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Effect of the Complete Foliar Fertilizer Nitrophoska Foliar 20 /19/19/TE and Yeast on Growth and Yield of Tow Sunflower Cultivars Under Newly Reclaimed Sandy Soil Condition.

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ABSTRACT

Two field experiments were carried out at private farm in Wadi El-Rayyan, El-Fayoum Governorate, Egypt, in the two summer seasons of 2014 and 2015 seasons, to study effect of the complete foliar fertilizer compound Nitrophoska foliar 20/19/19/TE and yeast extract on growth and yield of the two sunflower cultivars Pioneer-6480 and Imported G-101 under newly reclaimed sandy soil. The main results could be summarized as follows: 1-Pioneer-6480 cultivar significant outweighed Imported G-101 cultivar in growth characters at 70 and 100 days after sowing, as well as, yield and its components at harvest date except harvest index the increment of Imported G-101 than Pioneer 6480 failed to reach the significant level at 5%. 2- with respect of foliar spraying with Nitrophoska foliar 20/19/19/TE and yeast extract, results show that foliar spraying with 500g Nitrophoska foliar 100 L water + yeast extract produced the highest significant values from growth parameters at 70 and 100 days after sowing and yield and its components compared with other seven foliar fertilize treatments under study except the differences between 350g Nitrophoska/100 L water + yeast and 500g Nitrophoska/100 L water +yeast in shelling %,harvest index and oil %per seeds failed to significant level at 5% level. 3-Regarding of the interaction between sunflower cultivars and foliar fertilizer with Nitrophoska foliar 20/19/19/TE and yeast extract data obtained indicated that the most effective treatment for collecting greatest mean values from growth and its parameters and yield and its components was Pioneer-6480 cultivar sprayed with 500 g Nitrophoska foliar 20/19/19/TE /100 L water +yeast extract.

Keywords: Sunflower, cultivars, Nitrophoska foliar, yeast, growth parameters, yield and its components.

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INTRODUCTION

In Egypt, production of vegetative oil is fall below requirements for local consumption .An increase in consumption per capite was found and amounting to about 2 pounds per person every five years in the world, thus, this necessitate an increase in total production of edible oil in the world. Sunflower (*Helianthus annus L.*) is an important source of edible vegetable oil through the world for its high polysaturated fatty acid content and limited cholesterol content. Also, in Egypt sunflower is one of the important promising oil cropnew reclaimed sandy soils. Sunflower oil production can be increased horizontally by increasing area of sunflower crop/or vertically by increasing total seeds yield and the concentration of oil in the seeds. Therefore, continuous attempts were carried out for increasing its productivity to face urgent demands of increasing population especially in Egypt through the last period. This can be obtained through breeding programs to produce highly productive and quantitative gene forms;as well as; adjusting to mineral and bio-fertilizer respect to arrive to that strategy.

Nitrophoska foliar 20/19/19/TE is a complete foliar fertilizer produced by SHOURA Chemicals company. It contain, N 20%, P 19%, K 19 %, Mg 0.5 %,Mn 1000 ppm, Cu 400 ppm, B 130 ppm, S 0.3 %,Fe 1000 ppm, Zn 380 ppm and Mo 30 ppm. Furthermore, yeast extracts contain trehalose-6-phosphate syntheses which had a key enzyme for readies bio synthesis [1].The improving of growth,flowering,yield and its components of some plants by using foliar application with yeast extracts was indicated by [2-7] .

It is worthy that the aim of this experiment was to study effect of foliar application of Nitrophoska foliar fertilizer and yeast extract on growth ,yield and yield components of two sunflower cultivars under sandy soil conditions.

