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Impact of Foliar and NPK Fertilization Treatments on Bread Wheat Productivity and Quality

Seadh , S. E. ; W. A. E. Abido and Samar E. A. Ghazy
Agronomy Department, Faculty of Agriculture, Mansoura University, Egypt.

ABSTRACT

Two field experiments were conducted to study the effect of foliar and NPK fertilization on productivity and grains quality of wheat Misr 1 cultivar during 2014/2015 and 2015/2016 seasons at a private field in Dekernis Center, Dakahlia Governorate, Egypt. The experiments were carried out in a strip-plot design with four replicates. The vertical plots were assigned to six foliar treatments *i.e.* without, spraying with; commercial NPK as Ferti-plus powder (20-20-20), solution of micro-elements (Zn, Mn and Fe), amino acids in the form of Amino-Cat, yeast extract (YE) and the mixture of commercial NPK, micro-elements, amino acids and yeast extract. The horizontal plots were allocated to three levels of NPK fertilizers (60, 80 and 100 % of the recommended doses *i.e.* 80 kg N + 45.0 kg P_2O_5 + 48.0 K_2O/fed). The foliar spraying twice with the combination of commercial NPK, -elements, amino acids and yeast extract produced the highest values of all studied characters in both seasons, Followed by foliar spraying wheat plants twice with yeast extract (YE) (100 ml/Liter water) in each spraying. Fertilizing with 80 + 45.0 + 48.0 kg N, P_2O_5 and K_2O/fed gave the maximum values of all studied characters during both seasons. Mineral fertilizing with 64.0 + 36.0 + 38.4 kg N, P_2O_5 and K_2O/fed/fed ranked secondly after the highest level of NPK fertilization. It can be accomplished that foliar spraying wheat Misr 1 cultivar twice with the combination of commercial NPK, micro-elements, amino acids and yeast extract beside mineral fertilizing with 64.0 + 36.0 + 38.4 kg N, P_2O_5 and K_2O/fed/fed under the environmental conditions of Dekernis Center, Dakahlia Governorate, Egypt in order to maintain high productivity and grains quality at the same time reduce production costs and environmental pollution.

Keywords: Wheat, Foliar spraying, Amino acids (AA), Yeast extract, Micro elements, NPK, Growth, Yield, Grains quality.

INTRODUCTION

Wheat is used mainly as a human food. It is easily processed into various types of food like bread, macaroni, biscuit and sweets. Although wheat is useful as a livestock feed. Wheat production is not sufficient for local consumption in Egypt. Therefore, great efforts have been employed to increase wheat production by improving yield per unit area to meet the constant demand and reduce the gap between the production and the consumption of wheat.

It is well known that vertical expansion and maximize productivity of any crop could be achieved through using suitable agronomic practices. In addition, the pronounced role of the agronomical processes such as using promising cultivars, foliar fertilization with macro and micro-elements, bio-stimulates substances such as amino acids and yeast extract as well as nitrogen, phosphorus and potassium (NPK) fertilization levels has very imperative effect on the growth, yield and its attributes and chemical constituents of wheat crop.

A great attention has been given to use foliar fertilization and its time of application, which can be used to apply only small amounts of macro and micro nutrients, amino acids and yeast extract. In this concern, Seadh *et al.* (2009) stated that foliar application with the combination of Cu, Mn, Fe and Zn at the rate of 500 ppm of each one resulted in the maximum averages of grain yield and its components, chemical composition and parameters of quality for both grains and seed. Thomas *et al.* (2009) showed that foliar application of amino acid formulations, mixtures of nutrients, hydrolyzed proteins, triacontanol, humic acids, sea weed extracts and brasinolides are proposed as a commonly used for growth promoters. Yassen *et al.* (2010) showed that additional nitrogen foliar spraying (1% urea) and mixture of micronutrients (Fe, Zn ,Mn) gave significant increases in thousand grains weight, grain and straw yields, nitrogen and protein percentage. Habib (2012) showed that grain yield and its quality were increased by foliar with Zn and Fe at filling stage. Dromantienė *et al.* (2013) reported that spraying with liquid amide nitrogen fertilizer, containing different concentrations (0.5–3.0%) of amino acids at heading stage significantly increased grain yield and protein content in grains of wheat. Seadh and Abido (2014) showed that the highest averages of all studied characters were obtained when spraying wheat by combination of YE and HA. Hendawey (2015) reported that foliar application with amino acids led to increase of total cyclic amino acids content and decrease of total acyclic amino acids content in wheat plants. Kandil *et al.* (2016) found that foliar spraying with amino acids resulted in the highest values of all studied characters as compared with the control treatment.

