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Research Paper

Response of Biofertilizers on Growth and Yield of Sunflower Grown Under Indian and Libyan Natural Condition

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ABSTRACT: *The experiment was conducted at the Department of Biological Sciences, SHIATS, Allahabad, Department of Botany, Faculty of Science (Zintan), University of El-JabalWl-Gharby, Libya during year 2013-15. The experiment was laid out in Randomized Block Design (RBD). There were eleven treatments including control, replicated 3 times in which several fertilizer application control (FYM @ 2.51 t/ha, Vermicompost @ 2.5 t/kg, Trichoderma harizanum @10g/kg), In the view of present investigation the most effective growth treatment was T_5-(FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha),compared to control and other treatments was found to be the best in terms of plant height, number of leaves, number flower, Number of filled seed per capita, Weight of dry flowers (g), and Oil content (%).As far as planting condition concerned, Indian emerged superior in compare to Libyan condition.*

Keywords: *Sunflower, biofertilizers, FYM, Vermicompost and Trichoderm aharizanum,*

I. INTRODUCTION

Sunflower (Helianthus annuusL.) is an important oilseed crop and is native to southern parts of USA and Mexico. Sunflower ranks third next only to groundnut and soybean in total production of oilseed of the world. Sunflower is cultivated in an area of 28.57 million hectares with an annual production and productivity of 26.65 million tonnes and 1271 kg per hectare, respectively in the world (Anon., 2004). Sunflower crop was introduced to India during 1969 as a supplement to introduce oilseed crops to bridge the gap of recurring edible oil shortage in the country. The commercial cultivation of sunflower started in India during 1972-73 with a few imported varieties from USSR and Canada. Now, the crop has been well accepted by the farming community because of its desirable attributes such as short duration, photoperiod insensitivity, adaptability to wide range of soil and climatic conditions, drought tolerance, lower seed rate, higher seed multiplication ratio and high quality of edible oil. Now, India has emerged as second major sunflower producing country in Asia after China. In India, sunflower is cultivated over an area of about 2.4 million hectares with a production of 1.44 million tonnes and productivity of 608 kg per hectare (Anon., 2007). The cultivation of sunflower is largely confined to southern parts of the country comprising the states of Karnataka, Maharashtra, Tamil Nadu and Andhra Pradesh. These four states contribute about 90 per cent of total acreage and 78 per cent of total production (Anon., 2007). However, recently sunflower has moved to northern parts of the country where the productivity is very high. Karnataka is the leading sunflower producing state in the country and contributes nearly 44 per cent of the total area and 28 per cent of the total production in the country.

It is grown over an area of 0.91 million hectares with a production and productivity of 0.42 million tonnes and 456 kg per hectare, respectively (Anon., 2002). Hence, there is an urgent need to workout a suitable agro-production technology to explore potentiality of sunflower to meet the increasing demand of hybrid seed. The commercial yield in sunflower is the product of interaction between three important components *viz.*, seed, nutrients and climatic conditions. In this interaction seed plays a decisive role and it is therefore, necessary to use seeds of high quality and genetic purity. Organic agricultural practices aim to enhance biodiversity, biological cycles and soil biological activity so as to achieve optimal natural systems that are socially, ecologically and economically sustainable (Samman et al. 2008). Manure has always been considered as a valuable input to the soil for crop production. Even under scientific seed production programmes in Indian conditions, it has not been possible to realize full potential of these open pollinated varieties in view of their

heterogenous nature and erratic performance. Under such circumstances, hybrid sunflower is preferable over open pollinated varieties, since hybrids ensure homogeneity and stability to productivity.

