



Interaction Effect of Irrigation Frequency and Weed Control Methods on Growth and Yield of Sesame Crop

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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

A field experiment was conducted at the Sher-e-Bangla Agricultural University Farm, Dhaka during Kharif-1 season (March – June), 2014 to study the effect of irrigation frequency and weed control methods on growth and yield of sesame (*Sesamum indicum*). The experiment was consisted of two treatment factors, viz., factor- A: four levels of irrigation frequency and factor- B: four levels of weed control methods. The experiment was laid out in a split design. The highest plant height (104.4 cm), number of leaves plant-1 (104.6), number of branches plant-1 (6.44), number of capsules plant-1 (54.97), number of seeds capsule-1 (58.53), 1000 seeds weight (3.213 g), seed yield (1.413 t ha⁻¹) and harvest index (29.26%) were obtained with the interaction effect of I3W2 (three times irrigation + two hand weeding). But the shortest plant height (78.18), lowest dry weight plant 1 (15.36 g), number of leaves plant-1 (65.11), number of branches plant-1 (4.789), number of

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capsules plant⁻¹ (44.77), number of seeds capsule⁻¹ (49.60), 1000 seeds weight (2.910 g), and seed yield (0.944 t ha⁻¹) were obtained with the interaction effect of IOW0 (no irrigation + no weeding). Significant variations were found due to irrigation frequency, weed control methods practices and their interaction in the growth, yield components, seed yield, stover yield, biological yield and harvest index of sesame.

Keywords: Sesame; irrigation frequency; weed control methods; growth; yield.

1. INTRODUCTION

Sesame (*Sesamum indicum* L) is a minor crop, cultivated for edible oil in the Africa, China, Myanmar, India, Pakistan, Korea, Turkey, Mexico, South America etc. It is a broadleaf plant, has 5 to 6 feet height. Sesame seeds boast a high oil content, typically ranging from 50% to 60%. Additionally, they contain approximately 23-25% protein, 13.5% carbohydrates, and 5% ash [1,2,3]. Sesame oil is rich in essential nutritional elements, including iron, magnesium, manganese, copper, calcium, vitamin B1, and vitamin E. This versatile oil isn't the only valuable product derived from sesame; the oil cake and younger leaves are also utilized as high-quality feed for poultry, goats, sheep, cattle, and fish. Additionally, sesame oil and its by-products are widely used in soap factories, showcasing the diverse applications of this natural resource [4,5]. In summer in Bangladesh the sesame production was 28187.96 m ton, area was 72329.47 acre. And winter sesame was 2526.72 m ton within 6144.67 acre of land [6]. According to FAOSTAT, in 2021-2022 the worldwide production was 6741479.41 t and area was 12836776 ha [7]. To meet the demand, we need to increase the production. Proper irrigation practice and weed control methods can increase the productivity. Irrigation is a very important practice used in any crop management. It maintains the soil moisture which is positively connected with nutrient management. Weed is very disturbing for any crop production. It always uptake nutrients of main crop, spread disease and behave like a host of insect pest. So, a crop field should be cleaned. Both proper irrigation practices for soil moisture and weed controls will increase the productivity together. This paper will discuss the interaction effect of irrigation frequency and different weed control methods practices on growth and yield of sesame.

2. MATERIALS AND METHODS

2.1 Experiment site

A field experiment was conducted at the Sher-e-Bangla Agricultural University (SAU), Dhaka,

Bangladesh during Kharif-1 (March – June), 2014 to study the effect of irrigation frequency and weed control methods practices on growth and yield of sesame.

2.2 Climate

The experimental field was situated under Sub-tropical climate.

2.3 Crop

BARI Til-4 (a sesame variety) was used in this experiment.

2.4 Treatments

Four levels of irrigation and four levels of weed control methods and their interaction were used in the experiment. All the irrigation schedule and amount were followed BARI (Bangladesh Agriculture Research Institute) hand book. These were:

Factor- A: Four levels of irrigation

- I₀ = No irrigation
- I₁ = One irrigation at 20 DAS
- I₂ = Two irrigation at 20 and 40 DAS
- I₃ = Three irrigation at 20, 40 and 60 DAS

Factor- B: Four levels of weed control methods

- W₀ = No weeding
- W₁ = One hand weeding at 20DAS
- W₂ = Two hand weeding at 20 DAS and 40 DAS
- W₃ = Post emergent herbicide at 20 DAS and 40 DAS

2.5 Experimental Design

The experiment was laid out in Split plot design with 3 replications. Irrigation frequency was applied in main plot and weed control methods in sub plot. The size of the plot was 2.0 m x 2.0 m. The total number of treatments was (4 levels of irrigation x 4 levels of weed control methods) 16 and the number of plots were 48 as there was three numbers of replication.