NPK fertilization is among the vital factors affecting yield of wheat. In this respect, the highest values of plant height, spike length, grains weight/spike and grain index were recorded by fertilizing with 180-60-60 NPK kg/ha (Laghari *et al.*, 2010). Meena *et al.* (2013) pointed out application of 100% NPK associated with marked increases in heading date, plant height, number of spikes and grain and straw yields/ha. Youssef *et al.* (2013) reported that the highest averages of total chlorophyll content, FLA and protein content in wheat grains were obtained when fertilizing with 288 + 53 + 120 kg N, P_2O_5 and K_2O/ha. Seadh and El-Metwally (2015) reported that highest values of all studied characters of wheat were obtained when application 80.0 + 22.5 + 24.0 kg N, P_2O_5 and K_2O/fed, respectively.

Therefore, this study was established to decide the impact of foliar and mineral fertilization treatments on productivity and grains quality of bread wheat Misr 1 cultivar under conditions of Dakahlia Governorate, Egypt.

MATERIALS AND METHODS

Two field experiments were conducted at a private field in Dekernis Center, Dakahlia Governorate, during 2014/2015 and 2015/2016 seasons to study the effect of foliar and mineral NPK fertilization treatments on growth, yield and its components and grain quality of bread wheat Misr 1 cultivar.

This study was carried out in strip plot design in with four replicates. Where, the vertical plots were assigned to the following six foliar application treatments:

1- Without (control treatment).
2- Commercial fertilizer, Fert-plus powder (20-20-20) as a source of NPK (4 g/ liter water) in each spraying.
3- Solution of micro-elements (Zn, Mn and Fe) in the form of EDTA of each one (3 g of each/liter water) in each spraying.
4- Amino acids in the form of Amino-Cat (5 ml Amino-Cat/liter water) in each spraying.
5- Yeast extract (100 ml/Liter) in each spraying.
6- The combination of NPK, micro (Zn, Mn and Fe), amino acids and yeast extract (4 + 3 + 5 + 100/liter water, respectively) in each spraying.

The horizontal plots were billed to the levels of NPK fertilization i.e. 60, 80 and 100 % of the recommended doses (48.0 + 27.0 + 28.8 kg N, P_2O_5 and K_2O/fed), 64.0 + 36.0 + 38.4 kg N, P_2O_5 and K_2O/fed and 80 + 45.0 + 48.0 kg N, P_2O_5 and K_2O/fed, respectively).

After determine the experimental units, calcium superphosphate at the aforementioned rates was applied during soil preparation. The nitrogen fertilizer applied at the aforesaid rates broadcasting in two equal portions as ammonium nitrate (33.5 % N). The potassium fertilizer at previously mentioned rates was applied in the form of potassium sulphate (48 % K_2O) broadcasting in one dose.

Each experimental unit was 10.5 m^2 (3 X 3.5 m). Soil samples were taken to measure the mechanical and chemical soil properties (Table 1).

Table 1.Mechanical and chemical soil characteristics at the experimental sites during 2014/2015 and 2015/2016 seasons.