Organic farming is considered a remedy to cure the ills of modern chemical agriculture. It is essential to develop a strong workable, compatible package of nutrient management through organic resources for various crops, capable of providing all the essential minerals for promoting growth. Vermicomposting is being used increasingly as plant growth media and soil amendments. In vermicompost, accelerated bioxidation of organic matter is achieved mostly by high-density earthworm populations (Dominguez et al., 1997; Subler et al., 1998). It produces peat like material with high porosity, aeration, drainage water holding capacity and microbial activity which is stabilized by interactions between earthworm and micro-organisms in a non thermophilic process (Edwards & Burrows, 1988). Nutrients present in vermicompost are readily available for plant uptake (Orozco et al., 1996; Edwards, 1998)

Other Information Sunflower is perceived to be a drought tolerant crop as it roots deeply and extracts water at depths not reached by other crops. Sunflower is comparable to maize in many ways although it can extract water more efficiently in low-rainfall areas. The seedbed should be prepared so that a moist soil environment is available for germination and growth. The soil surface should be left as rough as possible to reduce the risk of soil erosion, drifting and blowing soil can seriously damage young seedlings. If the soil becomes compacted prior to planting reduced aeration and restricted water movement will occur, these conditions will increase the risk of downy mildew occurring. Breakdown of soil structure also reduces nutrient and water uptake and therefore yield. Sunflower has a wide potential sowing window.

II. MATERIALS AND METHODS

Experimental site in India

The experiment was conducted during the *Rabi* season 2013-14 at the Crop Research Farm, Department of Biological Sciences, SHIATS, Allahabad . The Crop Research Farm is situated at 25^0 57' N latitude, longitude and 98 m altitude from the sea level. This area is situated on the right side of the river Yamuna and by the opposite side of Allahabad city. All the facilities required for crop cultivation are available.

Experimental site in Libya

The experiment was conducted during the *Rabi* season 2014-15 at the Crop Research Farm, Department of Botany, faculty of Science (Zintan), University of El-JabalWl-Gharby, Libya. The Crop Research Farm is situated at 38^0 9' N latitude, 2^0 - 9' E longitude. All the facilities required for crop cultivation are available.

Trichoderma culture

The culture of Trichoderma were obtained from Department of Plant Protection, SHIATS, Allahabad (U.P) The bacterial slurry was prepared and applied as per procedure mentioned below.

- 200 g of jaggery was dissolved in 200 ml of water. Jaggery solution as per the volume of seed was prepared.
- Trichoderma was thoroughly mixed for slurry preparation in above solution.
- Seeds were treated with this mixture carefully, so that seed coat was not injured and a uniform coating is made.
- Treated seeds were dried under shade on gunny bags and then used for sowing.

Treatment combinations

T_0-Control
T_1-FYM @ 2.51 t/ha
T_2-Vermicompost @ 2.5 t/kg
T_3-*Trichoderma harizanum* @10g/kg
T_4-*Trichoderma viridie* @10 g/kg
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha
T_6-FYM @ 12.5 t/ha + *Trichoderm aharizanum* @10g/kg
T_7- Vermicompost @ 2.5 t/kg + *Trichoderma harzianum* @10 g/kg
T_8- FYM @ 12.5 t/ha + *Trichoderm aviridie* @10 g/kg
T_9- Vermicompost @ 2.5 t/kg + *Trichoderma viridie* @10 g/kg
T_{10}- *Trichoderm aharizanum* @10g/kg +*Trichoderma viridie* @10 g/kg

III. RESULTS AND DISCUSSION

In Indian condition

Data presented in table 1.1 of plant height the maximum was recorded in T_5(109.00 cm) followed by T_1 (105.33) and minimum plant height recorded in T_0 (70.33). While similar trend was noticed at all the stage.
In the table 1.2 number of leaves the maximum was recorded in T_5(23.00), followed by T_1(22.33) and minimum number of leaves found in T_0 (15.33).

The data recorded in table 1.3 the maximum number of flower was recorded in the maximum number of flowerwas recorded in T_5 (1.00), followed by T_1 (1.00) and minimum number of flower recorded in T_0(0.67).

In the table 1.4 the maximum number of filled seed per capita was recorded in T_5 (420.56), followed by T_1(418.11) and minimum number of filled seed per capita recorded in T_0 (176.56).