MATERIALS AND METHODS

Two field experimets were carried out during the two successive summer seasons of 2014 and 2015 at private farm in Wadi El-Rayyan Region, El-Fayoum Governorate; to study effect of foliar application with Nitrophoska foliar and bio-fertilizer (with yeast) on growth, yield and yield components of two sunflower cultivars under newly reclaimed sandy soil. The experiment included sixteen treatments which were the combination of two sunflower cultivars, i.e. Pioneer- 6480 and Imported G-101, and eight foliar spraying treatments as follows:

- 1- Control(Tap water).
- 2-Foliar spraying with 200 g Nitrophoska/ 100 liter water
- 3-Foliar spraying with 350g Nitrophoska/ 100 liter water
- 4-Foliar spraying with 500g Nitrophoska/100 liter water
- 5-Yeast extract
- 6-Foliar spraying with 200g Nitrophoska /100 liter water +Yeast
- 7-Foliar spraying with 350g Nitrophoska /100 liter water +Yeast
- 8-Foliar spraying with 500g Nitrophoska /100 liter water +Yeast

Soil samples was taken at depth of 30 cm for mechanical and chemical analysis as described by [8]. The mechanical and chemical of the soil at the experimental site were illustrated in Table(1).

Table (1): Mechanical and chemical analysis of soil at experimental sites (Average of 2014 and 2015 seasons)

Sand%	Silt%	Clay%	Texture	pH	Organic matter O.M.%	Available Nppm	Available K ppm	Available Pppm
73.59	22.47	3.45	Sandy	8.00	0.49	84.00	134.00	12.5

Split plot design with four replications was used, where the two sunflower cultivars,i.e. Pioneer -6480 and Imported G-101 were added in the main plots, meanwhile, the eight treatment of foliar application with Nitrophoska foliar and yeast extract were added randomly in the sub-plots.

The seeds were selected for uniformity in size, shape and color and sown in Middle of May in two seasons and sown in plots; the size of each plot was seven (7) ridges, five (5) meter long and 60 cm apart. Sowing was in hills spaced 20cm apart. Three seeds were sown in hills. Phosphorus as super phosphate (15.5 % P₂O₅) was mixed before sowing in the soil. Other agriculture processes were performed according to normal practice recommended by Oil Crop Research Section, Agricultural Research Centre, Ministry of Agriculture, Egypt. Plants were thinning to one plant per hill was done at 20 days after sowing. Moreover, yeast extract was prepared from brewer's yeast (*Saccharo mycescerevisiae*), dissolved in water followed by adding sugar at a ratio of 1:1 and kept 24 hours in a warm place for reproduction according to the methods of [9]. Chemical analysis of activated yeast is shown in Table(2).

Table (2): Chemical analysis of activated yeast (mg/100g dry weight)

Minerals		Amino acids		Vitamins	
Total N	7.23	Arginine	1.99	Thiamin	2.71
P ₂ O ₅	51.68	Histidine	2.63	Riboflavin	4.96
K ₂ O	34.39	Isoleucine	2.31	Nicotinic acid	39.88
Mg O	5.76	Leucine	3.09	Pantothenic acid	19.56
Ca O	3.05	Lysine	2.95	Biotin	0.09
Si O ₂	1.55	Methionine	0.72	Pyridoxine	2.90
SO ₂	0.49	Phraylalanine	2.01	Folic acid	4.36
Na Cl	0.30	Theronine	2.09	Cabalamine	153
Fe	0.92	Tryptophan	0.45	Enzymes	
Ba	157.6	Valine	2.19	Oxidase	0.35
Co	67.8	Glutamic acid	2.00	Peroxidase	0.29
Pd	438.6	Serine	1.59	Catalase	0.063
Mn	81.3	Aspartic acid	1.33	Carbohydrates	23.20
Sn	223.9	Proline	1.53		
Zn	335.6	Tyrosine	1.49		

The complete fertilizer Nitrophoska foliar 20/19/19/TE was sprayed twice during the growth period (30 and 40 days after sowing), meanwhile yeast extract were sprayed twice also at 35 and 45 days after sowing date at a rate 3 g/L. Spraying was applied in early morning . Foliar spray treatments were carried out using manual atomizer and liquid soap as wetting agent was added to sprayin solution at a rate of 0.1 %; while; control plants were sprayed with water only. The volume of foliar solution was maintained just to cover completely the plant foliage till drip.