Soil analyses		2014/2015	2015/2016
A: Mechanical analysis:			
Coarse sand (%)		4.53	4.55
Fine sand (%)		19.57	19.75
Silt (%)		40.01	39.57
Clay (%)		35.89	36.13
Texture class		Clay loam	Clay loam
B: Chemical analysis:			
E.C. dSm^{-1} (1:5)		1.35	1.17
pH (1:2.5)		7.91	7.89
Organic matter (%)		1.68	1.72
S.P. (%)		59.5	59.6
$CaCO_3$ (%)		4.81	4.77
Available (mg/kg)	N	41.5	46.9
	P	5.71	5.73
	K	181.4	185.5
Excitable DTPA (ppm)	Zn	0.95	0.98
	Fe	3.51	3.57
	Mn	1.42	1.46
	Cu	0.11	0.12

The cultivation took place on November 9th and 11th in both seasons, respectively. Wheat seeds (75 kg/fed) sown by using broadcasting Afir method.

Studied characters:

A- Growth characters:

1- Number of days to heading (days).
2- Total chlorophylls (SPAD).
3-Flag leaf area (cm^2).
4- Plant height (cm).

B- Yield and its components:

5- Number of spikes/m^2.
6- Length of spike (cm).
7- Number of spikelets/spike.
8- Grains number per spike.
9- Grains weight/spike (g).
10- One-thousand grains weight (g).
11- Grain yield (ardab/fed).
12- Straw yield (heml/fed).

C- Grains quality:

13- Crude protein percentage in grains (%) according to A.O.A.C. (2007).
14- Potassium percentage in grains (%) according to Peterburgski (1968).

According to strip plot design, all data were statistically analyzed (Gomez and Gomez, 1984) by using MSTAT-C Computer software package. Least significant difference (LSD) method was used to test the differences between treatment means as described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

1. Effect of foliar spraying treatments:

Regarding the effect of foliar application treatments *i.e.* without foliar spraying, spraying with commercial NPK fertilizer Fert-plus powder (20-20-20) as a source of NPK, solution of micro-elements (Zn, Mn and Fe), amino acids in the form of Amino-Cat, yeast extract (YE) and the mixture of NPK, micro (Zn, Mn and Fe), amino acids and yeast extract on growth characters *i.e.* number of days to 50% heading (days), total chlorophylls content in flag leaf (SPAD), flag leaf area (cm^2) and plant height (cm), yield and its components *i.e.* number of spikes/m^2, number of spikelets/spike, number of grains/spike, grains weight/spike (g), 1000-grain weight (g), grain yield (ardab/fed) and straw yield (heml/fed) and grains quality characters (crude protein and potassium percentages in grains, it was significant in both seasons as shown from results in Tables 2 and 3.

It is clearly seen that, foliar spraying with the combination of NPK, micro (Zn, Mn and Fe), amino acids and yeast extract was the best transactions to increase growth characters, yield and its components and grains quality characters, which produced the highest values of these characters in both growing seasons. It was followed by spraying with yeast extract, then foliar spraying with amino acids in the form of Amino-Cat, foliar spraying with commercial fertilizer Fert-plus powder (20-20-20) as a source of NPK and foliar spraying with solution of micro-elements (Zn, Mn

and Fe) in both seasons. On the contrary, in both seasons, control treatment gave the lowest values of all studied characters.

Such effects of foliar application treatments might have been due to the hormonal balance activating physiological and biochemical processes in plant, and also may be due to its effect on nitrogen metabolism in the plant which reflected on a better growth, more dry matter accumulation and stimulation the building of metabolic products accompanied with foliar nutrition plants with foliar fertilizers which contains macro and microelements, amino acids and yeast extract. These results are in partial compatible with those recorded by Seadh *et al.* (2009), Yassen *et al.* (2010), Habib (2012), Dromantienė *et al.* (2013), Seadh and Abido (2014), Hendawey (2015) and Kandil *et al.* (2016).

Table 2. Number of days to 50% heading, chlorophyll content in flag leaf, flag leaf area, plant height, number of spikes/m^2, spike length and number of spikelets/spike as affected by foliar spraying treatments, NPK minerals fertilization levels and their interactions during 2014/2015 and 2015/2016 seasons.

