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RESPONSE OF SOME SUGAR BEET VARIETIES TO NANO-METRIC FERTILIZERS

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ABSTRACT

Two field experiments were caried out at El- hamoul, Kafr El-Sheikh Governorate in 2015/2016 and 2016/2017seasons to study the effect of five nano-metric fertilizer treatments (Spraying plants with tap water (control), Spraying plants with mixed nano-microelements(Fe + Mn + Zn), Spraying plants with nano-nitrogen, Spraying plants with nano-phosphorus and Spraying plants with nano-potassium) on growth and yield in four sugar beet varieties(Farida, Karam, P .T.S and Hossam) The plants were sprayed at 40 and 70 days from sowing with the rate of 400cm^3/feddan for all fertilizers used.

The obtained results indicated that sugar beet variety Hossam gave the highest values of root weight, sodium %, top yield per feddan(ton), root yield per feddan and sugar yield per feddan, while sugar beet variety Farida gave the highest values of total soluble solids % , sucrose %, purity % as well as potassium percentage as compared with other sugar beet varieties tested in 2015/2016 and 2016/6017 seasons, respectively .

Sugar beet plants fertilized with nano-phosphorus fertilizer gave the highest values of root weight, potassium %, top yield per feddan, root yield per feddan as well as sugar yield per feddan as compared with all other fertilization treatments in both seasons .

Fertilized sugar beet variety Hossam with nano-phosphorus gave the highest values of root weight, top yield per feddan, root yield per feddan as well as sugar yield per feddan in both seasons.

Key words: mixed nano- microelements, nano-metric fertilizer, nano-nitrogen, nano-phosphorus, nano-potassium ,sugar beet and sugar beet varieties.

INTRODUCTION

Sugar beet (*Beta vulgaris*, L.) ranks the second important sugar crop in the world. Recently, sugar beet has an important position in Egyptian crop rotation as a winter crop not only in the fertile soils, but also in poor, saline, alkaline and calcareous soils. The great importance of sugar beet crop is not only from its ability to grown in the newly reclaimed areas as

economic crop, but also for production higher of sugar under these conditions as compared with sugar cane. Also it's productivity make it a good cash crop at this situation. Attempts are made to increasing sugar beet productivity and quality. This increase is likely to be obtained by growing sugar beet crop in newly reclaimed soils and increased productivity of unit area. Increasing of sugar beet production can be achieved through applying the optimizing agricultural practices i.e. cultivating high yielding varieties and fertilization.

Recently nanotechnology represent a new frontier for the research community. Nanotechnology is working with the smallest possible particles which raise hopes for improving agricultural productivity through encountering problems unsolved conventionally. In the management aspects, efforts are made to increase the efficiency of applied fertilizer with the help of nano clays and zeolites and restoration of soil fertility by releasing fixed nutrients. **El-Hawary and Mokadem (1999), Shalaby *et. al* (2011) and El-Hawary *et. al* (2013)** found that sugar beet varieties significantly differed in root yield / feddan , sugar yield / feddan, TSS% and sucrose % in both season, on other hand significantly differed in K%, Na% and total soluble solids percentage in both seasons.

Concerning nanofertilizer**, Mamyandi *et al* (2012),** found that the maximum root diameter (14.3cm) and leaf width (8.5cm) was obtained from Nano-iron spraying at 60% of ground cover. The lowest soluble solids (°Brix) of sugar beet root (19.7%) were observed in plants sprayed with Nano-iron at 60% ground coverage by canopy. **Jakiene *et al* (2015)**at the beginning of intensive sugar beet development , bio-organic nano fertilizer at single 1 L ha-1dose increased the number of leaves by 19.6%, leaf area by 13.4%, root diameter by 11.1%, canopy dry biomass by29.1%, root biomass by 42.6%, net photosynthetic productivity by 15.8%, root yield by

12.6%, sucrose content by1.03 percentage points and yield of white sugar by 19.2% in comparison with the untreated beets. **Liu and Lal (2015)** reported that the application of nanoparticles to plants can be beneficial for growth and development due to its ability for greater absorbance and high reactivity . **Barlog *et al* (2016)** reported that utilization of micronutrient like manganese, zinc and iron with balance can enhance and increased productivity of yield sugar beet. **Mekdad and Rady (2016)** showed that adding micronutrient mixtures (Fe + Zn+ Mn) improved yield and its attributes of sugar beet crop . **Dewdar *et al* (2018)** found that the best results were found when sugar beet plants were treated with nano-microelements 200 mg/ L + urea 1% and ranked as the first favorable treatments for root length and diameter , dry matter per plant as root, top and sugar yields in both seasons.