Growth analysis:

Samples of five guarded plants were taken random from the middle ridges of each plot of the four replication to measure growth characters at 60 and 75 days after sowing, where; plant height "cm", stem diameter "cm", number of leaves/plant ,internode length "cm" and total plant dry weight "g". Leaves area/plant was determined according to [10], whereas, leaf area index (LAI) was determined according to [11]. In addition specific leaf weight (mg/cm²) was estimated according to the described by [12].

At harvest date, a random of five plants were taken from the middle ridges of each plot to determine head diameter "cm", total plant dry weight "g", weight of seeds/head and seed index (1000 seeds/g). Furthermore, seed, straw and biological yield "Kg/feddan" were collected from the whole area of each experimental unit and then converted into yield per Fadden. The harvest index (seed yield/biological yield) and shelling% (seed weight /head weight) were calculated.

Nitrogen concentration of seed was determined by colorimetry in Kjeldahl digests [13] and the seed oil content by Soxhlet method.

All data were subjected to statistical analysis according to procedure outlined by [14]. Treatments means were compared by L.S.D at 5% level test. Combined analysis was made for the two growing seasons as results followed similar trend.

RESULTS AND DISCUSSION

A. Cultivar differences:

A.1. Growth parameters:

Table (3) observed clearly that significant differences were found between sunflower cultivars Pioneer- 6480 and Imported G-101 in growth parameters at 60 and 75 days after sowing. Moreover, the growth parameters estimated under this study, i. e. plant height, stem diameter, internodes length, total plant dry weight, leaves area plant and leaf area index increased with advancing plant age from 60 to 75 days after sowing, meanwhile, number of leaves /plant and specific leaf weight tended to decreased with advancing plant age from 60 to 75 days after sowing date. On the other hand , the sunflower cultivar Pioneer- 6480 produced the greatest mean values from growth parameters , and its increment than Imported G-101 was significant , and the superiority of Pioneer- 6480 than Imported G-101 were true at the different stages of growth.

It is worthy that the difference between the two sunflower cultivars Pioneer - 6480 and Imported G-101 may be due to the genetic structure differences between cultivars, to the cultivar differences in glucose required for synthesis of different chemical constituents at different plant organs, in carbon equivalent and partitioning of photosynthate among the plant organ of sunflower plant [15], also, to the great differences between genotypes for mineral elements concentrations [16]. Furthermore , the inconstant decrement in number of leaves/plant and specific leaf weight after 60 days from sowing may be due to the cultivar differences in migration coefficient of dry matter from vegetative organs (i.e. stem and leaves) to head and the cultivar differences in photosynthate partitioning [15].

Generally , the cultivar differences in growth parameter herein in our study are in great harmony with those obtained by[15,17-22].

A-2: yield and its attributes:

Results reported in Table (4) indicate that the two sunflower cultivars Pioneer - 6480 and Imported G-101 significantly differed in head diameter , total plant dry weight , seeds weight / head , shelling % , seed index , seed yield /fed , straw yield / fed , above ground biomass (biological yield / fed) ;as well as protein and oil percentages per dry seeds at harvest date , whereas , the difference in harvest index failed to reach the significant level at 5 % . Moreover ,Pioneer- 6480 cultivar significantly outweighed Imported G-101 cultivar in each of head diameter , total plant dry weight , seed yield /head , shelling % , seed index , seed yield / fed ,straw yield / fed, biological yield / fed, as well as , protein and oil percentages per dry seeds at harvest date . On the other hand, Imported G-101 show insignificant superiority in harvest index compared with Pioneer - 6480 cultivar. The superiority of Pioneer -6480 over Imported G-101 maybe due to its superiority of Pioneer - 6480 cultivar in growth characters at 70 and 90 days after sowing compared with Imported G-101 cultivar (Table 3) and in yield components in comparison with Imported G-101 cultivar, also (Table 4).

Generally the cultivar difference in yield and its components herein in our scientific study could be due to the difference in genetic structure between the two sunflower cultivars Pioneer -6480 and Imported G-101, also, to the differences between cultivars in glucose required for synthesis of different chemical constituents compound at different plant organs, to differences in carbon equivalent and partitioning of photosynthates between the plant organs of sunflowers plant [15] again, to the great differences between genotypes for mineral element concentrations [16].