Characters / Seasons	Number of days to 50% heading		Chlorophyll content in flag leaf (SPAD)		Flag leaf area (cm^2)		Plant Height (cm)		Number Of spikes/m^2		Spike length (cm)		Number of spikelets/spike	
Treatments	**2014/ 2015**	**2015/ 2016**	**2014/ 2015**	**2015/ 2016**	**2014/ 2015**	**2015/ 2016**	**2014/ 2015**	**2015/ 2016**	**2014/ 2015**	**2015/ 2016**	**2014/ 2015**	**2015/ 2016**	**2014/ 2015**	**2015/ 2016**
A- Foliar application treatments:														
Without	99.4	96.5	20.73	23.11	59.55	61.51	114.6	113.6	135.9	162.6	16.10	17.08	19.00	20.00
NPK	100.4	97.6	21.16	24.70	64.47	62.46	120.8	124.7	206.3	289.7	17.03	18.87	19.65	21.33
Micro (Zn, Mn and Fe)	99.6	96.6	21.01	24.17	63.22	62.13	118.3	115.1	168.2	199.3	16.78	17.75	19.21	20.68
Amino acids	100.6	97.7	22.57	24.83	64.70	65.94	122.3	126.1	376.8	448.7	17.65	19.55	20.00	22.00
Yeast extract	100.9	98.1	24.03	27.56	69.83	68.12	155.0	153.2	497.8	498.9	21.72	23.24	24.70	25.13
Mixture	101.1	99.0	25.68	28.94	72.89	71.30	157.9	156.3	661.2	664.7	21.84	23.26	25.20	26.25
F. test	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.5	0.6	0.53	0.49	0.61	0.56	0.27	0.27	2.9	3.6	0.05	0.05	0.13	0.12
B- NPK minerals fertilization levels:														
60% of RD	100.1	97.38	21.38	24.58	65.24	63.65	130.6	130.6	299.3	334.6	18.37	19.79	21.01	22.16
80% of RD	100.4	97.72	22.12	25.61	65.29	65.38	131.6	131.5	339.9	373.4	18.50	19.92	21.33	22.47
100% of RD	100.5	97.77	24.09	26.46	66.80	66.70	132.4	132.3	383.9	423.9	18.68	20.16	21.53	23.05
F. test	NS	NS	*	*	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	-	-	0.69	0.57	0.29	0.15	0.20	0.15	2.2	2.0	0.06	0.04	0.22	0.33
C- Interaction (F. test):														
A × B	NS	NS	*	*	NS	*	*	*	*	*	NS	*	*	*

***RD: is the recommended doses.**

Table 3. Number of grains/spike, grains weight/spike, 1000 – grain weight, grain and straw yields per feddan, crude protein and potassium percentages in grains as affected by foliar application treatments, NPK minerals fertilization levels and their interactions during 2014/2015 and 2015/2016 seasons.