List 1. Interaction between irrigation and weed control methods

$I_0 \times W_0$	$I_1 \times W_1$	$I_2 \times W_2$	$I_3 \times W_3$
$I_0 \times W_1$	$I_1 \times W_2$	$I_2 \times W_3$	$I_3 \times W_0$
$I_0 \times W_2$	$I_1 \times W_3$	$I_2 \times W_0$	$I_3 \times W_1$
$I_0 \times W_3$	$I_1 \times W_0$	$I_2 \times W_1$	$I_3 \times W_2$

2.6 Land Preparation

The experimental land was ploughed with a tractor followed by harrowing to attain a desirable filth. All uprooted weeds and stubbles of the previous crop were removed from the experimental field. The land was finally prepared with power tiller to ensure a good land preparation. The land was leveled by tractor drawn leveler.

2.7 Sowing

The seeds of the variety BARI Til-4 were collected from the Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur. Seeds were subjected to germination test and were treated with Vitavex-200 at the rate of 2.5 g kg⁻¹ of seeds before sowing. Seeds were sown on March 15, 2014 in solid lines. Three to five seeds were sown per hill.

2.8 Agricultural Practices

The desired population density was maintained by thinning plants 8 days after emergence. Irrigation and weeding were performed as per treatments. Plant protection measures were performed as needed to uniform germination, better crop establishment and proper plant growth.

2.9 Sampling

The sampling was done first at 15 days after sowing and it was continued at an interval of 15 days, viz. 30, 45, 60 days after sowing (DAS). At each harvest, three plants were selected randomly from each plot. The selected plants of each plot were uprooted carefully by a khurpi and washed in running tap water to remove the soil. The number of leaves, branches and pods were recorded separately. The components were oven dried at 60° for 72 hours to record constant dry weight. From each plot the weight of the straw were taken. Biological yield and the harvest index were also calculated from this data.

2.10 Data collection

The data on the following parameters of three plants were recorded at each harvest.

Growth data

- Plant height (cm)
- Number of branch plant⁻¹
- Number of leaves plant⁻¹

Yield data

- Number of capsule plant⁻¹
- Number of seeds capsule⁻¹
- 1000 seeds weight (g)
- Yield plant⁻¹(g)
- Total seed yield(t ha⁻¹)
- Stover yield (t ha⁻¹)
- Harvest Index

2.11 Dry Weight of Weed (g m⁻²)

After weeding, treatment wise weeds were packed and oven dried to determine the dry weight.

2.12 Statistical Analysis

The data collected on different parameters were statistically analyzed to obtain the level of significance using the MSTAT- C computer package program developed by Russel (1986). Mean difference among the treatments were tested with least significant differences (LSD) at 5% level of significance.

3. RESULTS AND DISCUSSION**3.1 Plant height**

The interaction effect of irrigation frequency and weed control methods on plant height was significant at different days after sowing (Table 1). It was observed that on the plant height at 30 DAS and 45 DAS interaction had no significant effect but at 60 DAS and at harvest the significantly highest plant height was recorded in the treatment combination of I₃W₂ (99.66 and

104.4 cm, respectively), which was not significantly different from I₃W₃ at 60 DAS and at harvest. On the other hand, the lowest plant height (70.65 and 78.18 cm) at 60 DAS and at harvest respectively was recorded in the treatment combination of I₀W₀. Irrigation frequency makes water available for plants and weed control decreases crop weed competition, plant can grow well without competition it might be the reason of significance of interaction of treatments.

Irrigation regimes significantly affected growth of sesame. It might be due to nutrient availability as a result of irrigation. Similar phenomenon was also observed by Nadeem et al. [8] in sesame. Weeding regime also significantly (P<0.05) affected plant height [9].