Table (3): Effect of varietal differences and Nitrophoska foliar and bio-fertilizer (Yeast) on growth characters of sunflower plant at 60 and 75days after sowing. (Average of 2014 and 2015 seasons)

Characters Treatments	Plant height(cm)		Stem diameter (cm)		Number of leaves/ plant		Internodes length (cm)		Total dry weight/plant (kg)		LA (cm) ²		LAI		SLW (g/cm ²)	
	60	75	60	75	60	75	60	75	60	75	60	75	60	75	60	75
Cultivars																
Pioneer 6480	283.47	331.85	2.314	2.516	29.21	25.60	12.49	12.62	2.60	2.97	1345.4	1378.4	1.130	1.158	3.817	3.560
Imported G 101	273.02	299.74	2.293	2.492	27.45	23.04	12.40	12.51	2.53	2.90	1334.3	1354.1	1.116	1.133	3.718	3.554
L.S.D at 5%	1.39	5.12	0.005	0.014	0.48	0.33	0.05	0.03	0.01	0.01	2.2	8.5	0.002	0.008	0.023	0.004
Nitrophoska foliar and bio-fertilizer(Yeast)																
Control	260.25	300.28	2.230	2.442	23.85	21.98	12.25	12.47	2.43	2.83	1318.5	1355.5	1.098	1.130	3.593	3.440
200g/100L	271.44	308.94	2.285	2.490	27.48	23.35	12.41	12.54	2.49	2.88	1332.1	1361.3	1.115	1.143	3.695	3.480
350g/100L	280.17	316.69	2.302	2.502	28.95	24.04	12.48	12.56	2.56	2.94	1339.4	1365.8	1.123	1.148	3.763	3.510
500g/100L	287.48	322.51	2.325	2.530	30.07	25.72	12.52	12.59	2.63	2.97	1347.0	1372.9	1.128	1.133	3.838	3.595
Yeast	264.05	303.58	2.258	2.468	25.92	22.31	12.29	12.52	2.49	2.89	1330.0	1360.8	1.115	1.138	3.658	3.480
200g/100L+ Yeast	278.20	318.12	2.298	2.507	28.47	24.06	12.45	12.56	2.55	2.95	1340.6	1367.2	1.123	1.150	3.783	3.513
350g/100L+ Yeast	287.56	323.17	2.342	2.533	30.95	25.99	12.56	12.61	2.65	2.99	1351.7	1372.7	1.135	1.160	3.865	3.658
500g/100L+ Yeast	296.99	333.15	2.388	2.558	31.11	27.12	12.61	12.64	2.73	3.02	1359.8	1373.7	1.145	1.162	3.945	3.780
L.S.D at 5%	2.05	1.40	0.016	0.017	0.81	0.84	0.04	0.03	0.01	0.01	2.1	8.0	0.005	0.003	0.019	0.016

Table (4): Effect of varietal differences and Nitrophoska foliar and bio-fertilizer(Yeast)on yield , its components and chemicalconstituent of sunflower plant.(Average of 2014 and 2015 seasons).