Characters / Seasons	Number of grains/spike		Grains weight/spike (g)		1000 – grain weight (g)		Grain yield (ardab/fed)		Straw yield (heml/fed)		Crude protein (%)		K (%)	
Treatments	**2014/ 2015**	**2015/ 2016**	**2014/ 2015**	**2015/ 2016**	**2014/ 2015**	**2015/ 2016**	**2014/ 2015**	**2015/ 2016**	**2014/ 2015**	**2015/ 2016**	**2014/ 2015**	**2015/ 2016**	**2014/ 2015**	**2015/ 2016**
A- Foliar application treatments:														
Without	67.55	73.66	4.444	5.533	59.60	58.29	16.69	18.54	11.70	13.73	8.74	11.01	0.658	2.064
NPK	73.36	79.00	5.041	5.660	61.18	63.16	18.95	20.60	14.30	16.12	9.56	11.05	1.121	2.386
Micro (Zn, Mn and Fe)	71.33	75.40	4.986	5.602	60.17	59.25	17.42	20.44	13.28	15.93	9.37	11.03	1.050	2.312
Amino acids	79.49	82.16	5.123	5.893	62.15	64.66	20.75	22.87	15.60	17.94	9.63	11.73	1.427	2.591
Yeast extract	82.95	86.37	5.144	6.133	77.58	77.53	22.33	23.65	17.13	18.28	9.86	12.23	1.690	2.641
Mixture	85.07	88.05	5.778	6.559	78.01	77.78	23.57	24.38	18.23	19.23	10.50	12.72	1.918	2.787
F. test	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.66	0.60	0.07	0.07	0.19	0.19	0.23	0.25	0.25	0.26	0.08	0.06	0.031	0.030
B- NPK minerals fertilization levels:														
60% of RD	74.47	78.99	4.890	5.706	65.66	65.99	18.94	20.78	14.20	16.02	9.36	11.39	1.208	2.359
80% of RD	76.72	80.61	5.102	5.901	66.43	66.82	19.92	21.72	15.00	16.85	9.61	11.61	1.304	2.453
100% of RD	78.68	82.72	5.267	6.084	67.25	67.51	21.00	22.74	15.91	17.75	9.87	11.88	1.419	2.578
F. test	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.74	0.66	0.06	0.04	0.21	0.18	0.26	0.21	0.22	0.17	0.07	0.04	0.040	0.038
C- Interaction (F. test):														
A × B	*	*	*	*	NS	*	*	*	*	*	*	*	NS	*

***RD: is the recommended doses.**

2. Effect of NPK minerals fertilization levels:

With reference to the effect of NPK fertilization levels on growth characters, yield and its components and grains quality characters, it is apparent from obtained results indicated that each increase in NPK fertilization levels was accompanied with significant increase in all studied characters, with exception number of days to 50% heading (days) in both seasons (Tables 2 and 3).

Mineral fertilizing wheat plants with 80 + 45.0 + 48.0 kg N, P_2O_5 and K_2O/fed, respectively gave the highest values of growth characters, yield and its components and grains quality characters in the first and second seasons. However, mineral fertilizing wheat plants with 64.0 + 36.0 + 38.4 kg N, P_2O_5 and K_2O/fed, respectively ranked secondly after the highest level of NPK fertilization in the first and second seasons. Whereas, mineral fertilizing wheat plants with 48.0 +

27.0 + 28.8 kg N, P_2O_5 and K_2O/fed, respectively produced the lowest values of all studied characters in the first and second seasons.

These increases due to increased mineral fertilization levels may be due to the key role of nitrogen which is considered one of the feed key elements of plant nutrition, and it increases the vegetative growth the plant forms a strong plant with long screws. Also, the function of phosphorus in activating the enzyme, osmotic regulation, and therefore the growth of plants, thereby enhancing the growth measurements and all yield components and grain yield per unit area. These results are in good accordance with those of Meena *et al.* (2013), Youssef *et al.* (2013) and Seadh and El-Metwally (2015).

3. Effect of interaction:

About the effect of interaction, there are a lot of significant special effects of the interaction between foliar treatments and NPK levels on the studied characters as showed in (Tables 2 and 3). We present only the effect of significant interaction on grain yield.

Mineral fertilizing wheat plants with 80 + 45.0 + 48.0 kg N, P_2O_5 and K_2O/fed, respectively in addition foliar spraying with the combination of NPK, micro (Zn, Mn and Fe), amino acids and yeast extract resulted in highest values of grain yield/fed in both seasons (Figure 1). The second best interaction treatment was mineral fertilizing wheat plants with 64.0 + 36.0 + 38.4 kg N, P_2O_5 and K_2O/fed, respectively besides foliar spraying with the combination of NPK, Micro (Zn, Mn and Fe), amino acids and yeast extract and followed by mineral fertilizing wheat plants with 80 + 45.0 + 48.0 kg N, P_2O_5 and K_2O/fed, respectively and foliar spraying with yeast extract treatment in both seasons. These results are coincidence with those obtained by Seadh *et al.* (2009), Seadh and Abido (2014), Seadh and El-Metwally (2015) and Kandil *et al.* (2016).

