

greater dry weight (Table 1 and Fig. 2) at 60, 90 days after sowing and at harvest stage of crop growth. The probable reason is combined application of pendimethalin with hand weeding at 30 days after sowing attained least number of weeds and so that less competition was there between crop and weeds. Gnanavel and Anbhazhagan (2006), Mane *et al.* (2018) also endorsed similar results.

Crop growth rate: Application of pendimethalin 1000 g ha^{-1} in pre-emergence + hand weeding at 30 days after sowing (T_6) generated considerably greatest crop growth rate (Table 1 and Fig. 3) due to less population of weeds resulted by combined application of pendimethalin and hand weeding that could offered least competition to plants for growth factors which ultimately made the faster accessibility of nutrients accelerated multiple physiological procedures and higher photosynthetic activity. These results are in line with Mane *et al.* (2018) and Sahu *et al.* (2019).

Yield attributes: Application of pendimethalin 1000 g ha^{-1} in pre-emergence with hand weeding at 30 days after sowing (T_6) resulted in significant variation of greatest numbers of capsules per plant (Table 1 and Fig. 4) that might be due to control of weeds right from early stage by application of pendimethalin in pre-emergence and thereafter one hand weeding at 30 days after sowing helped safely crossing the critical period for weed competition. Similar result was also reported by Mane *et al.* (2017). Length of capsule, number of seeds per capsule and 1000-seed weight remained unaffected due to different weed management practices. However, application of pendimethalin 1000 g ha^{-1} in pre-emergence + hand weeding at 30 days after sowing (T_6) produced maximum values for length of capsule and number of seeds per capsule (Table 1 and Fig. 4). 1000-seed weight was not influenced significant variation by different weed management practices because is governed mainly by inherent genetic makeup of the cultivar.

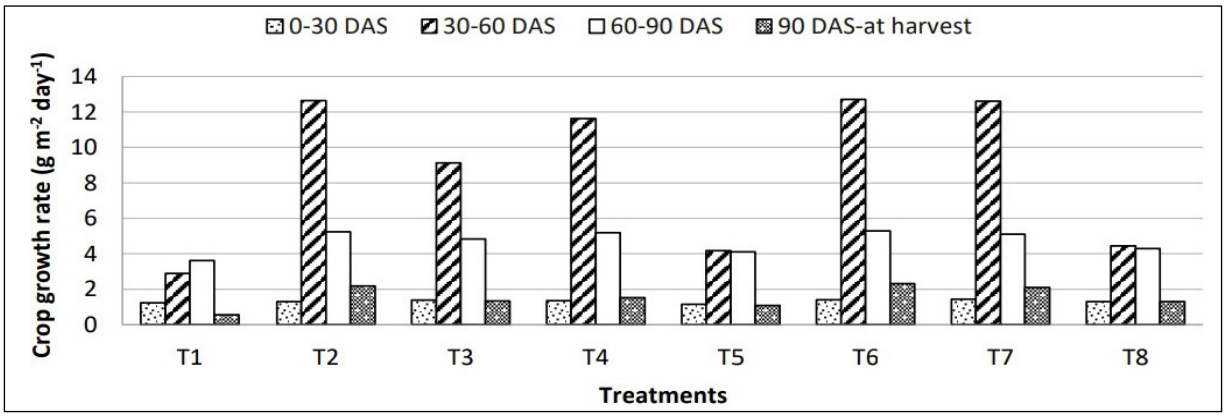

Fig. 3: Effect of weed management practices on crop growth rate of Sesame

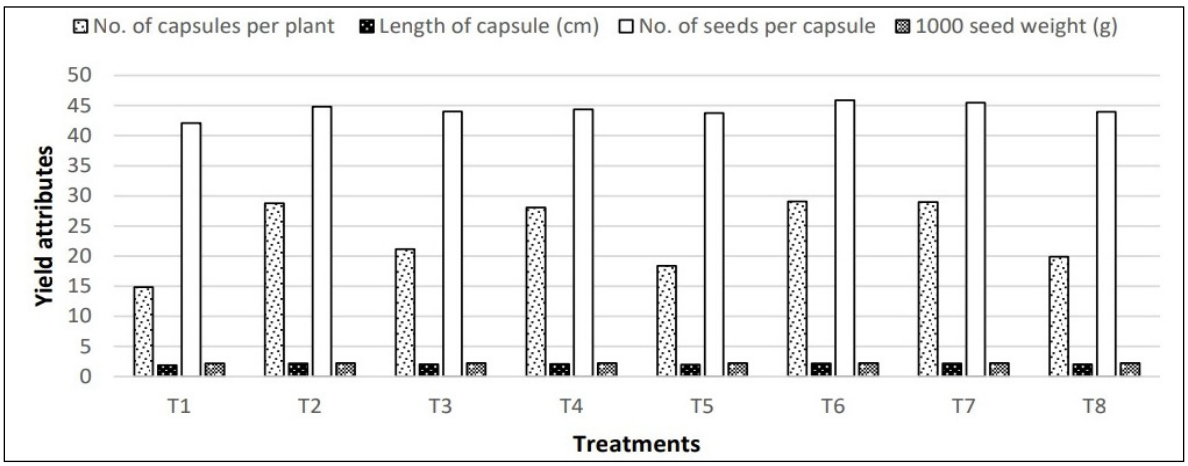

Fig. 4: Effect of weed management practices on number of capsules per plant, length of capsule, number of seeds per capsule and 1000-seed weight of Sesame

Grain yield: Yield attributing characters like length of capsule, number of capsules per plant, number of seeds per capsule have directly influenced on the grain yield. Pendimethalin 1000g/ha in pre-emergence application + hand weeding at 30 days after sowing (T_6) was resulted greatest grain yield 693.60 kg ha^{-1} (Table 1 and Fig. 5). This may be due to least weed density and competition throughout the crop growth period and during reproductive phase brought favourable effect on accumulated photosynthates to sink and in turn, contributed to favourable development of yield indices and finally the grain yield. Similar result related to grain yield was observed by Onkar and Angadi (2018).