Characters Treatments	Head diameter (cm)	Total dry weight/ plant (kg)	Weight of seeds /head (g)	Shelling %	Seed index (g)	Seed yield (kg) /fed.	Straw yield(kg) /fed.	Biological yield (kg) /fed.	Harvest index %	Protein %	Oil %
Cultivars											
Pioneer 6480	33.02	3.782	196.36	51.94	91.95	1103.13	4532.07	5636.20	19.55	17.61	38.32
Imported G 101	30.18	3.562	181.96	51.03	87.73	1047.82	4274.95	5322.77	19.63	17.35	37.38
L.S.D at 5%	1.01	0.012	3.58	0.85	1.62	1.33	8.90	14.91	n.s	0.01	0.27
Nitrophoska foliar and bio-fertilizer(Yeast)											
Control	24.18	3.460	176.06	50.83	80.54	966.44	4151.60	5118.04	18.89	17.23	37.12
200g/100L	27.48	3.566	182.53	51.15	85.32	1028.80	4279.21	5303.00	19.30	17.35	37.84
350g/100L	31.30	3.672	188.86	51.42	89.88	1078.52	4406.12	5484.64	19.70	17.45	38.02
500g/100L	34.48	3.763	196.11	51.18	94.21	1125.21	4515.61	5646.07	19.84	17.56	38.12
Yeast	28.93	3.568	182.74	51.52	84.13	1009.70	4282.04	5291.66	18.99	17.40	37.41
200g/100L+ Yeast	32.50	3.666	188.91	51.73	89.58	1074.84	4398.97	5478.80	19.62	17.51	37.99
350g/100L+ Yeast	35.68	3.793	196.26	51.91	95.43	1130.46	4527.18	5652.39	20.00	17.61	38.13
500g/100L+ Yeast	38.27	3.889	201.80	52.16	99.63	1194.80	4667.38	5862.35	20.39	17.72	38.16
L.S.D. at 5%	1.03	0.012	1.47	0.38	1.28	28.80	25.64	37.66	0.45	0.01	0.18

It is worthy to mention that the cultivar differences in yield and its attributes in this study are in full agreement with previous results collected by [15, 17- 22].

B-Effect of foliar spraying with Nitrophoska foliar 20/19/19/TE and yeast

B.1. Growth parameters:

Table (3) indicate that the effect of different treatments from Nitrophoska foliar 20/19/19/TE and yeast extract on plant height, stem diameter, number of leaves/plant, internodes length, total plant dry weight, leaves area /plant, leaf area index and specific leaf weight of sunflower plant was significant at 60 and 75days after sowing. In addition, growth parameters of sunflower plant increased with advancing plant age from 60 to 75 days after sowing date; except; number of leaves/plant and specific leaf weight where those two growth parameters tended to decreased with advancing plant age from 60 to 75 after sowing. Furthermore, spraying sunflower plants with 200g /100LNitrophoska foliar 20/19/19/TE caused significant increment in growth parameters of sunflower plant compared with control treatment (untreated plants). Increasing Nitrophoska foliar from 200g/ 100 L to 350 g / 100 L caused another increase in growth parameters compared with 200 g / 100 L conc., whereas, another additional increment were observed when Nitrophoska foliar concentration was increased from 350 g / 100 L to 500 g / 100 L .With respect of yeast extract treatment , table (3) indicate that foliar spraying with yeast extract on sunflower plant caused an significant increment in growth attributes compared with control treatment (untreated plants).

Regarding Nitrophoska foliar + yeast extract mixture date reported in Table (3) observed clearly that 200g/ 100 L + yeast caused significant increase in growth parameters compared with control treatment and yeast extract , whereas , increasing foliar solution concentration from 200g/ 100 L + yeast to 350 g / 100 L + yeast caused another significant increase in growth parameters. It is worthy that date reported indicate that the most favorable treatment of harvesting a great mean values from growth parameters of sunflower plants was foliar spraying with 500g Nitrophoska foliar 20 / 19 / 19/ TE + yeast extract compared with control , 200 , 350 , and 500g/ 100 L Nitrophoska , yeast and each of 200 g / 100 L+ yeast and 350 g / 100 L Nitrophoska + yeast , respectively .