Therefore , this investigation was carried out to study the effect of five nano-metric fertilizer treatments (Spraying plants with tap water (control), Spraying plants with mixed nano-microelements(Fe +Mn +Zn), Spraying plants with nano-nitrogen, Spraying plants with nano-phosphorus and Spraying plants with nano-potassium) on growth and yield in four sugar beet varieties(Farida, Karam, P .T.S and Hossam) at El- hamoul, Kafr El- Sheikh Governorate .

MATERIALS AND METHODS

Two field experiments were caried out at El- hamoul, Kafr El-sheikh Governorate in 2015/2016 and 2016/2017seasons to study the effect of some nanofertilizers on growth and yield of some sugar beet varieties.

The experiment treatments were as follows:

A-Sugar beet varieties

Four sugar beet varieties were studied as follows:

1 – Farida 2- Karam 3- P .T.S 4- Hossam

Seeds of studied varieties were obtained from Delta Sugar Company at El- hamoul, Kafr El- sheikh Governorate , Egypt .

B- Nano-metric fertilizers treatment

1-Spraying plants with tap water (control)

2- Spraying plants with mixed nano-microelements(Fe + Mn + Zn) at 40 and 70 days from sowing date (powder 10%).

3- Spraying plants with nano-nitrogen at 40 and 70 days from sowing date (liquid 20%) .
4- Spraying plants with nano-phosphorus at 40 and 70 days from sowing date (liquid 20%).
5- Spraying plants with nano-potassium at 40 and 70 days from sowing date (liquid 20%) .

The plants were sprayed at the rate of 400cm^3/feddan for all fertilizer treatments.

The experiments were laid out in split plot design with three replications. The main plots were devoted to sugar beet varieties and sub plots were allocated to nanofertilizers treatment. The area of each sub plot was 21 m^2 (10 rows x 0.60 m width x 3.5 m long).

The Mechanical and chemical analysis of the soil at the experimental site according to standard methods of **Page (1982)** and **Arnold (1986)** in the 2015 / 2016 and 2016 / 2017 seasons are shown in Table 1.

Table 1: Chemical and Mechanical analysis of the experimental sites in 2015 / 2016 and 2016 / 2017seasons.

Characters	seasons	
	2015/2016	2016/2017
A-Chemical characters:		
PH	6.65	6.74
E.C.	1.09	1.17
Total N%	0.48	0.53
Available P (ppm)	14.23	15.08
Available Zn (ppm)	5.03	5.22
Available K (ppm)	1.39	1.61
B-Mechanical characters:		
Sand %	13.70 %	13.35 %
Silt %	22.75%	22.25%
Clay %	63.55%	64.40%
Soil texture	Clay	Clay

On 12 and 15 October, seeds were hand sown in hill 20 cm apart in 2015 / 2016 and 2016 / 2017 seasons, respectively. Super phosphate fertilizer was added at the rate of 100 kg / feddan (15.5 % P_2O_5) at soil preparation. Nitrogen fertilizer was added at the rate of 90 kg / feddan (urea 46%) after thinning at 30 and 60 days from sowing date. All other agronomic practices were followed as usually done for the sugar beet crop.

Characters studied:

At harvest time (after 185 days from sowing date) 10 plants were token at random from each plot to determine root weight (g) per plant.

The plants of the six middle rows were harvested to determine the following characters:

1.Total soluble solids percentage

2.Root sucrose percentage, it was measured by saccharimeter apparatus according to **Le Docte A (1927).**

3.Purity percentage

4.Root potassium and sodium percentages.

K and Na were measured by flamephotometer according to **Brown and Lilland (1964).**

5.Top yield / feddan (ton).

6.Root yield / feddan (ton).

7.Sugar yield / feddan (ton).

The data were statistically analyzed according to **Gomeze and Gomeze (1984).**

RESULTS AND DISCUSSION

Data recorded in Table 2-10 show clearly that sugar beet varieties were significantly differed in root weight (g) , total soluble solids % , sucrose % , purity % , potassium % , sodium % , top yield per feddan , root yield per feddan and sugar yield per feddan in both 2015/2016 and 2016/6017 seasons .