3.2 Number of Branches Plant⁻¹

The interaction effect of irrigation frequency and weed control methods on number of branches plant⁻¹ was not significant at 45 and 60 DAS (Table 2). It was observed that the highest number of branches plant⁻¹ was with the treatment combination of I₃W₂ (6.444) at harvest

which was not significantly different from I₃W₃ at 30 harvest. On the other hand lowest number of branch plant⁻¹ was observed with the treatment combination of I₀W₀ and I₁W₁. The results obtained from all other treatment combinations were significantly different. The branches of plant are affected by weed [10].

3.3 Number of Leaves Plant⁻¹

The interaction effect of irrigation frequency and weed control methods on number of leaves plant⁻¹ was not significant up to 30 DAS but was significant at 45 and 60 DAS. (Table 3). It was observed that the highest number of branches plant⁻¹ was with the treatment combination of I₃W₂ (75.78 and 104.6) at 45 DAS and 60 DAS respectively. Leaves number plant⁻¹ of 45 DAS in this interaction was not significantly different from I₃W₃. On the other hand the lowest number of leaves plant⁻¹ was observed with the treatment combination of I₀W₀ at 45 DAS and 60 DAS but there was no significant difference with I₀W₁ at 60 DAS. The results obtained from all other treatment combination were significantly different from each other. The results also supported by Bahador and Moosavi [11].

Table 1. Interaction effect of irrigation frequency and weed control methods practices on plant height of sesame at different days after sowing

Treatments	Plant height (cm)				
	15 DAS	30 DAS	45 DAS	60 DAS	At harvest
I ₀ W ₀	14.3	23	37.81	70.65	g 78.18 h
I ₀ W ₁	17.22	23.91	41.3	74.30	f 87.49 g
I ₀ W ₂	12.39	22.84	43.53	79.20	e 94.69 f
I ₀ W ₃	13.67	22.94	44.77	78.32	e 97.44 def
I ₁ W ₀	18.56	26.33	41.72	71.77	fg 96.13 ef
I ₁ W ₁	16.5	26.62	46.17	80.42	e 99.51 bcde
I ₁ W ₂	14.58	26.52	47.75	90.90	d 101.0 abcd
I ₁ W ₃	16.72	27.31	47.94	96.89	abc 101.2 abc
I ₂ W ₀	16.17	24.53	41.72	90.71	d 98.43 cde
I ₂ W ₁	22.17	26.23	46.83	96.03	c 102.3 b
I ₂ W ₂	16.73	25.62	48.75	96.68	bc 103.5 ab
I ₂ W ₃	14.67	26.09	47.94	97.64	abc 103.0 ab
I ₃ W ₀	12.44	25.04	46.5	95.24	c 101.5 abc
I ₃ W ₁	19.61	26.11	48.75	99.27	ab 102.5 b
I ₃ W ₂	18.38	24.92	48.94	99.66	a 104.4 a
I ₃ W ₃	15.84	26.09	48.84	97.99	ab 104.3 a
CV%	10.53	8.03	7.08	9.90	11.18
LSD (0.05)	NS	NS	NS	2.80	1.76

I₀ = No irrigation; I₁ = Single irrigation at 20 DAS; I₂ = Two times irrigation at 20 and 40 DAS; I₃ = Three times irrigation at 20, 40 and 60 DAS; W₀ = No weeding; W₁ = One hand weeding at 20 DAS; W₂ = Two hand weeding at 20 and 40 DAS; W₃ = Application of herbicide at 20 and 40 DAS; NS = Non-significant.

Table 2. Interaction effect of irrigation frequency and weed control methods on Branches plant¹ of sesame at different days after sowing

Treatments	Branches plant ⁻¹		
	45 DAS	60 DAS	At harvest
I ₀ W ₀	3.33	3.67	3.993 h
I ₀ W ₁	3.45	3.913	4.111 h
I ₀ W ₂	3.55	4.008	4.223 gh
I ₀ W ₃	3.60	4.251	4.513 fgh
I ₁ W ₀	3.77	4.343	4.607 efgh
I ₁ W ₁	3.97	4.555	4.666 efgh
I ₁ W ₂	4.32	4.677	4.889 defgh
I ₁ W ₃	4.43	4.844	4.886 defgh
I ₂ W ₀	3.99	4.351	5.111 cdefg
I ₂ W ₁	4.55	4.903	5.333 bcdef
I ₂ W ₂	4.89	4.966	5.626 abcd
I ₂ W ₃	5.18	4.94	5.597 abcd
I ₃ W ₀	4.16	4.67	5.444 bcde
I ₃ W ₁	4.74	5.118	5.950 abc
I ₃ W ₂	6.00	6.15	6.444 a
I ₃ W ₃	5.109	5.324	6.222 ab
CV%	8.96	7.93	9.45
LSD (0.05)	NS	NS	0.804