Straw yield: The highest straw yield (Table 1 and Fig. 5) was attained under pendimethalin 1000 g ha^{-1} in pre-emergence application with one hand weeding at 30 days after sowing (T_6). An increase in straw yield directly depends on the vegetative growth of the plants which resulted in significant variation of greater plant height, greater plant dry weight accumulation which finally influenced in producing greatest straw yield. The results are in line with the previous findings of Sahu *et al.* (2019).

Harvest index: Application of pendimethalin 1000 g ha^{-1} in pre-emergence with hand weeding at 30 days after sowing (T_6) was found producing highest harvest index (Table 1 and Fig. 6) due to highest grain yield recovery. Findings of Mane *et al.* (2018) and Sahu *et al.* (2019) were in close conformity with the above finding.

CONCLUSION

It was concluded that pre-emergence application of pendimethalin 1000 g ha^{-1} along with hand weeding at 30 days after sowing (T_6) may be recommended for effective weed control method in enhancing growth and yield of sesame under sub-tropical and sub humid climate.

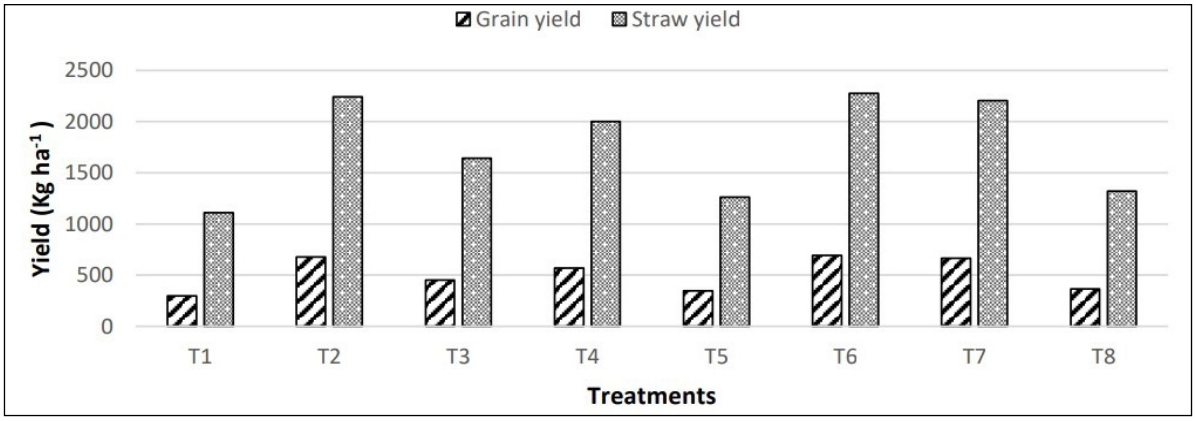

Fig. 5: Effect of weed management practices on grain yield and straw yield of Sesame

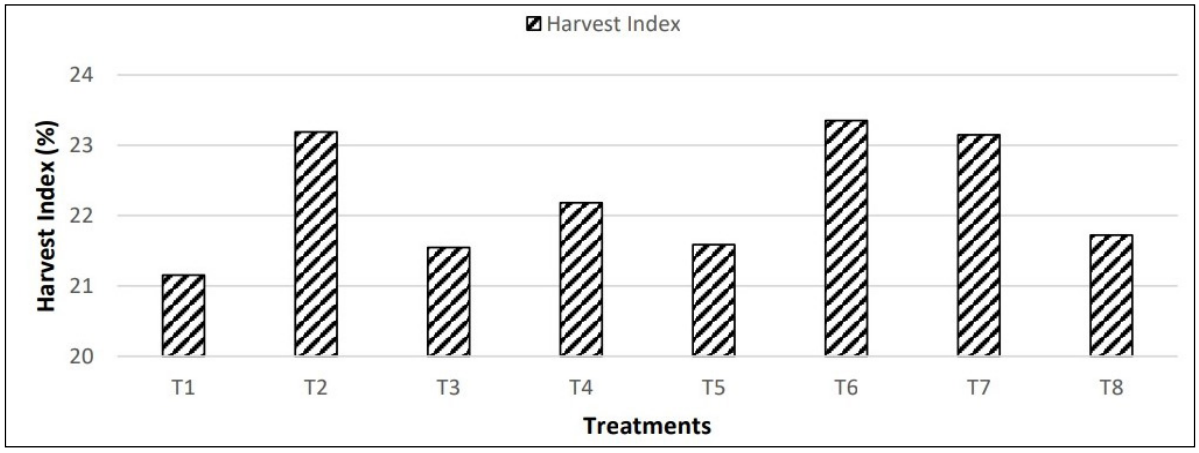

Fig. 6: Effect of weed management practices on harvest index of Sesame

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