The data recorded in table 1.5 the maximum number of unfilled seed per capita was recorded in T_0 (180.21), followed by T_{10} (175.00) and minimum number of unfilled seed per capita recorded in T_1 (138.47).

In the table 1.6 the maximum weight of flowers was found in T_5 (18.52), followed by T_1(18.30) and minimum weight of flowers recorded in T_0 (10.21). The maximum oil content was recorded in T_5 (40.00) followed by T_1 (40.00) and minimum oil content recorded in T_0(37.00).

The data recorded in table 1.7 the maximum weight of flowers was recorded in T_5 (18.52) followed by T_1-(FYM @ 2.51 t/ha) (18.30) and minimum weight of flowers recorded in T_0 (Control) (10.21).

The data recorded in table 1.8 the maximum oil content was recorded in T_5-(FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha), (40.00) followed by T_1-(FYM @ 2.51 t/ha) (40.00) and minimum oil content recorded in T_0 (Control) (37.00).

Table 1.1 : Effect of biofertilizers Plant height (cm) of sun flower at Indian condition.

Treatments	Plant height (cm)
T_0-Control	70.33
T_1-FYM @ 2.51 t/ha	105.33
T_2-Vermicompost @ 2.5 t/kg	103.00
T_3-*Trichoderma harizanum* @10g/kg	98.33
T_4-*Trichoderma viridie* @10 g/kg	98.00
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha	109.67
T_6-FYM @ 12.5 t/ha + *Trichoderma harizanum* @10g/kg	83.33
T_7- Vermicompost @ 2.5 t/kg + *Trichoderm aharzianum* @10 g/kg	96.67
T_8- FYM @ 12.5 t/ha + *Trichoderma viridie* @10 g/kg	98.67
T_9- Vermicompost @ 2.5 t/kg + *Trichoderm aviridie* @10 g/kg	100
T_{10}- *Trichoderma harizanum* @10g/kg +*Trichoderma viridie* @10 g/kg	71.33
Overall mean	**94.06**
F- test	S
S. Ed. (±)	7.862
C. D. (P = 0.05)	16.517

Table 1.2 : Effect of biofertilizers no of leaves of sun flower at Indian condition.

Treatments	Number of leaves per plant
T_0-Control	15.33
T_1-FYM @ 2.51 t/ha	22.33
T_2-Vermicompost @ 2.5 t/kg	22.00
T_3-*Trichoderma harizanum* @10g/kg	14.67
T_4-*Trichoderma viridie* @10 g/kg	16.00
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha	23.00
T_6-FYM @ 12.5 t/ha + *Trichoderma harizanum* @10g/kg	18.33
T_7- Vermicompost @ 2.5 t/kg + *Trichoderm aharzianum* @10 g/kg	16.00
T_8- FYM @ 12.5 t/ha + *Trichoderma viridie* @10 g/kg	17.67
T_9- Vermicompost @ 2.5 t/kg + *Trichoderm aviridie* @10 g/kg	17.00
T_{10}- *Trichoderma harizanum* @10g/kg +*Trichoderma viridie* @10 g/kg	16.33
Overall mean	**18.06**
F- test	S
S. Ed. (±)	2.705
C. D. (P = 0.05)	5.684

Table 1.3 : Effect of biofertilizers No. of flowers of sun flower at Indian condition.

Treatments	Number of flower per plant
T_0-Control	0.67
T_1-FYM @ 2.51 t/ha	1.33
T_2-Vermicompost @ 2.5 t/kg	1.00
T_3-Trichoderma harizanum @10g/kg	1.00
T_4-Trichoderma viridie @10 g/kg	1.00
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha	1.67

T_6-FYM @ 12.5 t/ha + Trichoderma harizanum @10g/kg	1.00
T_7- Vermicompost @ 2.5 t/kg + Trichoderm aharzianum @10 g/kg	1.00
T_8- FYM @ 12.5 t/ha + Trichoderma viridie @10 g/kg	1.00
T_9- Vermicompost @ 2.5 t/kg + Trichoderm aviridie @10 g/kg	1.00
T_{10}- Trichoderma harizanum @10g/kg +Trichoderma viridie @10 g/kg	1.00
Overall mean	**1.00**
F- test	NS
S. Ed. (±)	0.049
C. D. (P = 0.05)	0.103

Table 1.4 : Effect of biofertilizers on Number of filled seed per capita of sun flower at Indian condition.

