Original Research Article

INTERACTION EFFECT OF IRRIGATION FREQUENCY AND WEED CONTROL METHODSON GROWTH AND YIELD OF SESAME CROP

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 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 I0W0 (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.

KEY WORDS: Sesame, Irrigation Frequency, Weed Control methods. Growth, Yield

Introduction

Sesame (*Sesamum indicum* L) is a minor crop, cultivated for edible oil in the Africa,China, Mayanmer,India, Pakistan, Korea, Turkeya, 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 mton, 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 was6741479.41 tand 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.

MATERIALS AND METHODS

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.

Climate

The experimental field was situated under Sub-tropical climate.

Crop

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

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

I_0 = No irrigation

I_1 = One irrigation at 20 DAS

I_2 = Two irrigation at 20 and 40 DAS

I_3 = Three irrigation at 20, 40 and 60 DAS

Factor- B: Four levels of weed control methods

W_0 = No weeding

W_1 = One hand weeding at 20DAS

W_2 = Two hand weeding at 20 DAS and 40 DAS

W_3 = Post emergent herbicide at 20 DAS and 40 DAS

List 1: Interaction between irrigation and weed control methods

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

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 × 4 levels of weed control methods) 16 and the number of plots were 48 as there was three numbers of replication.

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.

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.

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.

Sampling

The sampling was done first at15 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 recordedseparately. The components were oven dried at 60^0 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.

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

Dry weight of weed (g m^{-2})

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

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.

RESULTS AND DISCUSSION

Plant height

The interaction effect of irrigation frequency and weed control methodson 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 I_3W_2 (99.66 and 104.4 cm, respectively), which was not significantly different from I_3W_3 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 I_0W_0. 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].

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	Atharvest
I_0W_0	14.3	23	37.81	70.65 g	78.18 h
I_0W_1	17.22	23.91	41.3	74.30 f	87.49 g
I_0W_2	12.39	22.84	43.53	79.20 e	94.69 f
I_0W_3	13.67	22.94	44.77	78.32 e	97.44 def
I_1W_0	18.56	26.33	41.72	71.77 fg	96.13 ef

I_1W_1	16.5	26.62	46.17	80.42 e	99.51 bcde
I_1W_2	14.58	26.52	47.75	90.90 d	101.0 abcd
I_1W_3	16.72	27.31	47.94	96.89 abc	101.2 abc
I_2W_0	16.17	24.53	41.72	90.71 d	98.43 cde
I_2W_1	22.17	26.23	46.83	96.03 c	102.3 b
I_2W_2	16.73	25.62	48.75	96.68 bc	103.5 ab
I_2W_3	14.67	26.09	47.94	97.64 abc	103.0 ab
I_3W_0	12.44	25.04	46.5	95.24 c	101.5 abc
I_3W_1	19.61	26.11	48.75	99.27 ab	102.5 b
I_3W_2	18.38	24.92	48.94	99.66 a	104.4 a
I_3W_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

I_0 = No irrigation; I_1 = Single irrigation at 20 DAS; I_2 = Two times irrigation at 20 and 40 DAS; I_3= Three times irrigation at 20, 40 and 60 DAS; W_0 = No weeding; W_1 = One hand weeding at 20 DAS; W_2 = Two hand weeding at 20 and 40 DAS; W_3 = Application of herbicide at 20 and 40 DAS; NS = Non- significant.

Number of branches plant^{-1}

The interaction effect of irrigation frequency and weed control methodson 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 I_3W_2 (6.444) at harvest which was not significantly different from I_3 W_3 at 30 harvest. On the other hand lowest number of branch plant^{-1} was observed with the treatment combination of I_0W_0 and I_1W_1. The results obtained from all other treatment combinations were significantly different. The branches of plant are affected by weed [10].