The obtained results showed that in 2015/2016 season, sugar beet variety Hossam gave the highest values of root weight 986.00 g , , sodium % 1.92 % , , top yield per feddan 8.53 ton , root yield per feddan 34.54 ton and sugar yield per feddan 6.90 ton. Results in 2016/2017 season fallowed similar trend. The results showed that sugar beet variety Farida gave the highest values of total soluble solids %22.16 %, sucrose % 20.62 % , purity % 92.91 % as well as potassium percentage 4.18 % as compared with other sugar beet varieties tested in 2015/2016 season. On the other hand Farida variety gave the lowest values of root weight 889.00 g , , sodium % 1.73 % , , top yield per feddan 6.87 ton , root yield per feddan 31.12 ton and sugar yield per feddan 6.42 ton in 2016/2017 season.

The superiorty of sugar beet variety Hossam in root and sugar yield per feddan might be attributed to its highest root weight per plant which led to raising root yield per feddan and consequently gave the higher sugar yield than other varieties studied . These results are in the same line with those obtain by **El-Hennawy and El-Hawary (1995), El-Sayed (1997), El-Hawary and Mokadem (1999), Shalaby *et. al* (2011) and El-Hawary *et. al* (2013).**

Also results presented in Tables 2-10 indicate that fertilization treatments significantly affected all studied characters in both seasons. Sugar beet plants fertilized with nano-phosphorus fertilizer gave the highest values of root weight 1019.00 and 1028.00 g, potassium percentage 4.12 and 4.15 % , top yield per feddan 8.45 and 8.74 ton , root yield per feddan 35.67 and 35.98 ton as well as sugar yield per feddan 7.83 and 7.68 ton as compared with all other fertilization treatments in 2015/2016 and 2016 /2017 seasons, respectively. The increase in root yield by phosphorus fertilizer may be attributed to the increase cell number and elongation which led to raising root valium as well as gave heaviest root ,therefore increasing root yield per feddan and consequently raising sugar yield . In this connection , sugar beet plants treated with nano-potassium fertilizer gave the highest values of total soluble solids 22.60 and 22.77% , sucrose percentage 21.59 and 21.94 % as well as purity percentage 95.54 and 96.37 % compared to other fertilization treatments in 2015/2016 and 2016/2017 seasons ,respectively .

The increase in total soluble solids percentage and sucrose percentage caused by potassium fertilizer could be attributed to the stimulating effect of potassium on increasing rate of photosynthesis and transport of photosynthate from leaves to the storage root which led to raising sucrose percentage.

These results are in harmony with those of **Mamyandi *et al* (2012),Moghadam *et al* (2012), Jakienė *et al* (2015), Liu and Lal (2015), Barlog *et al* (2016), Mekdad and Rady (2016) and Dewdar *et al* (2018).**

Data recorded in Tables 2-10 showed too clearly that all traits studied were significantly affected by the interaction effect among sugar beet varieties and fertilization treatments in both seasons. However, the obtained results showed that fertilized sugar beet variety Hossam with nano-phosphorus gave the highest values of root weight 1065.00 g ,top yield per feddan 9.15 ton , root yield per feddan 37.30

ton as well as sugar yield per feddan 7.83 ton as compared with all other this interaction treatments in 2015/2016 season. Data recorded in 2016/2017 followed similar trend. Results showed that this variety, i.e. Hossam gave the highest sodium percentage 2.01 and 2.21 % when grown under control treatment in 2015/2016 season. In 2016/2017 season this variety gave the highest values of root weight 1084.00 g ,top yield per feddan 9.49 ton , root yield per feddan 37.95 ton as well as sugar yield per feddan 8.18 ton as compared with all other this interaction treatments.

In this connection , fertilized sugar beet variety Farida by nano-potassium gave the highest total soluble solids percentage 23.37 and 23.53 % and sucrose percentage 22.35 and 22.83 % as compared with all other treatments in 2015/2016 and 2016/2017 seasons , respectively .

From this investigation it could be concluded that fertilized sugar beet variety Hossam by nanotechnology phosphorus gave the highest root and sugar yield per feddan at El- hamoul, Kafr El- sheikh Governorate condition.

Table (2): Effect of some nanofertilizers on root weight per plant (g)of some sugar beet varieties in 2015/2016 and 2016/2017 seasons.