Treatments	Number of filled seed per capita
T_0-Control	176.56
T_1-FYM @ 2.51 t/ha	418.11
T_2-Vermicompost @ 2.5 t/kg	410.56
T_3-*Trichoderma harizanum* @10g/kg	400.20
T_4-*Trichoderma viridie* @10 g/kg	395.22
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha	420.56
T_6-FYM @ 12.5 t/ha + *Trichoderma harizanum* @10g/kg	359.56
T_7- Vermicompost @ 2.5 t/kg + *Trichoderm aharzianum* @10 g/kg	358.56
T_8- FYM @ 12.5 t/ha + *Trichoderma viridie* @10 g/kg	340.22
T_9- Vermicompost @ 2.5 t/kg + *Trichoderm aviridie* @10 g/kg	373.56
T_{10}- *Trichoderma harizanum* @10g/kg +*Trichoderma viridie* @10 g/kg	323.53
Overall mean	**361.51**
F- test	S
S. Ed. (±)	0.743
C. D. (P = 0.05)	1.561

Table 1.5 : Effect of biofertilizers on Number of unfilled seed per capita of sun flower at Indian condition.

Treatments	Number of unfilled seeds per capita
T_0-Control	180.21
T_1-FYM @ 2.51 t/ha	138.47
T_2-Vermicompost @ 2.5 t/kg	142.74
T_3-*Trichoderma harizanum* @10g/kg	150.51
T_4-*Trichoderma viridie* @10 g/kg	140.41
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha	147.12
T_6-FYM @ 12.5 t/ha + *Trichoderma harizanum* @10g/kg	168.57
T_7- Vermicompost @ 2.5 t/kg + *Trichoderm aharzianum* @10 g/kg	170.24
T_8- FYM @ 12.5 t/ha + *Trichoderma viridie* @10 g/kg	168.70
T_9- Vermicompost @ 2.5 t/kg + *Trichoderm aviridie* @10 g/kg	171.56
T_{10}- *Trichoderma harizanum* @10g/kg +*Trichoderma viridie* @10 g/kg	175.00
Overall mean	**159.41**
F- test	S
S. Ed. (±)	0.980
C. D. (P = 0.05)	2.060

Table 1.6 : Effect of biofertilizers on weight of dry flower of sun flower at Indian condition.

Treatments	Weight of dry flowers (g)
T_0-Control	10.21
T_1-FYM @ 2.51 t/ha	18.30
T_2-Vermicompost @ 2.5 t/kg	18.03
T_3-*Trichoderma harizanum* @10g/kg	17.83
T_4-*Trichoderma viridie* @10 g/kg	17.67
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha	18.52
T_6-FYM @ 12.5 t/ha + *Trichoderma harizanum* @10g/kg	14.73
T_7- Vermicompost @ 2.5 t/kg + *Trichoderm aharzianum* @10 g/kg	15.50
T_8- FYM @ 12.5 t/ha + *Trichoderma viridie* @10 g/kg	14.67
T_9- Vermicompost @ 2.5 t/kg + *Trichoderm aviridie* @10 g/kg	14.83
T_{10}- *Trichoderma harizanum* @10g/kg +*Trichoderma viridie* @10 g/kg	16.03
Overall mean	**16.03**
F- test	S
S. Ed. (±)	0.554
C. D. (P = 0.05)	1.164

Table 1.7 : Effect of biofertilizers on oil content of sun flower at Indian condition.

