INTERNATIONAL JOURNAL OF BUSINESS, SOCIAL AND SCIENTIFIC RESEARCH
ISSN: 2309-7892 (Online), 2519-5530 (Print), Volume: 8, Issue: 3, Page: 103–106, July-December 2020

EFFECT OF FERTILIZERS ON GROWTH AND YIELD OF SUNFLOWER

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[**Citation:** Haq, M. T., Akter, R. and Jewel, K.N.A. (2020). Effect of Fertilizers on Growth and Yield of Sunflower. *Int. J. Bus. Soc. Sci. Res.* 8(3): 103–106. Retrieve from http://www.ijbssr.com/currentissueview/14013382]

Received Date: 15/09/2020 *Acceptance Date: 13/11/2020* *Published Date: 14/11/2020*

Abstract

The experiment was conducted to study the effect of fertilizers on growth and yield of BARI sunflower-2 during January to April 2018. Six fertilizers combination was used as treatments, *viz*., T_0 (No fertilizer), T_1 (Urea, TSP and MoP), T_2 (Urea, TSP, MoP and Gypsum), T_3 (Urea, TSP, MoP, Gypsum and Zinc sulphate), T_4 (Urea, TSP, MoP, Gypsum, Zinc sulphate and Boric acid) and T_5 (Urea, TSP, MoP, Gypsum, Zinc sulphate, Boric acid and Magnesium sulphate). The doses of different fertilizers were 180 kg Urea, 160 kg TSP, 150 kg MoP, 150 kg Gypsum, 8 kg zinc Sulphate, 10 kg Boric acid, 80 kg Magnesium Sulphate and 8 tonnes of cowdung per hectare. In all the treatment's statistically increased plant height, leaf length, leaf width, head diameter, head weight, 1000 seed weight and seed yield over control. The highest plant height at 25, 45 and 120 days after sowing were 2.90, 11.99 and 120.01 cm, respectively. The highest head diameter, head weight, 1000 seed weight and seed yield were 17.08 cm, 105.60 gm, 68.09 gm and 2.39 t/ha, respectively. The results revealed that different growth parameters and yield of sunflower (BARI sunflower-2) where increase gradually with combined application of fertilizers.

Key words: Sunflower, fertilizer, seed, growth, yield.

Introduction

Sunflower (*Heliantus annuus* L.) is an important oil seed crop which ranks 3rd after soybean and groundnut along with other oil seed crops which contributes considerably to edible oil in the world (Thavaprakash *et.al.*2002). It is grown throughout the world for various purposes. Sunflower is originated in North America and after spread to most of the countries in the world. Usually, sunflower seeds contain about 40-45% edible oil. Its oil is rich Vitamin, 'E' and it is free from cholesterol. So, sunflower oil is considered premium compared to other vegetable oil as it has high level of linoleic acid.

Sunflower can be grown as inter-crop with crops like groundnut, castor, soybean, Green or Black gram and pulses. The sunflower is grown in the southern part of our country in a very limited scale. Though its production is decreased due to increase the rice area, poor fertility of soils, lack of proper production technology, unavailability of inputs, and marketing problems, it has bright future as the cropping intensity increasing day by day. In order to reduce the oil import, it is needed to increase oil seed production in our country (Ahmed *et. al.* 2015).

Nutrients play important role in crop growth and development. Nutrients management is one of the most critical factors affecting seed yield in sunflower. Among the different nutrients such as Nitrogen, Phosphorous, Potassium, Sulphur, Boron and Magnesium etc. Phosphate application is the second important nutritional factor next only to nitrogen in deciding sunflower yield. Response of phosphorus application has been established (Prasad *et. at.*, 1983), phosphorus is an important plant nutrition and it affects the seed germination, cell wall division, flowering, fruiting, synthesis of fat, starch and in fact most biochemical activities (Singh and Singh, 2012). Phosphorus fertilization is of prime importance needed for normal growth and development of plants due to its vital role in chlorophyll synthesis and involvement in various physiological and metabolic processes of the plant (Mehta *et. al*. 2005). Phosphorus has an important role in the process of photosynthesis of plant (Amor, 1953). Significant response, of sunflower to phosphorus has been reported by several workers (Singh and Kaushal, 1975, Chardhari *et. al*. 1978). Potassium is a vital role of sunflower production.