The increment in growth parameters according to foliar spraying with Nitrophoska Foliar 20/19/19/TE compared with untreated plants (control treatment) may be due to that this compound contain N 20%,P 19%, K 19%,Mg 0.5%, Mn 1000 ppm, Cu 400 ppm, B 130 ppm, S 0.3%, Fe 1000 ppm, Zn 380 ppm and Mo 30 ppm and these element made positive effects on growth parameters, where, the chemical fertilizers are industrially manipulated , substances composed of known quantities of nitrogen , phosphorus and potassium, and their exploitation causes air and ground water pollution by eutrophication of water bodies[23] and in addition , the foliar spraying with nutrients keep the nutrients fertilizer from lost where 60 % to 90 % of the total applied fertilizer is lost and the remaining 10 % to 40 % is taken up by plant by soil fertilizers application method [24].On the other hand , the positive effect of yeast extract on growth parameters may be due to the that yeast is one of the richest source of high protein quality i.e. amino acids arginine , histidine , isoleucine , leucine , lysine , methionine , phrnylalanine , theronine , tryptophan , valine ,glutamic acid , serine , aspartic acid , proline , and tyrosine , contain the essential minerals and trace elements , such as , N , P₂ O₂ , K₂O , MgO , CaO , Si O₂ ,SO₂ , NaCl , Fe , Ba , Co , Pd , Mn , Sn , and Zn , as well as , that yeast is one of the richest source from vitamins such as , i.e. thiamin , Riboflavin , Nicotanic acid , pantothenic acid , Biotin , Pyridoxine , Folic acid , cabalamin, and also from enzymes , i.e. oxidase , peroxidase and catalase, and from carbohydrate (Table 2). Thus, the simulative increase with Nitrophoska + yeast extract may be due to the effect of these two materials on growth.

It is worthy that our results are in good harmony with previous results reported by [7,13,21,24, 25-32].

B.2.Yield and its components

Data illustrated in Table(4)observed that the effect of different treatments from Nitrophoska Foliar 20 / 19 / 19/ TE and yeast extract on head diameter, total plant dry weight, seed yield/head, shelling %,seed index, seed, straw and biological yields/fed., harvest index, as well as, protein and oil percentages per dry

seeds at harvest date. In addition, spraying sunflower plants with 200g Nitrophoska Foliar 20 / 19 / 19/ TE caused significant increment in the previous yield and its components compared with control treatment (untreated plants). With increasing the concentration of Nitrophoska Foliar from 200 to 350g /100 L spraying solution additional increase in yield and its attributes were reported, meanwhile, another increment were shown in yield and its components under 500g/100 L compared with 350g Nitrophoska /100 L solution.

Regarding ,the effect of foliar application with 3 g yeast /Lon sunflower plants, a significant increase were found in head diameter, total plant dry weight, weight of seeds/head, shelling %,seed index, seed, straw and biological yields, and protein and oil % per dry seeds at harvest date (table 4).

With respect of the mixture of Nitrophoska Foliar 20 / 19 / 19/TE and yeast extract mixture, results illustrated in Table (4) show clearly that 200g Nitrophoska /100 L+ yeast caused significant increment in yield and its compared with control, 200,350 and 500g Nitrophoska /100 L and or yeast extract only, meanwhile , increasing foliar solution concentration from 200 to 350g Nitrophoska/100 L + yeast enhanced yield and its components compared with control, 200,350 and 500g Nitrophoska /100L, yeast, 200g Nitrophoska /100 L+ yeast ,respectively. Generally, data collected show that the most favorable treatments to harvesting great yield and its components are foliar spraying with 500g Nitrophoska Foliar 20 / 19 / 19/TE + yeast extract compared with other seven treatments under study, i.e. control,200,350 and 500g/ Nitrophoska Foliar /100 L, yeast,200g Nitrophoska/100 L + yeast and 350g Nitrophoska /100 L + yeast, respectively.

The increases in yield and its components caused by foliar application with Nitrophoska Foliar 20 / 19 / 19/TE compared with untreated plants (control plants) may be due to the contain of this compounds from macro and micro fertilizer elements that caused positive effect on growth parameters and the foliar application minimized the lost of fertilizer elements that caused by soil fertilizer from 60 - 90 % to 10 - 40 % [24]. Moreover, the positive effect of yeast extract on yield and its attributes can be due to that yeast extract is one of the richest source from amino acids, essential minerals and trace elements, vitamins, enzymes ;as well as; carbohydrates (Table 2). In addition, the simulative effects of treatments with Nitrophoska Foliar 20 / 19 / 19/ TE and yeast extract may be due to the effect of two treatments on growth characters (Table 3) and thus, reflect on yield and its attributes (Table 4).