Treatments	Oil content (%)
T_0-Control	37.00
T_1-FYM @ 2.51 t/ha	40.00
T_2-Vermicompost @ 2.5 t/kg	39.00
T_3-*Trichoderma harizanum* @10g/kg	40.00
T_4-*Trichoderma viridie* @10 g/kg	40.00
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha	40.00
T_6-FYM @ 12.5 t/ha + *Trichoderma harizanum* @10g/kg	39.00
T_7- Vermicompost @ 2.5 t/kg + *Trichoderm aharzianum* @10 g/kg	40.00
T_8- FYM @ 12.5 t/ha + *Trichoderma viridie* @10 g/kg	40.00
T_9- Vermicompost @ 2.5 t/kg + *Trichoderm aviridie* @10 g/kg	40.00
T_{10}- *Trichoderma harizanum* @10g/kg +*Trichoderma viridie* @10 g/kg	38.00
Overall mean	**39.36**
F- test	S
S. Ed. (±)	0.410
C. D. (P = 0.05)	0.870

In Libyan Condition

Data presented in table 2.1 of plant height the maximum was recorded in T_5 (89.67 cm), followed by T_1 (84.33) and minimum plant height recorded in T_0 (43.33). In the table 2.2 number of leaves the maximum number of leaveswas recorded in T_5 (24.67), followed by T_1 (23.67) and minimum number of leaves recorded in T_0 (16.33). The data recorded in table 2.3 the maximum number of flowerwas showed in T_5 (1.00), followed by T_1 (1.00) and minimum number of flower recorded in T_0 (1.00). In the table 2.4 the maximum number of filled seed per capita was recorded in T_5 (426.67), followed by T_1 (421.67) and minimum number offilled seed per capita recorded in T (181.67).

The data recorded in table 2.5 the number of unfilled seed per capita the maximum was recorded in T_0 (184.32), followed by T_{10} (180.12) and minimum number ofunfilled seed per capita recorded in T_1 (FYM @ 2.51 t/ha l) (147.58). In the table 2.6 the maximum weight of flowers was recorded in T_5 (17.56) followed by T_2 (17.13) and minimum weight of flowers recorded in T_0 (9.11).

The data recorded in table 1.7 oil content the maximum was recorded in T_5 (39.00) followed by T_1 (39.00) and minimum oil content recorded in T_0 (35.00). FYM helps to improve and conserve the fertility of soil. FYM imparts dark color of the soil and thereby help to maintain the temperature of soil. The activity and population of beneficial soil organisms increased on application of FYM in soil. These findings are in accordance with the results of Ujjinaiah *et al.,* (1994) observed application of FYM exhibited a significant influence on the seed and stalk yield of sunflower (*Helianthus annuus* L.) which was attributed to the enhanced growth of plant height, stem diameter and number of leaves, in sunflower (*Helianthus annuus* L.) .

In nature, some time plants follow altered growth patterns such as negative geotropism of roots, stem elongation and dwarfing, shortening of vegetative phase, enhancement of leaf area, photosynthetic rate, flowering and fruiting by matured plants. Edwards (1988) reported that vermicompost could promote early and vigorous growth of seedlings. Vermicompost has found to effectively enhance the root formation, elongation of stem and production of biomass, vegetables, ornamental plants etc.

Table 2.1 : Effect of biofertilizers on Plant heigh (cm) of sunflower at Libyan natural condition.