Sulphur is increasingly being recognized as the further major plant nutrient after nitrogen, phosphorus and potassium (Tandon and Messick, 2002). Seed yield and S uptake increase by sulphur application. Seed oil content was higher with S dose @ 20kg/ha as mentioned by Sreem annareyan *et. al.* (1994). S is an essential constituent of many proteins enzymes and certain volatile compounds in polyunsaturated fatty acid (PUFA) in sunflower. Sulphur application significantly improves quality of sunflower oil concerning free fatty acid iodine value, lower saturated fatty acids like stearic and palmitic acids and higher PUFA like linoleic and oleic acids (Krishnamurthy and Mathan, 1996). The application of zinc caused significant yield increase over control due to improvement in growth and yield attributes (Kumar *et. al*. 2010). Boron has many important roles like flowering fruiting processes,

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pollen germination and hence seed setting also, Seed yield of sunflower was significantly higher with 25kg S/ha and foliar application of Boron (Tamak *et. al*. 1997). This element has positive effect on seed yield and quality. B also improves the seed quality parameters such as higher germination, higher speed of germination, higher shoot and root length, higher vigor index and seedling growth rate. Boron application leads fare. Boron applied on leads higher photosynthetic activity and translocation of photosynthesis of the sink, consequently results in better development in yield attributes and finally higher seed yield of sunflower (Sarkar and Samual, 1989). Magnesium has many functions in photosynthesis involving the control of thylakoid stacking are being a part of chlorophyll. The pumping of Mg^{2+} from thylakoids into the stroma in the light serves to activate ribulose-1, 5-bisphosphate carboxylase (Portis and Heldt, 1976). Many enzymatic reactions also require or are promoted by magnesium. We want to know from this study, what is the effect of fertilizers application on growth and yield of sunflower (*Helianthus annuus* L.). Therefore, the objective of the study was to find out the effect of different doses of fertilizers application on growth and yield of sunflower.

Materials and Methods

The study was conducted at Bangabandhu Academy for Poverty Alleviation and Rural Development (BAPARD) Agricultural farm field, Kotalipara, Gopalgonj during 01 January to 30 April 2018. Geographically the farm is located between $21^0 51'$ and $23^0\ 10'$ north latitudes and between $89°56'$ and $90^0 10'$ east longitudes. The topography of the farm field was medium high and the soil as sandy loam and well drained. The mean annual temperature of the location varies from 12.1^0C to 36.1^0C. The climate of the location was characterized by heavy rainfall starts from June which continues up to September.

BARI Sunflower-2 variety was used for the present study which was collected from On Farm Research Division (OFRD), Bangladesh Agricultural Research Institute, Gopalgonj. The seeds were sown in the field on 01 January 2018 and in rows at a depth of 2-3 cm from the soil surface. The distances between row to row and seed to seed were 50 cm and 30 cm. respectively. The experiment was laid out in a Randomized Complete Block Design with three replications. The field was divided into 18 plots. The experiment plot size was 2.0 m×2.0 m. Six fertilizers combination was used as treatments, *viz*., T_0 (No fertilizer), T_1 (Urea, TSP and MoP), T_2 (Urea, TSP, MoP and Gypsum), T_3 (Urea, TSP, MoP, Gypsum and Zinc sulphate), T_4 (Urea, TSP, MoP, Gypsum, Zinc sulphate and Boric acid) and T_5 (Urea, TSP, MoP, Gypsum, Zinc sulphate, Boric acid and Magnesium sulphate). The doses of different fertilizers were 180kg Urea, 160 kg TSP, 150 kg MoP, 150 kg Gypsum, 8 kg zinc Sulphate, 10 kg Boric acid and 80 kg Magnesium Sulphate per hectare (FGR-2012). Eight tones of cowdung was used as organic fertilizer per hectare as a basal dose. The total amount of cowdung, TSP, MoP, Gypsum, Zinc sulphate, Boric acid, Magnesium Sulphate and half of Urea were applied during the final land preparation. Rest the half of Urea was applied at 45 days after sowing (DAS). Irrigation, weeding, plant protection measures and other intercultural operation were done during sunflower cultivation as and when necessary. The crop was harvested on 30 April, 2018 and different parameters were recorded as following the standard method. The 1st and 2nd crop sampling was done at 25 and 45 days after sowing (DAS). Growth parameters were the average plant height (cm), leaf length (cm), and leaf width (cm) per plant was measured and recorded from the randomly selected 5 plants in each plot. Finally, the crop was harvested at 120 DAS (30 April 2018). The finally sampling five plants were collected carefully from each plot and were carried to the laboratory in properly labeled tag. Then, the plants were separated into plant and head. yields and yield contributing characters, *viz*., plant height (cm), head weight (gm), 1000 seeds weight (gm) and seed yield (t/ha) were recorded. All the data were subjected to analysis of variance (ANOVA). The mean values were compared using by the Duncan´s multiple range test (DMRT) at $P < 0.05$.