I₀ = No irrigation; I₁ = Single irrigation at 20 DAS; I₂ = Two times irrigation at 20 and 40 DAS; I₃ = Three times irrigation at 20, 40 and 60 DAS; W₀ = No weeding; W₁ = One hand weeding at 20 DAS; W₂ = Two hand weeding at 20 and 40 DAS; W₃ = Application of herbicide at 20 and 40 DAS; NS = Non-significant.

Table 3. Interaction effect of irrigation frequency and weed control methods on leaf area of sesame plant at different days after sowing

Treatments	Number of leaves plant ⁻¹					
	15 DAS	30 DAS	45 DAS	60 DAS		
I ₀ W ₀	7.889	10.33	51.66	j	65.11	j
I ₀ W ₁	7.889	11.11	55.66	i	68.04	ij
I ₀ W ₂	7.222	11.78	59.55	h	71.63	h
I ₀ W ₃	7.666	12.67	60.56	gh	72.78	h
I ₁ W ₀	7.777	10.44	62.41	fg	70.2	hi
I ₁ W ₁	8	13.11	67.78	d	77.44	g
I ₁ W ₂	7.555	13.67	71.56	c	83.67	ef
I ₁ W ₃	7.666	14.67	72.00	bc	82.11	f
I ₂ W ₀	8.333	11.22	63.78	ef	77.33	g
I ₂ W ₁	9	12.44	67.22	d	83.56	ef
I ₂ W ₂	8.111	13.33	72.11	bc	89.56	c
I ₂ W ₃	7.555	14.2	71.33	c	88.44	cd
I ₃ W ₀	6.777	11.19	63.97	ef	85.67	de
I ₃ W ₁	7.666	12.11	65.22	de	97.44	b
I ₃ W ₂	7.444	14	75.78	a	104.6	a
I ₃ W ₃	8.111	15.04	73.43	ab	98.78	b
CV%	13.24	9.16	8.50		12.59	
LSD (0.05)	NS	NS	1.74		3.55	

I₀ = No irrigation; I₁ = Single irrigation at 20 DAS; I₂ = Two times irrigation at 20 and 40 DAS; I₃ = Three times irrigation at 20, 40 and 60 DAS; W₀ = No weeding; W₁ = One hand weeding at 20 DAS; W₂ = Two hand weeding at 20 and 40 DAS; W₃ = Application of herbicide at 20 and 40 DAS; NS = Non-significant.

3.4 Number of capsules plant⁻¹

The interaction effect of irrigation frequency and weed control methods on the number of capsules plant⁻¹ of sesame had significant effect at harvest (Table 4). It was observed that the highest number of capsules plant⁻¹ was recorded with the treatment combination of I₃W (54.97) which were significantly similar with I₃W₃ at harvest. On the other hand, the lowest number of capsules plant⁻¹ (44.77) was recorded with the treatment combination of I₀W₀ which was significantly similar with I₁W₀ at harvest. The results obtained from all other treatment combinations were significantly different compared to highest and lowest results. Similar trend in number of capsules plant⁻¹ in sesame was reported by Nadeem et. al [8] and Ahmad [12].