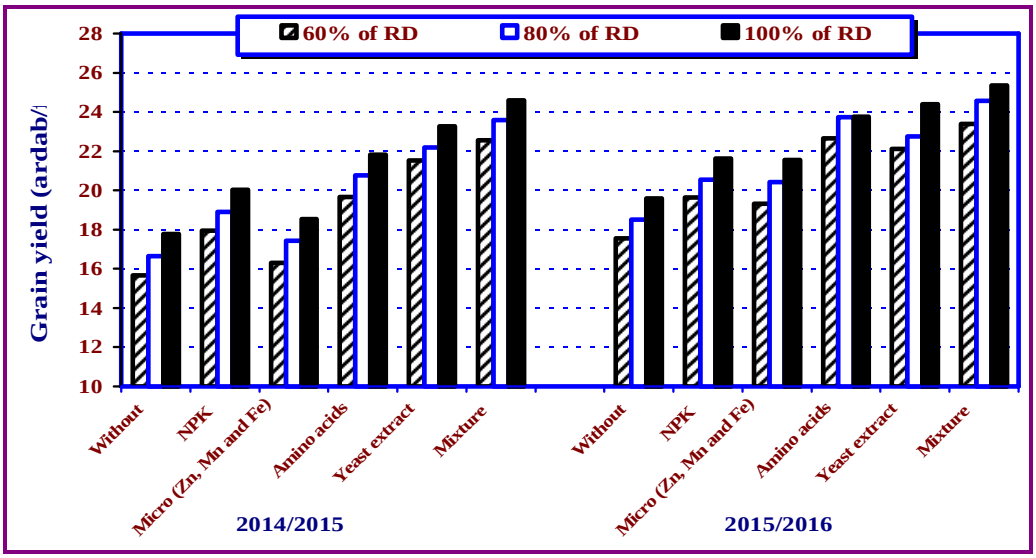

Fig. 1: Grain yield (ardab/fed) as affected by the interaction between foliar spraying treatments and NPK minerals fertilization levels during 2014/2015 and 2015/2016 seasons.

CONCLUSION

It can be concluded that foliar spraying wheat Misr 1 cultivar two time after 35 and 50 days after sowing with the combination of NPK, Micro (Zn, Mn and Fe), amino acids and yeast extract beside mineral fertilizing with 64.0 + 36.0 + 38.4 kg N, P_2O_5 and K_2O/fed, respectively in order to maintain high productivity and grains quality at the same time reduce production costs and environmental pollution.

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تأثير التسميد الورقى والمعدني على النمو والمحصول ومكوناته وصفات جودة الحبوب لقمح الخبز

صالح السيد سعده ، وليد أحمد المعداوى عبيدو وسمر إسماعيل على غازى

قسم المحاصيل– كلية الزراعة – جامعة المنصورة – مصر.