Treatments	Plant height (cm)
T_0-Control	43.33
T_1-FYM @ 2.51 t/ha	84.33
T_2-Vermicompost @ 2.5 t/kg	81.00
T_3-*Trichoderma harizanum* @10g/kg	71.67
T_4-*Trichoderma viridie* @10 g/kg	79.67
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha	89.67
T_6-FYM @ 12.5 t/ha + *Trichoderma harizanum* @10g/kg	75.33
T_7- Vermicompost @ 2.5 t/kg + *Trichoderm aharzianum* @10 g/kg	72.00
T_8- FYM @ 12.5 t/ha + *Trichoderma viridie* @10 g/kg	65.00
T_9- Vermicompost @ 2.5 t/kg + *Trichoderm aviridie* @10 g/kg	69.00
T_{10}- *Trichoderma harizanum* @10g/kg +*Trichoderma viridie* @10 g/kg	53.33
Overall mean	**71.30**
F- test	S
S. Ed. (±)	4.591
C. D. (P = 0.05)	9.646

Table 2.2 : Effect of biofertilizers on No of leaves of sunflower at Libyan natural condition.

Treatments	Number of leaves per plant
T_0-Control	16.33
T_1-FYM @ 2.51 t/ha	24.33
T_2-Vermicompost @ 2.5 t/kg	23.67

T_3-*Trichoderma harizanum* @10g/kg	22.33
T_4-*Trichoderma viridie* @10 g/kg	20.33
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha	24.67
T_6-FYM @ 12.5 t/ha + *Trichoderma harizanum* @10g/kg	22.33
T_7- Vermicompost @ 2.5 t/kg + *Trichoderm aharzianum* @10 g/kg	23.00
T_8- FYM @ 12.5 t/ha + *Trichoderma viridie* @10 g/kg	20.33
T_9- Vermicompost @ 2.5 t/kg + *Trichoderm aviridie* @10 g/kg	19.33
T_{10}- *Trichoderma harizanum* @10g/kg +*Trichoderma viridie* @10 g/kg	21.00
Overall mean	**21.61**
F- test	S
S. Ed. (±)	2.156
C. D. (P = 0.05)	4.529

Table 2.3 : Effect of biofertilizers on No of Flowers per plant of sunflower at Libyan natural condition.

Treatments	Number of flower per plant
T_0-Control	1.00
T_1-FYM @ 2.51 t/ha	1.00
T_2-Vermicompost @ 2.5 t/kg	1.00
T_3-*Trichoderma harizanum* @10g/kg	1.00
T_4-*Trichoderma viridie* @10 g/kg	1.00
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha	1.00
T_6-FYM @ 12.5 t/ha + *Trichoderma harizanum* @10g/kg	1.00
T_7- Vermicompost @ 2.5 t/kg + *Trichoderm aharzianum* @10 g/kg	1.00
T_8- FYM @ 12.5 t/ha + *Trichoderma viridie* @10 g/kg	1.00
T_9- Vermicompost @ 2.5 t/kg + *Trichoderm aviridie* @10 g/kg	1.00
T_{10}- *Trichoderma harizanum* @10g/kg +*Trichoderma viridie* @10 g/kg	1.00
Overall mean	**1.00**
F- test	NS
S. Ed. (±)	0.075
C. D. (P = 0.05)	0.159

Table 2.4 : Effect of biofertilizers on No of filled seed per capita of sunflower at Libyan natural condition.

Treatments	Number of filled seed per capita
T_0-Control	181.67
T_1-FYM @ 2.51 t/ha	421.67
T_2-Vermicompost @ 2.5 t/kg	420.00
T_3-Trichoderma harizanum @10g/kg	415.33
T_4-Trichoderma viridie @10 g/kg	416.33
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha	426.67
T_6-FYM @ 12.5 t/ha + Trichodermaharizanum @10g/kg	366.67
T_7- Vermicompost @ 2.5 t/kg + Trichodermaharzianum @10 g/kg	371.67
T_8- FYM @ 12.5 t/ha + Trichodermaviridie @10 g/kg	360.33
T_9- Vermicompost @ 2.5 t/kg + Trichodermaviridie @10 g/kg	377.67
T_{10}- Trichodermaharizanum @10g/kg +Trichodermaviridie @10 g/kg	320.52
Overall mean	**370.78**
F- test	S
S. Ed. (±)	0.926
C. D. (P = 0.05)	1.946

Table 2.5 : Effect of biofertilizers on No unfilled seeds per capita of sunflower at Libyan natural condition.