Nanofertilizers treatments (N)	2015/2016season					2016/2017 season				
	sugar beet varieties (V)				mean	sugar beet varieties (V)				mean
	Farida	Karam	P.T.S	Hossam		Farida	Karam	P.T.S	Hossam	
control	808.00	841.00	891.00	914.00	863.00	828.00	853.00	911.00	938.00	882.00
Fe + Mn + Zn	852.00	900.00	911.00	945.00	902.00	885.00	905.00	948.00	964.00	926.00
N	934.00	980.00	994.00	1028.00	984.00	941.00	1000.00	1017.00	1005.00	1002.00
P	967.00	1017.00	1027.00	1065.00	1019.00	970.00	1021.00	1037.00	1084.00	1028.00
K	883.00	925.00	941.00	980.00	932.00	884.00	930.00	952.00	1002.00	942.00
mean	889.00	932.00	953.00	986.00	941.00	902.00	942.00	973.00	1008.00	956.00
L.S.D at 5% for: V			17.00						19.00	
N			23.00						25.00	
V.N			39.20						42.71	

Table (3):Effect of some nanofertilizers on total soluble solids percentage of some sugar beet varieties in 2015/2016 and 2016/2017 seasons.

Nanofertilizers treatments (N)	2015/2016season					2016/2017 season				
	sugar beet varieties (V)				mean	sugar beet varieties (V)				mean
	Farida	Karam	P.T.S	Hossam		Farida	Karam	P.T.S	Hossam	
control	21.13	20.11	20.83	21.00	20.76	21.19	20.45	20.92	21.36	20.98
Fe + Mn + Zn	21.93	20.43	20.87	21.35	21.14	22.03	20.63	20.98	21.87	21.37
N	21.36	20.25	20.85	21.12	20.89	21.69	20.59	20.88	21.31	21.11
P	23.05	21.33	21.73	22.41	22.13	23.15	21.49	21.97	22.59	22.30
K	23.37	21.79	22.13	23.11	22.60	23.53	22.03	22.31	23.22	22.77
mean	22.16	20.78	21.28	21.79	21.50	22.31	21.03	21.41	22.07	21.70
L.S.D at 5% for: V				0.41					0.51	
N				0.59					0.67	
V.N				1.19					1.21	

Table (4):Effect of some nanofertilizers on sucrose percentage of some sugar beet varieties in 2015/2016 and 2016/2017 seasons.

Nanofertilizers treatments (N)	2015/2016season					2016/2017 season				
	sugar beet varieties (V)				mean	sugar beet varieties (V)				mean
	Farida	Karam	P.T.S	Hossam		Farida	Karam	P.T.S	Hossam	
control	19.03	18.13	18.60	18.95	18.67	19.08	18.17	18.71	18.97	18.73
Fe + Mn + Zn	20.20	18.86	18.93	19.17	19.29	20.31	18.89	19.03	19.23	19.36
N	19.35	18.43	18.71	18.96	18.86	19.67	18.47	18.81	19.03	18.99
P	22.17	20.16	20.93	21.00	21.06	22.47	20.19	21.30	21.56	21.38
K	22.35	21.05	21.23	21.73	21.59	22.83	21.21	21.77	21.98	21.94
mean	20.62	19.32	19.68	19.96	19.89	20.87	19.38	19.92	20.15	20.08
L.S.D at 5% for: V				0.24					0.27	
N				0.46					0.49	
V.N				1.06					1.10	

Table (5):Effect of some nanofertilizers on Purity percentage of some sugar beet varieties in 2015/2016 and 2016/2017 seasons.

Nanofertilizers treatments (N)	2015/2016season					2016/2017 season				
	sugar beet varieties (V)				mean	sugar beet varieties (V)				mean
	Farida	Karam	P.T.S	Hossam		Farida	Karam	P.T.S	Hossam	
control	90.06	90.15	89.29	90.23	89.93	90.04	88.85	89.43	88.81	89.28
Fe + Mn + Zn	92.11	92.31	90.70	89.78	91.22	92.19	91.56	90.70	87.92	90.59
N	90.58	91.01	89.73	89.77	90.27	90.68	89.70	90.08	89.30	89.94
P	96.28	94.51	96.31	93.70	95.20	97.06	93.95	96.95	95.44	95.85
K	95.63	96.60	95.93	94.02	95.54	97.02	96.27	97.57	94.65	96.37
mean	92.93	92.91	92.39	91.50	92.43	93.39	92.06	92.94	91.22	92.40
L.S.D at 5% for: V				0.33					0.30	
N				0.50					0.48	
V.N				1.00					1.08	

Table (6):Effect of some nanofertilizers on potassium percentage of some sugar beet varieties in 2015/2016 and 2016/2017 seasons.