3.5 Number of seeds capsule⁻¹

Interaction effect of irrigation frequency and weed control methods on the number of seeds capsules⁻¹ had significant effect at harvest (Table 4). It was observed that the highest number of seeds capsules⁻¹ was

recorded with the treatment combination of I₃W₂ (58.53). On the other hand the lowest number of seeds capsules⁻¹ (49.60) was recorded with the treatment combination of I₀W₀ which was significantly similar with I₁W₀ and I₀W₁ at harvest. The results obtained from all other treatment combinations were significantly different compared to highest and lowest results. It was also reported by Ahmed et al.[13]

3.6 Weight of 1000 seeds (g)

The interaction effect of irrigation frequency and weed control methods on 1000 seeds weight had significant effect (Table 4). It was observed that the highest 1000 seeds weight was recorded with the treatment combination of I₃W₂ (3.213 g) which was statistically similar with the treatment combination of I₂W₃, I₃W₁ and I₃W₃. On the other hand the lowest 1000 seed weight (2.91 g) was recorded with the treatment combination of I₀W₀ which was significantly similar with I₁W₀. The results obtained from all other treatment combinations were significantly different compared to highest and lowest results. Similar results were observed by Ahmad [12].

Table 4. Interaction effect of irrigation frequency and weed control methods on different yield contributing characters of sesame

Treatments	Number of capsules plant ⁻¹	Number of seeds capsule ⁻¹	Weight of 1000 seeds (g)
I ₀ W ₀	44.77 i	49.60 j	2.910 h
I ₀ W ₁	44.96 hi	49.95 hij	2.930 h
I ₀ W ₂	45.24 g	50.13 ghi	2.983 g
I ₀ W ₃	45.88 f	50.24 gh	3.027 fg
I ₁ W ₀	44.79 i	49.73 ij	3.007 g
I ₁ W ₁	45.97 f	52.94 f	3.077 ef
I ₁ W ₂	46.86 e	53.63 e	3.117 cde
I ₁ W ₃	46.94 e	53.92 e	3.130 bcd
I ₂ W ₀	44.97 hi	50.07 ghi	3.093 de
I ₂ W ₁	48.97 d	54.89 d	3.167 abc
I ₂ W ₂	50.95 c	55.36 c	3.177 ab
I ₂ W ₃	50.98 c	55.57 c	3.183 a
I ₃ W ₀	45.15 gh	50.47 g	3.093 de
I ₃ W ₁	52.97 b	57.96 b	3.190 a
I ₃ W ₂	54.97 a	58.53 a	3.213 a
I ₃ W ₃	54.88 a	58.20 ab	3.190 a
CV%	5.23	6.42	7.62
LSD (0.05)	0.19	0.03	0.053

I₀ = No irrigation; I₁ = Single irrigation at 20 DAS; I₂ = Two times irrigation at 20 and 40 DAS; I₃ = Three times irrigation at 20, 40 and 60 DAS; W₀ = No weeding; W₁ = One hand weeding at 20 DAS; W₂ = Two hand weeding at 20 and 40 DAS; W₃ = Application of herbicide at 20 and 40 DAS.

3.7 Seed yield plant⁻¹

Irrigation frequency and weed control methods practices on Seed yield plant-1 (g) had significant effect (Table 5). It was observed that the highest Seed yield plant-1 was recorded with the treatment combination of I₃W₂ (10.21 g) which was not significantly different from I₃W₃. On the other hand the lowest Seed yield plant-1 (6.626 g) was recorded with the treatment combination of I₀W₀ which was similar to the combination of I₁W₀. The results obtained from all other treatment combinations were significantly different compared to highest and lowest results. Similar result was also reported by Nadeem et al. [8] and Ahmed et al. [14].

3.8 Seed yield (tha⁻¹)

The interaction effect of irrigation frequency and weed control methods on seed yield (t ha⁻¹) had significant effect (Table 5). It was observed that the highest yield was recorded with the treatment combination of I₃W₂ (1.413 t ha⁻¹) which had no significant difference with the treatment combination of I₃W₃. On the other hand the lowest yield (0.944 t ha⁻¹) was recorded with the treatment combination of I₀W₀ which was similar to the treatment combination of I₀W₁. The results obtained from all other treatment combinations were significantly

different compared to highest and lowest results. The similar trends were observed by Nadeem et al. [8] and Ali et al. [15]. Similar result was obtained by Ahmad [12] and by Singh [16].

3.9 Stover Yield (t ha⁻¹)

The interaction effect of irrigation frequency and weed control methods on stover yield (t ha⁻¹) had significant effect (Table 5). It was observed that the highest stover yield was recorded with the treatment combination of I₃W₁ (3.446 t ha⁻¹). On the other hand the lowest stover yield (2.452 t ha⁻¹) was recorded with the treatment combination of I₀W₀. The results obtained from all other treatment combinations were significantly different compared to highest and lowest results.