Results and discussion

Plant height: Plant height at 25 DAS varied from 2.08 to 2.90 cm. (Table 1). Maximum and minimum plant height was recorded with T_5 (2.90cm) and T_0 (2.08 cm.). At 45 DAS plant height varied from 10.58 to 11.99 cm. Maximum and minimum Plant height was recorded with T_5 (11.99cm) and T_0 (10.58cm), were Statistically superior over control. At 120 DAS plant height varied from 64.66 to 120.01cm. Maximum plant height was recorded with T_5 (120.01cm) followed by T_1 (83.53cm), T_2 (90.82cm), T_3 (110.01cm) and T_4 (115.03cm).

Table 1. Effect of fertilizers on growth of BARI Sunflower 2

Treatments	Plant height (cm)			Leaf length (cm)		Leaf width (cm)	
	25 DAS*	45DAS	120 DAS	25DAS	45 DAS	25 DAS	15 DAS
T_0	2.08	10.58	64.66	1.36	5.93	0.68	3.23
T_1	2.50	10.76	83.53	1.36	7.33	0.78	3.26
T_2	2.58	10.95	90.82	1.46	7.36	0.82	3.46
T_3	2.78	11.40	110.01	1.63	7.50	0.87	3.70
T_4	2.80	11.90	115.03	1.66	7.70	0.92	3.73
T_5	2.90	11.99	120.01	1.86	8.23	1.03	3.76
Mean	2.60	11.26	97.34	1.55	7.34	0.85	3.52
SD	0.29	0.59	21.39	0.19	0.76	0.12	0.24
LSD (0.05)	0.14	0.38	8.40	0.12	0.31	0.1	0.28
CV (%)	11.41	5.28	21.97	12.69	10.43	14.15	6.82

*** DAS=Day after sowing**

T_0 (64.66 cm) gave minimum plant height as and overall effect of treatment was significantly increased. The

results suggest that the pant height varied according to fertilizers application especially nitrogen forms. The observations were also supported by Abdelgadir *et.al.* (2011).

Leaf length: Leaf length at 25 DAS varied from 1.36 to 1.86cm. (Table-1). Maximum and minimum leaf length was recorded with T_5 (1.86 cm) and T_0 (1.36cm). At 45 DAS leaf length varied from 5.93 to 8.23 cm. maximum leaf length was recorded with the treatment T_5 (8.23cm) and is found statistically superior over T_0 (5.93), T_1 (7.33cm), T_2 (7.36 cm), T_3 (7.50 cm), and T_4 (7.70cm). Minimum leaf length was recorded in T_0 (5.93 cm). As a result, the combined application of fertilizer (Urea, TSP, MoP, Gypsum, Boric acid, Zinc Sulphate and Magnesium Sulphate) increased leaf length of sunflower. Therefore, T_5 could be identified as the best treatment to obtain higher yield of sunflower.

Leaf Width: The leaf width at 25 DAS varied from 0.68 to 1.03cm. (Table-1). The highest and lowest leaf width was recorded with T_5 (1.03cm) and T_0 (0.68cm) were significantly superior over control. At 45 DAS leaf width varied from 3.23 to 3.76cm. The highest leaf width was recorded with T_5 (3.76cm) followed by T_1 (3.26 cm), T_2 (3.23cm), T_3 (3.70 cm) and T_4 (3.73 cm). T_0 (3.23 cm) gave the lowest leaf width, and overall effect of treatment was statistically increased.