Generally, our results there are in good agreement with [7,13,21,24,27-32].

C. Effect of the interaction

Table(5) show that effect of the interaction between sunflower cultivars and foliar spraying with Nitrophoska Foliar 20 / 19 / 19/ TE and yeast extract was significant on some growth characters, i.e. plant height, total plant dry weight and SLW at 60 and 75 days age, also, the interaction was significant on internodes length and leaf area at 60 days, as well as, on LAI at75 day, after sowing date. Data observed that the most favorable treatment for harvesting the greatest mean values from growth parameters are Pioneer 6480 +500g Nitrophoska Foliar 20 / 19 / 19/ TE/100 L + yeast extract.

Regarding the effect of interaction between sunflower cultivars and foliar spraying with Nitrophoska Foliar 20 / 19 / 19/ TE + yeast extract on yield and its components, data illustrated in Table(6) indicate that the interaction was significant on head diameter, total plant dry weight, weight of seeds/ head, shelling %, seed index, straw yield/fed., above ground biomass/fed.(biological yield),as well as, protein and oil % per seeds. It is worthy that the most effective treatment on yield and its components are Pioneer-6480 + foliar spraying with 500g Nitrophoska Foliar 20 / 19 / 19/ TE + yeast extract.

Table (5): Effect of interaction between cultivars and Nitrophoska Foliar and bio-fertilizer(Yeast)on growth characters of sunflower plant at 60 and 75 days after sowing. (Average of 2014 and 2015 seasons)

Characters Treatments		Plant height(cm)		Stem diameter (cm)		Number of leaves/ plant		Internodes length (cm)		Total dry weight/ plant (kg)		LA (cm) ²		LAI		SLW (g /cm ²)	
		60	75	60	75	60	75	60	75	60	75	60	75	60	75	60	75
Cultivars x Nitrophoska Foliar and bio-fertilizer(Yeast)																	
Pioneer 6480	Control	269.21	310.51	2.247	2.453	24.54	23.52	12.28	12.50	2.46	2.89	1324.1	1367.8	1.107	1.140	3.663	3.450
	200g/100L	276.45	323.23	2.290	2.500	29.04	24.75	12.49	12.59	2.51	2.94	1337.3	1373.5	1.123	1.157	3.723	3.487
	350g/100L	284.18	333.93	2.310	2.510	29.59	25.16	12.52	12.62	2.59	2.99	1345.6	1378.2	1.133	1.167	3.803	3.510
	500g/100L	291.81	341.86	2.340	2.530	30.69	26.91	12.55	12.65	2.66	3.00	1352.9	1385.5	1.137	1.140	3.873	3.580
	Yeast	271.95	313.26	2.280	2.487	27.16	23.78	12.27	12.58	2.51	2.90	1335.5	1373.1	1.123	1.147	3.733	3.483
	200g/100L+ Yeast	285.21	336.67	2.307	2.520	29.04	24.87	12.51	12.62	2.58	2.98	1343.9	1380.9	1.127	1.160	3.847	3.510
	350g/100L+ Yeast	290.15	342.72	2.343	2.550	31.48	26.86	12.63	12.65	2.68	3.00	1356.9	1379.0	1.140	1.170	3.913	3.677
	500g/100L+ Yeast	299.17	352.77	2.393	2.577	32.18	28.95	12.71	12.72	2.78	3.04	1367.2	1389.2	1.150	1.183	3.980	3.787
Imported G 101	Control	251.29	290.04	2.213	2.430	23.15	20.43	12.21	12.44	2.39	2.78	1312.8	1343.1	1.090	1.120	3.523	3.430
	200g/100L	266.42	294.65	2.280	2.480	25.91	21.95	12.33	12.49	2.46	2.82	1326.9	1349.1	1.107	1.130	3.667	3.473
	350g/100L	276.15	299.46	2.293	2.493	28.32	22.91	12.44	12.51	2.52	2.89	1333.2	1353.4	1.113	1.130	3.723	3.510
	500g/100L	283.15	303.16	2.310	2.530	29.44	24.53	12.49	12.53	2.59	2.93	1341.2	1360.2	1.120	1.127	3.803	3.610
	Yeast	256.15	293.90	2.237	2.450	24.69	20.84	12.32	12.46	2.47	2.89	1324.5	1348.6	1.107	1.130	3.583	3.477
	200g/100L+ Yeast	271.19	299.57	2.290	2.493	27.90	23.24	12.38	12.50	2.52	2.92	1337.3	1353.5	1.120	1.140	3.720	3.517
	350g/100L+ Yeast	284.98	303.62	2.340	2.517	30.18	25.11	12.48	12.57	2.61	2.98	1346.5	1366.5	1.130	1.150	3.817	3.640
	500g/100L+ Yeast	294.80	313.52	2.383	2.540	30.03	25.30	12.51	12.56	2.67	3.01	1352.4	1358.2	1.140	1.140	3.910	3.773
L.S.D. at 5%		2.90	1.99	n.s	n.s	n.s	n.s	0.06	n.s	0.02	0.01	2.9	n.s	n.s	0.005	0.028	0.023