Nanofertilizers treatments (N)	2015/2016season					2016/2017 season				
	sugar beet varieties (V)				mean	sugar beet varieties (V)				mean
	Farida	Karam	P.T.S	Hossam		Farida	Karam	P.T.S	Hossam	
control	4.13	3.76	3.68	3.20	3.69	4.16	3.83	3.72	3.32	3.75
Fe + Mn + Zn	4.03	3.65	3.47	3.11	3.81	4.11	3.78	3.51	3.18	3.64
N	4.28	4.11	3.96	3.55	3.97	4.31	4.12	4.05	3.79	4.06
P	4.32	4.23	4.15	3.79	4.12	4.35	4.21	4.16	3.91	4.15
K	4.16	3.79	3.78	3.21	3.73	4.17	3.92	3.96	3.35	3.85
mean	4.18	3.90	3.80	3.37	3.86	4.22	3.97	3.88	3.51	3.89
L.S.D at 5% for: V				0.21					0.23	
N				0.30					0.34	
V.N				0.71					0.78	

Table (7):Effect of some nanofertilizers on sodium percentage of some sugar beet varieties in 2015/2016 and 2016/2017 seasons.

Nanofertilizers treatments (N)	2015/2016season					2016/2017 season				
	sugar beet varieties (V)				mean	sugar beet varieties (V)				mean
	Farida	Karam	P.T.S	Hossam		Farida	Karam	P.T.S	Hossam	
control	1.81	1.86	1.93	2.01	1.90	1.89	1.97	2.03	2.21	2.02
Fe + Mn + Zn	1.79	1.81	1.91	1.96	1.86	1.83	1.88	1.96	2.03	1.92
N	1.76	1.78	1.82	1.93	1.82	1.79	1.83	1.87	1.98	1.86
P	1.62	1.65	1.77	1.82	1.71	1.67	1.71	1.79	1.86	1.75
K	1.69	1.73	1.79	1.89	1.77	1.71	1.79	1.81	1.90	1.80
mean	1.73	1.76	1.84	1.92	1.81	1.77	1.83	1.89	1.99	1.87
L.S.D at 5% for: V				0.11					0.12	
N				0.21					0.24	
V.N				0.60					0.63	

Table (8):Effect of some nanofertilizers on top yield / fed (ton) of some sugar beet varieties in 2015/2016 and 2016/2017 seasons.

Nanofertilizers treatments (N)	2015/2016season					2016/2017 season				
	sugar beet varieties (V)				mean	sugar beet varieties (V)				mean
	Farida	Karam	P.T.S	Hossam		Farida	Karam	P.T.S	Hossam	
control	6.30	6.75	7.18	8.00	7.05	6.45	6.83	7.32	8.13	7.18
Fe + Mn + Zn	6.65	7.40	7.65	8.30	7.50	6.82	7.63	8.13	8.45	7.75
N	7.00	7.85	8.12	8.79	7.94	7.21	8.17	8.31	8.96	8.16
P	7.65	8.45	8.56	9.15	8.45	7.95	8.83	8.91	9.49	8.74
K	6.75	7.55	7.93	8.45	7.67	6.93	7.88	8.22	8.77	7.95
mean	6.87	7.60	7.88	8.53	7.72	7.07	7.82	8.17	8.76	7.95
L.S.D at 5% for: V				0.14					0.12	
N				0.33					0.29	
V.N				0.93					0.89	

Table (9):Effect of some nanofertilizers on root yield / fed (ton)of some sugar beet varieties in 2015/2016 and 2016/2017 seasons.

Nanofertilizers treatments (N)	2015/2016season					2016/2017 season				
	sugar beet varieties (V)				mean	sugar beet varieties (V)				mean
	Farida	Karam	P.T.S	Hossam		Farida	Karam	P.T.S	Hossam	
control	28.30	29.45	31.20	32.00	30.23	29.00	29.87	31.90	32.85	30.90
Fe + Mn + Zn	29.85	31.50	31.90	33.10	31.58	31.00	31.70	33.20	33.75	32.41
N	32.70	34.30	34.80	36.00	34.45	32.95	35.00	35.60	36.75	35.07
P	33.85	35.60	35.95	37.30	35.67	33.95	35.75	36.30	37.95	35.98
K	30.92	32.40	32.95	34.30	32.64	30.95	32.55	33.35	35.10	32.98
mean	31.12	32.65	33.36	34.54	32.95	31.57	32.97	34.07	35.28	33.46
L.S.D at 5% for: V				0.62					0.55	
N				0.80					0.72	
V.N				1.40					1.32	

Table (10):Effect of some nanofertilizers on sugar yield / fed (ton) of some sugar beet varieties in 2015/2016 and 2016/2017 seasons.