Table 2. Effect of fertilizers on yield and yield contributing characters

Treatments	Head diameter (cm.)	Head weight (gm.)	1000 seed weight (gm.)	Seed yield (kg/ha)	Seed yield (t/ha.)
T_0	14.16	70.74	61.48	1902	1.90
T_1	15.03	82.55	62.19	2104	2.10
T_2	15.06	94.7	63.04	2205	2.20
T_3	15.08	98.86	65.25	2304	2.30
T_4	16.09	103.53	66.90	2378	2.37
T_5	17.08	105.60	68.09	2395	2.39
Mean	15.41	92.66	64.49	2214.66	2.21
SD	1.01	13.49	2.67	188.29	0.18
LSD (0.05)	5.31	5.40	5.39	74.07	0.16
CV (%)	6.60	14.56	4.14	8.50	8.41

Head diameter: The head diameter is a one of the components that effect yield. Head diameter of a sunflower was significantly affected by ecological factor and fertilizers application such as Urea, TSP, MoP, gypsum, Boric acid, Zinc sulphate and Magnesium sulphate. Head diameter varied from 14.16 to 17.08 cm. (Table-2). Maximum head diameter was recorded with T_5 (17.08 cm.) which is followed by T_1 (15.03cm), T_2 (15.06 cm), T_3 (15.08cm) and T_4 (16.09cm). Minimum head diameter was recorded with T_0 (14.16 cm) and overall effects of treatment was significantly increased. It is clear from the data that application of different combined fertilizers significantly increases the head diameter. These results confirm the findings of Iqbal and Asraf (2006); Munir *et. al.* (2007).

Head weight: Weight of head with seed of BARI Sunflower-2 are presented Table-2. Head weight varied from 70.74 to 105.60gm. Maximum head weight was recorded under Treatment T_5 (105.60gm) and minimum with treatment T_0 (70.74gm). Treatment T_1, T_2, T_3, and T_4 significantly superior over control. It was found that applying of fertilizer including nitrogen. Phosphorus, Potasium, Sulphur, Zine, boron and magnesium increased head weight in a semi sandy soil.

1000 seed weight: Thousand seed weight is another yield component in sunflower's thousand seed weight differs based on growing seasons and fertilizers application. The data on thousand seed weight are presented in Table-2. weight of thousand seed of BARI Sunflower-2 was varied from 61.48 to 68.09 gm. Maximum thousand seed weight was recorded under treatment T_5(68.09gm) and minimum with treatment T_0 (61.48gm.) Treatments T_1, T_2, T_3 and T_4 were found to be statistically superior over control. It was found that seed weight varied with their size and shape. It is clear from the data that application of combined inorganic fertilizers increased thousand seed weight. Murir *et.al.* (2007) design an experiment to check the combination effect of inorganic fertilizer on sunflower are produced the highest yield in plot where application rate was 100-57-50 kg/ha N,P,K as compared to organic fertilizer.

Seed yield: The data pertaining to seed yield are presented in Table-2. The mean seed yield was 2214.66kg/ha (2.21t/ha). Response of fertilizer treatments on seed yield was significant. The highest seed yield was for treatment T_5 (Urea, TSP, MoP, Gymsum, Zinc Sulphate, Boric Acid and Magnesium Sulphate) 2395kg/ha (2.39 t/ha) which was statistically superior over treatment T_0 (control) 1902 kg/ha (1.90 t/ha), T_1 (Urea, TSP and MoP) 2104 kg/ha. (2.10 t/ha), T_2 (Urea, TSP, MoP and Gypsum) 2205 kg/ha. (2.20 t/ha), T_3 (Urea, TSP, MoP, Gypsum and Zinc Sulphate) 2304kg/ha (2.30 t/ha) and T_4 (Urea, TSP, MoP, Gypsum, Zinc Sulphate and Boric Acid) 2378 kg/ha (2.37 t/ha). The lowest seed yield was observed Treatment T_0 (control) 1902kg/ha (1.90 t/ha). As a result, application of different fertilizers gradually increased the seed yield of sunflower. These results are in conformity with those of supak *et.al.* (1975), Stulin (1991), Nagar and Allam (1991) and Sathiyavelu *et. al*. (1994).

Conclusion

Sunflower is sensitive to sowing date and fertilizers application. So, sowing date and fertilizers application were studied to maximum yield and quality of sunflower. From the findings, it could be suggested that the BARI sunflower-2 was good for cultivation during Robi season and application of 180 kg Urea, 160 kg TSP, 150 kg

MoP, 150 kg Gypsum, 8 kg Zinc Sulphate, 10 kg Boric Acid, 80 kg Magnesium Sulphate and 8 tonnes cowdung per hectare (FGR 2012) gave more seed yield. Finally these findings will help our farmer to apply balanced fertilizer application which will be synchronized with crop demand and also will reduce the cost of production. It can be introduced all the southern area of Bangladesh to increase the total production of sunflower.

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