أقيمت تجربتان حقليتان فى حقل خاص بمركز دكرنس، محافظة الدقهلية، مصر خلال موسمى ٢٠١٤/٢٠١٥ و٢٠١٥/٢٠١٦ م لدراسة بعض العمليات الزراعية التى تساهم فى زيادة إنتاجية وجودة حبوب القمح مثل معاملات الرش الورقى والتسميد المعدنى بالنيتروجين والفوسفور والبوتاسيوم. نفذت التجارب فى تصميم الشرائح المتعامدة فى أربع مكررات حيث إشتملت الشرائح الرأسية على ستة معاملات الرش الورقى مرتين وهي: ١- بدون رش ورقي (معاملة المقارنة). ١- الرش الورقى بالسماد التجاري فيرت بلاس بودر (٢٠-٢٠-٢٠) كمصدر للحصول على النيتروجين والفوسفور والبوتاسيوم بمعدل ٤ جم ماء / لتر ماء في كل رشة. ٢- الرش الورقى بمحلول العناصر الصغرى (الزنك، المنجنيز والحديد) بمعدل ٣ جرام / لتر ماء في كل رشة. ٣- الرش الورقى بالأحماض الأمينية في صورة مركب الأمينو كات بمعدل ٥ مل / لتر ماء في كل رشة. ٤- الرش الورقى بمستخلص الخميرة بمعدل ١٠٠ مل / لتر ماء في كل رشة. ٥- الرش الورقى بخليط من فيرت بلاس بودر ، محلول العناصر الصغرى (الزنك، المنجنيز والحديد) ، الأحماض الأمينية ومستخلص الخميرة بمعدل ٤ + ٣ + ٥ + ١٠٠ / لتر على التوالي في كل رشة. أما الشرائح الأفقية فقد إحتوت على ثلاث مستويات من التسميد المعدنى بالنيتروجين والفوسفور والبوتاسيوم وهي: ٦٠، ٨٠ و١٠٠ % من المعدلات الموصى بها من النيتروجين والفوسفور والبوتاسيوم (٨٠ كجم نيتروجين + ٤٥ كجم فوسفور + ٤٨ بوتاسيوم/فدان). أشارت النتائج المتحصل عليها أن معاملة الرش الورقى لنباتات القمح مرتين بخليط من السماد التجاري المعدنى فيرت بلاس بودر (٢٠-٢٠-٢٠)، محلول العناصر الصغرى (الزنك، المنجنيز والحديد)، والأحماض الأمينية ومستخلص الخميرة سجلت أفضل القيم لكل من صفات النمو والمحصول ومكوناته وصفات جودة الحبوب في كلا الموسمين، بينما جاءت معاملة الرش الورقى لنباتات القمح مرتين بمستخلص الخميرة بمعدل ١٠٠ مل / لتر في كل رشة في المرتبة الثانية للمعاملة السابقة. أدى التسميد المعدنى لنباتات القمح بـ ١٠٠ % من المعدلات الموصى بها من النيتروجين والفوسفور والبوتاسيوم أي (٨٠ كجم نيتروجين + ٤٥ كجم فوسفور + ٤٨ بوتاسيوم/فدان) للحصول على أعلى القيم من صفات النمو والمحصول ومكوناته وصفات جودة الحبوب في كلا الموسمين. أما التسميد المعدني لنباتات القمح بـ ٨٠ % من المعدلات الموصى بها من النيتروجين والفوسفور والبوتاسيوم أي (٦٤.٠ كجم نيتروجين + ٣٦.٠ كجم فوسفور + ٣٨.٤ بوتاسيوم/فدان) فقد جاء في المرتبة الثانية بعد التسميد بـ ١٠٠ % من المعدلات الموصى بها من النيتروجين والفوسفور والبوتاسيوم في الموسمين الأول والثاني من هذه الدراسة. من النتائج المتحصل عليها من هذه الدراسة يمكن التوصية بالرش الورقي لنباتات القمح صنف مصر ١ مرتين بعد ٣٥ و٥٠ يوماً من الزراعة بخليط من فيرت بلاس بودر كمصدر للحصول على النيتروجين والفوسفور والبوتاسيوم ، محلول العناصر الصغرى (الزنك، المنجنيز والحديد)، الأحماض الأمينية ومستخلص الخميرة بمعدل ٤ + ٣ + ٥ + ١٠٠ / لتر على التوالي في كل رشة بالإضافة إلى التسميد المعدنى بـ (٦٤.٠ كجم نيتروجين + ٣٦.٠ كجم فوسفور + ٣٨.٤ بوتاسيوم/فدان) وذلك للحفاظ على إنتاجية وجودة حبوب القمح وفي نفس الوقت خفض تكاليف الإنتاج الزراعى وتقليل التلوث البيئي تحت الظروف البيئية محافظة الدقهلية، مصر.