Table 2. Interaction effect of irrigation frequency and weed control methodson Branches plant^{-1} of sesame at different days after sowing

Treatments	Branches plant^{-1}		
	45 DAS	60 DAS	Atharvest
I_0W_0	3.33	3.67	3.993 h
I_0W_1	3.45	3.913	4.111 h
I_0W_2	3.55	4.008	4.223 gh
I_0W_3	3.60	4.251	4.513 fgh
I_1W_0	3.77	4.343	4.607 efgh
I_1W_1	3.97	4.555	4.666 efgh
I_1W_2	4.32	4.677	4.889 defgh
I_1W_3	4.43	4.844	4.886 defgh
I_2W_0	3.99	4.351	5.111 cdefg
I_2W_1	4.55	4.903	5.333 bcdef
I_2W_2	4.89	4.966	5.626 abcd
I_2W_3	5.18	4.94	5.597 abcd
I_3W_0	4.16	4.67	5.444 bcde
I_3W_1	4.74	5.118	5.950 abc
I_3W_2	6.00	6.15	6.444 a
I_3W_3	5.109	5.324	6.222 ab
CV%	8.96	7.93	9.45
LSD (0.05)	NS	NS	0.804

I_0 = No irrigation; I_1 = Single irrigation at 20 DAS; I_2 = Two times irrigation at 20 and 40 DAS; I_3= Three times irrigation at 20, 40 and 60 DAS; W_0 = No weeding; W_1 = One hand weeding at 20 DAS; W_2 = Two hand weeding at 20 and 40 DAS; W_3 = Application of herbicide at 20 and 40 DAS; NS = Non- significant.

Number of Leaves palnt^{-1}

The interaction effect of irrigation frequency and weed control methodson 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 I_3W_2 (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 I_3W_3. 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 3. Interaction effect of irrigation frequency and weed control methodson 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_0W_0	7.889	10.33	51.66 j	65.11 j
I_0W_1	7.889	11.11	55.66 i	68.04 ij
I_0W_2	7.222	11.78	59.55 h	71.63 h
I_0W_3	7.666	12.67	60.56 gh	72.78 h
I_1W_0	7.777	10.44	62.41 fg	70.2 hi
I_1W_1	8	13.11	67.78 d	77.44 g
I_1W_2	7.555	13.67	71.56 c	83.67 ef
I_1W_3	7.666	14.67	72.00 bc	82.11 f
I_2W_0	8.333	11.22	63.78 ef	77.33 g
I_2W_1	9	12.44	67.22 d	83.56 ef
I_2W_2	8.111	13.33	72.11 bc	89.56 c
I_2W_3	7.555	14.2	71.33 c	88.44 cd
I_3W_0	6.777	11.19	63.97 ef	85.67 de
I_3W_1	7.666	12.11	65.22 de	97.44 b
I_3W_2	7.444	14	75.78 a	104.6 a

I_3W_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

I_0 = No irrigation; I_1 = Single irrigation at 20 DAS; I_2 = Two times irrigation at 20 and 40 DAS; I_3= Three times irrigation at 20, 40 and 60 DAS; W_0 = No weeding; W_1 = One hand weeding at 20 DAS; W_2 = Two hand weeding at 20 and 40 DAS; W_3 = Application of herbicide at 20 and 40 DAS; NS = Non- significant.

Number of capsules plant^{-1}

The interaction effect of irrigation frequency and weed control methodson 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 I_3W(54.97) which were significantly similar with I_3W_3 at harvest. On the other hand, the lowest number of capsules plant^{-1} (44.77) was recorded with the treatment combination of I_0W_0 which was significantly similar with I_1W_0 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].

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 I_3W_2 (58.53). On the other hand the lowest number of seeds capsules-1 (49.60) was recorded with the treatment combination of I_0W_0 which was significantly similar with I_1W_0 and I_0W_1 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]

Weight of 1000 seeds (g)

The interaction effect of irrigation frequency and weed control methodson 1000 seeds weight had significant effect (Table 4). It was observed that the highest 1000 seeds weight was recorded with the treatment combination of I_3W_2 (3.213 g) which was statistically similar with the treatment combination of I_2W_3, $I_3W_1$and I_3W_3 . On the other hand the lowest 1000 seed weight (2.91 g) was recorded with the treatment combination of I_0 W_0 which was significantly similar with I_1W_0. 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 methodson different yield contributing characters of sesame