Treatments	Number of unfilled seeds per capita
T_0-Control	184.32
T_1-FYM @ 2.51 t/ha	147.58
T_2-Vermicompost @ 2.5 t/kg	152.85
T_3-*Trichoderma harizanum* @10g/kg	153.62
T_4-*Trichoderma viridie* @10 g/kg	149.52
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha	151.24
T_6-FYM @ 12.5 t/ha + *Trichoderma harizanum* @10g/kg	171.68
T_7- Vermicompost @ 2.5 t/kg + *Trichoderm aharzianum* @10 g/kg	175.35
T_8- FYM @ 12.5 t/ha + *Trichoderma viridie* @10 g/kg	172.80
T_9- Vermicompost @ 2.5 t/kg + *Trichoderm aviridie* @10 g/kg	176.67
T_{10}- *Trichoderma harizanum* @10g/kg +*Trichoderma viridie* @10 g/kg	180.12
Overall mean	**165.07**
F- test	S
S. Ed. (±)	1.329
C. D. (P = 0.05)	2.793

Table 2.6 : Effect of biofertilizers on weight of dry flower (g) of sunflower at Libyan natural condition.

Treatments	Weight of dry flowers (g)
T_0-Control	9.11
T_1-FYM @ 2.51 t/ha	16.41
T_2-Vermicompost @ 2.5 t/kg	17.13
T_3-*Trichoderma harizanum* @10g/kg	16.72
T_4-*Trichoderma viridie* @10 g/kg	17.21
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha	17.56
T_6-FYM @ 12.5 t/ha + *Trichoderma harizanum* @10g/kg	17.73
T_7- Vermicompost @ 2.5 t/kg + *Trichoderm aharzianum* @10 g/kg	14.40
T_8- FYM @ 12.5 t/ha + *Trichoderma viridie* @10 g/kg	13.56
T_9- Vermicompost @ 2.5 t/kg + *Trichoderm aviridie* @10 g/kg	13.43
T_{10}- *Trichoderma harizanum* @10g/kg +*Trichoderma viridie* @10 g/kg	15.25
Overall mean	**15.32**
F- test	S
S. Ed. (±)	0.456
C. D. (P = 0.05)	0.959

Table 2.7 : Effect of biofertilizers on Oil content (%) of sunflower at Libyan natural condition.

Treatments	Oil content (%)
T_0-Control	35.00
T_1-FYM @ 2.51 t/ha	39.00
T_2-Vermicompost @ 2.5 t/kg	39.00
T_3-*Trichoderma harizanum* @10g/kg	37.00
T_4-*Trichoderma viridie* @10 g/kg	38.00
T_5-FYM @ 12.5 t/ha + vermicompost @ 2.5 t/ha	39.00
T_6-FYM @ 12.5 t/ha + *Trichoderma harizanum* @10g/kg	36.00
T_7- Vermicompost @ 2.5 t/kg + *Trichoderm aharzianum* @10 g/kg	37.00
T_8- FYM @ 12.5 t/ha + *Trichoderma viridie* @10 g/kg	38.00
T_9- Vermicompost @ 2.5 t/kg + *Trichoderm aviridie* @10 g/kg	37.00
T_{10}- *Trichoderma harizanum* @10g/kg +*Trichoderma viridie* @10 g/kg	36.00
Overall mean	**37.36**
F- test	S
S. Ed. (±)	0.50
C. D. (P = 0.05)	1.06

IV. CONCLUSION

Experimental findings showed that judicious application of organic and inorganic fertilizer was positive response in terms of plant height, number of leaves, number flower, Number of filled seed per capita, Weight of dry flowers (g), and Oil content (%). Organic amendments, such as FYM are known to improve soil physical properties organic matter is an important soil constituent influencing a number of constraints linked with crop productivity. As far as planting condition concerned, India emerged superior in compare to Libyan condition.

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