3.10 Harvest Index (%)

It was observed that the highest harvest index (29.26%) was recorded with the treatment combination of I₃W₂ which was significantly similar with I₃W₃. On the other hand the lowest harvest index (22.40%) was recorded with the treatment combination of I₃W₀. The results obtained from all other treatment combinations were significantly different compared to highest and lowest results.

Table 5. Interaction effect of irrigation frequency and weed control methods on yield parameters of sesame

Treatments	Seed yield plant ⁻¹	Seed yield (tha ⁻¹)	Stover yield (tha ⁻¹)	Harvest Index
I ₀ W ₀	6.627 j	0.94 e	2.542 g	27.10 bc
I ₀ W ₁	6.760 ij	0.95 e	2.646 f	26.46 cdef
I ₀ W ₂	6.837 hi	0.96 de	2.695 f	26.32 def
I ₀ W ₃	6.970 gh	0.97 de	2.793 e	25.84 fg
I ₁ W ₀	6.680 j	0.96 de	2.854 e	25.33 gh
I ₁ W ₁	7.480 f	1.02 cd	2.959 d	25.75 fgh
I ₁ W ₂	7.747 e	1.04 cd	2.975 d	26.03 efg
I ₁ W ₃	7.830 e	1.05 cd	3.034 d	25.87 fg
I ₂ W ₀	6.870 hi	0.97 de	3.207 c	23.33 i
I ₂ W ₁	8.337 d	1.12 c	3.365 b	25.02 h
I ₂ W ₂	8.910 c	1.23 b	3.389 ab	26.69 cde
I ₂ W ₃	8.913 c	1.24 b	3.391 ab	26.86 cd
I ₃ W ₀	7.040 g	0.98 de	3.404 ab	22.40 j
I ₃ W ₁	9.707 b	1.32 ab	3.446 a	27.72 b
I ₃ W ₂	10.21 a	1.41 a	3.415 ab	29.26 a
I ₃ W ₃	10.09 a	1.41 a	3.431 ab	29.13 a
CV%	8.20	8.60	7.79	8.25
LSD (0.05)	0.141	0.10	0.075	0.763

I₀ = No irrigation; I₁ = Single irrigation at 20 DAS; I₂ = Two times irrigation at 20 and 40 DAS; I₃ = Three times irrigation at 20, 40 and 60 DAS; W₀ = No weeding; W₁ = One hand weeding at 20 DAS; W₂ = Two hand weeding at 20 and 40 DAS; W₃ = Application of herbicide at 20 and 40 DAS.

4. CONCLUSION

Plant height (cm), number of branches plant-1, number of capsules plant-1, number of seeds capsule-1, 1000 seed weight (g), yield plant-1 (g), total yield (t ha-1), stover yield (t ha-1) and harvest index were also significantly influenced by different interaction effect of irrigation frequency and weed control methods practices. The tallest plant (104.4 cm) was obtained by the combined effect of I3W2 (Three times irrigation + Two hand weeding) and the smallest plant height (78.18 cm) was obtained by I0W0 (No irrigation + No weeding). The highest number of branches plant-1 (6.444), dry weight plant-1 (23.58 g) and yield plant-1 (10.21 g) were recorded with the combined effect of I3W2 (Three times irrigation + Two hand weeding). The highest total yield (1.413 t ha-1) stover yield (3.446 t ha-1) were found with I3W2 (Three times irrigation + Two hand weeding) and I3W1 (Three times irrigation + One hand weeding) respectively. The lowest total yield (0.944 t ha-1) and stover yield (2.542 t ha-1) were recorded with the combined effect of I0W0 (No irrigation + No weeding). In case of highest number of capsules plant-1 (54.97), number of seeds capsule-1 (58.53), 1000 seed weight (3.213 g) and harvest index (29.26) were obtained with the combined effect I3W2 (Three times irrigation + Two hand weeding). But the lowest number of seeds capsule-1 (49.60) and 1000 seed weight (2.910 g), harvest index (22.40) were obtained with the combined effect of I0W0 (No irrigation + No weeding) and I3W0 (Three times irrigation + No weeding) respectively.

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 this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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