Treatments	Number of capsules plant^{-1}	Number of seeds capsule^{-1}	Weight of 1000 seeds (g)
I_0W_0	44.77 i	49.60 j	2.910 h
I_0W_1	44.96 hi	49.95 hij	2.930 h
I_0W_2	45.24 g	50.13 ghi	2.983 g
I_0W_3	45.88 f	50.24 gh	3.027 fg
I_1W_0	44.79 i	49.73 ij	3.007 g
I_1W_1	45.97 f	52.94 f	3.077 ef
I_1W_2	46.86 e	53.63 e	3.117 cde
I_1W_3	46.94 e	53.92 e	3.130 bcd
I_2W_0	44.97 hi	50.07 ghi	3.093 de
I_2W_1	48.97 d	54.89 d	3.167 abc
I_2W_2	50.95 c	55.36 c	3.177 ab
I_2W_3	50.98 c	55.57 c	3.183 a
I_3W_0	45.15 gh	50.47 g	3.093 de
I_3W_1	52.97 b	57.96 b	3.190 a
I_3W_2	54.97 a	58.53 a	3.213 a
I_3W_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

I_0 = No irrigation; I_1 = Single irrigation at 20 DAS; I_2 = Two times irrigation at 20 and 40 DAS; I_3= Three times irrigation at 20, 40 and 60 DAS; W_0 = No weeding; W_1 = One hand weeding at 20 DAS; W_2 = Two hand weeding at 20 and 40 DAS; W_3 = Application of herbicide at 20 and 40 DAS.

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 I3 W2 (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].

Seed yield (tha^{-1})

The interaction effect of irrigation frequency and weed control methodson seed yield (t ha^{-1}) had significant effect (Table 5). It was observed that the highest yield was recorded with the treatment combination of I_3W_2 (1.413 t ha^{-1}) which had no significant difference with the treatment combination of I_3W_3. On the other hand the lowest yield (0.944 t ha-1) was recorded with the treatment combination of I_0W_0 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].

Stover Yield (t ha-1)

The interaction effect of irrigation frequency and weed control methodson 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 I_3W_1 (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 I_0W_0. The results obtained from all other treatment combinations were significantly different compared to highest and lowest results.

Harvest Index (%)

It was observed that the highest harvest index (29.26%) was recorded with the treatment combination of I_3W_2 which was significantly similar with I_3 W_3. On the other hand the lowest harvest index (22.40%) was recorded with the treatment combination of I_3W_2. 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 methodson yield parameters of sesame

Treatments	Seed yield plant^{-1}	Seed yield (tha^{-1})	Stover yield (tha^{-1})	Harvest Index
I_0W_0	6.627 j	0.94 e	2.542 g	27.10 bc
I_0W_1	6.760 ij	0.95 e	2.646 f	26.46 cdef
I_0W_2	6.837 hi	0.96 de	2.695 f	26.32 def
I_0W_3	6.970 gh	0.97 de	2.793 e	25.84 fg
I_1W_0	6.680 j	0.96 de	2.854 e	25.33 gh
I_1W_1	7.480 f	1.02 cd	2.959 d	25.75 fgh
I_1W_2	7.747 e	1.04 cd	2.975 d	26.03 efg
I_1W_3	7.830 e	1.05 cd	3.034 d	25.87 fg
I_2W_0	6.870 hi	0.97 de	3.207 c	23.33 i
I_2W_1	8.337 d	1.12 c	3.365 b	25.02 h
I_2W_2	8.910 c	1.23 b	3.389 ab	26.69 cde
I_2W_3	8.913 c	1.24 b	3.391 ab	26.86 cd
I_3W_0	7.040 g	0.98 de	3.404 ab	22.40 j
I_3W_1	9.707 b	1.32 ab	3.446 a	27.72 b
I_3W_2	10.21 a	1.41 a	3.415 ab	29.26 a
I_3W_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

I_0 = No irrigation; I_1 = Single irrigation at 20 DAS; I_2 = Two times irrigation at 20 and 40 DAS; I_3= Three times irrigation at 20, 40 and 60 DAS; W_0 = No weeding; W_1 = One hand weeding at

20 DAS; W_2 = Two hand weeding at 20 and 40 DAS; W_3 = Application of herbicide at 20 and 40 DAS.

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.

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