Nanofertilizers treatments (N)	2015/2016season					2016/2017 season				
	sugar beet varieties (V)				mean	sugar beet varieties (V)				mean
	Farida	Karam	P.T.S	Hossam		Farida	Karam	P.T.S	Hossam	
control	5.38	5.33	5.80	6.06	5.64	5.53	5.42	5.96	6.23	5.78
Fe + Mn + Zn	6.02	5.94	6.03	6.34	6.08	6.29	5.98	6.31	6.49	6.26
N	6.32	6.32	6.51	6.82	6.49	6.48	6.46	6.69	6.99	6.65
P	7.50	7.17	7.52	7.83	7.50	7.62	7.21	7.73	8.18	7.68
K	6.91	6.82	6.99	7.45	7.04	7.06	6.90	7.26	7.71	7.23
mean	6.42	6.31	6.57	6.90	6.55	6.59	6.39	6.79	7.12	6.72
L.S.D at 5% for: V				0.02					0.04	
N				0.21					0.22	
V.N				0.75					0.82	

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استجابة بعض أصناف بنجر السكر للأسمدة النانو مترية

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أجريت تجربتان حقليتان بمنطقة الحامول محافظة كفر الشيخ في موسمي 2016/2015 و 2017/2016م وذلك لدراسة تأثير أربعة أنواع من الأسمدة النانو متريه (خليط من عناصر الحديد والزنك والمنجنيز ، النيتروجين ، الفوسفور ، البوتاسيوم) على أربعة أصناف من بنجر السكر(فريده ، كرم ، P.T.S ، حسام) وقد تم رش نباتات بنجر السكر بمعدل 400 سم^3 / الفدان وصممت التجربة في قطع منشقه مره واحده.

وقد أظهرت النتائج أن صنف البنجر حسام قد أعطى زياده معنويه فى كلا من وزن الجذر والنسبه المئويه للصوديوم ومحصول العرش للفدان ومحصول الجذور للفدان ومحصول السكر للفدان بينما أعطى صنف فريده زياده في كلا من النسبة المئويه للمواد الصلبه الذائبه الكليه والنسبه المئويه للسكروز والنسبة المئوية للنقاوة والنسبة المئوية للبوتاسيوم وذلك بالنسبة لباقي الأصناف الأخرى في كلا موسمي الدراسه. كما أوضحت النتائج أن تسميد نباتات البنجر بسماد النانو فوسفور أعطى أعلى معدل نمو وزن الجذور والنسبه المئويه للصوديوم والبوتاسيوم ومحصول العرش للفدان ومصول الجذور للفدان ومحصول السكر للفدان بينما أعطى التسميد بسماد النانو بوتاسيوم أعلى قيم لكلا من النسبه المئويه للمواد الصلبه الذائبه الكليه والنسبه المئويه للسكر والنسبه المئويه للنقاوه وذلك بالنسبه لباقي الأسمده الأخرى في كلا موسمى الدراسه.

كان تأثير التفاعل معنويا حيث أن زراعة نباتات بنجر السكر صنف حسام مع تسميده بالنانو فوسفور أعطت أعلى قيم لوزن الجذور ومحصول العرش للفدان ومحصول الجذور للفدان ومحصول السكر للفدان بينما كانت أعلى قيمه للنسبه المئويه للمواد الصلبه الذائبه

الكليه والنسبه المئويه للسكر عند زراعة نباتات بنجر السكر بالصنف فريدا وتسميده بالنانو بوتاسيوم وذلك في كلا موسمي الدراسه.

توصى هذه الدراسه بزراعة محصول بنجر السكر في منطقة الحامول محافظة كفرالشيخ بالصنف حسام مع تسميده بالنانو فوسفور حيث يعطى أعلى قيم من وزن الجذور ومحصول العرش للفدان ومحصول الجذور للفدان ومحصول السكر للفدان.