Table 6: Effect of interaction between cultivars and and Nitrophoska Foliar and biofertilizer(Yeast)on yield , its componentsand chemicalconstituent of sunflower plant. (Average of 2014 and 2015 seasons).

Characters Treatments		Head diameter (cm)	Total dry weight/plant (kg)	Weight of seeds /head (g)	Shelling %	Seed index (g)	Seed yield (kg) /fed.	Straw yield(kg) /fed.	Biological yield (kg) /fed.	Harvest index %	Protein %	Oil %
Cultivars x Nitrophoska Foliar and biofertilizer(Yeast)												
Pioneer 6480	Control	25.56	3.563	188.24	52.82	82.16	985.96	4276.08	5262.04	18.74	17.33	37.09
	200g/100L	29.66	3.681	192.33	52.24	88.46	1061.56	4418.28	5479.84	19.37	17.48	38.44
	350g/100L	33.35	3.782	196.38	51.92	92.10	1105.20	4538.52	5643.72	19.58	17.54	38.58
	500g/100L	37.20	3.842	200.19	52.32	96.70	1169.00	4611.18	5771.60	20.06	17.66	38.78
	Yeast	29.22	3.673	192.21	52.12	86.89	1042.68	4408.49	5451.00	19.13	17.57	37.58
	200g/100L+ Yeast	33.49	3.790	197.54	51.04	91.96	1103.32	4548.00	5661.32	19.48	17.66	38.62
	350g/100L+ Yeast	36.62	3.922	199.65	51.10	97.42	1160.44	4657.76	5826.76	20.10	17.73	38.69
	500g/100L+ Yeast	39.05	3.998	204.30	51.96	99.87	1196.84	4798.28	5995.12	19.97	17.86	38.75
Imported G 101	Control	22.79	3.356	163.88	48.83	78.91	946.92	4027.12	4974.04	19.04	17.12	37.14
	200g/100L	25.29	3.450	172.72	50.06	82.17	986.04	4140.14	5126.16	19.23	17.23	37.24
	350g/100L	29.25	3.561	181.34	50.92	87.65	1051.84	4273.72	5325.56	19.82	17.35	37.46
	500g/100L	31.75	3.683	192.03	50.03	91.71	1081.43	4420.04	5520.54	19.61	17.46	37.46
	Yeast	28.64	3.463	173.27	50.92	81.37	976.72	4155.60	5132.32	18.86	17.22	37.24
	200g/100L+ Yeast	31.50	3.541	180.28	52.41	87.20	1046.36	4249.94	5296.28	19.75	17.35	37.37
	350g/100L+ Yeast	34.73	3.664	192.86	52.72	93.44	1100.48	4396.60	5478.03	19.90	17.48	37.57
	500g/100L+ Yeast	37.48	3.780	199.30	52.36	99.40	1192.76	4536.48	5729.57	20.82	17.57	37.57
L.S.D. at 5%		1.45	0.018	2.08	0.54	1.81	n.s	36.26	53.26	n.s	0.02	0.26

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