J. of Soil Sciences and Agricultural Engineering, Mansoura Univ., Vol. 12 (3):99-103, 2021

Journal of Soil Sciences and Agricultural Engineering

Journal homepage: www.jssae.mans.edu.eg
Available online at: www.jssae.journals.ekb.eg

Productivity and Chemical Constituents of some Maize Hybrids as Affected by Foliar Sprinkle Treatments

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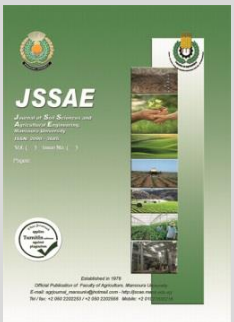

ABSTRACT

At Experimental Station Farm, Faculty of Agriculture, Mansoura University, Egypt, throughout 2019 and 2020 years, 2 field experiments were done to study the effect of sprinkle treatments (without, sprinkle with NPK, Zn + Mn + Fe, seaweed extract and combination of NPK + "Zn + Mn + Fe" and seaweed extract) on development, yield and its ingredient and chemical constituents of three maize hybrids (TWC 368, SC 162 and SC168). Every trial was brought in a strip-plot design with 4 duplications. The results appeared that SC 168 hybrid exceeded other researched hybrids (TWC 368 and SC 162) in all studied characters, except plant height and stover yield fed^{-1} in jointly seasons. Foliar sprinkle maize plants 3 periods with combination of Fert-plus powder at 4 g liter^{-1} + Zn, Mn and Fe at 3.0 g of each liter^{-1} + seaweed extract (SWE) at 1.0 g liter^{-1} water, which topped further foliar sprinkle treatments and formed the highest growth characteristics, yields and its attributes, chemical constituents and uptakes in jointly seasons. It could be decided that sprayed maize SC 168 or SC 162 hybrids with combination of Fert-plus fertilizer at 4 g + micro-elements (Zn, Mn and Fe) at 3.0 g + seaweed extract at 1.0 g liter^{-1} water in each sprinkle in order to maximize productivity, NPK contents and uptakes underneath the ecological situations of Dakahlia Governorate, Egypt.

Keywords: Corn, Maize, hybrids, genotypes, foliar sprinkle treatments, macro-elements

INTRODUCTION

Maize or corn (*Zea mays* L.) is the generally essential cereal crops subsequently wheat and rice in the world along with in Egypt, supplying nutrients for humans and animals. Consequently, a wonderful consideration should be rewarded to grow maize productivity. In this manner, amongst factors that augment maize productivity through chosen high yielding hybrids and foliar fertilization with macro and micro elements and natural growth promoters likes seaweed extract.

Selected the elevated yielding capability hybrids undoubtedly is very important to raise maize productivity. Significant varietal differences in growth, yield components, yield and grains quality of maize were observed by Mahgoub and El-Shenawy (2006), Khalil (2007), El-Sharifi *et al.* (2009), Abdou *et al.* (2012), Attia and El-Dissoky (2016), Awadalla and Morsy (2016) and Ul-Allah *et al.* (2020). Hassaan (2018) indicated that maize hybrids (SC 168, SC 176, TWC 353 and TWC 360) considerably affected plant height, number of grains per row, 1000-kernal weight and yield of grain in kg fed^{-1}. Manjunatha *et al.* (2018) discovered that significant variations among maize hybrids were observed in yield and yield component. The highest and lowest grain yield were recorded for VH132059 hybrid (11.11 t/ha) and VH141651 hybrid (6.06 t/ha), respectively. El-Mekser *et al.* (2020) stated that three ways cross 353 was the earliest hybrid for number of days to 50% tasseling and silking. Three ways cross 324 and 329 showed the tallest plant height and ear height. The highest grain yield was obtained by TWC 324 and TWC 329.

Foliar fertilization is a widely used practice to correct nutritional deficiencies in plants caused by improper supply of nutrients to roots (Ryan, 2002). Foliar fertilizing maize plants with nutrients solution as Crystal Nasr as a source of macro and microelements (Attia *et al.*, 2012) or Dolfan as a source of many amino acids +1 % Zn (El-Ghareib *et al.*, 2014) or biostimulants (Habibi *et al.*, 2015) or combination of amino acids at 500 ml + yeast extract at 2000 ml/200-liter water fed^{-1} (Seadh *et al.*, 2015) or combination of amino acids (AA) and yeast extract (YE) (Abido *et al.*, 2017 a and b) or yeast extract only (Seadh *et al.*, 2017) significantly increased growth, chlorophyll content, ear weight, ear grain weight, grain yield fed^{-1}, nitrogen content, protein% and carbohydrate %. Basavaraja *et al.* (2018) concluded that application of seaweed liquid extract at 10% increased the nutrient uptake, grain and stover yield of maize over control. Tadros *et al.* (2019) indicated that the maize plant height, chlorophyll content, nitrogen, phosphorus, potassium and protein content were significantly affected by foliar application with biostimulants at appropriate growth stage. Brankov *et al.* (2020) stated that the positive effects have been noticed due to foliar fertilizing with fertilizers containing NPK. Stewart *et al.* (2020) found that maize yield response to foliar micronutrient application can be profitable if micronutrient deficiency symptoms are observed.

Accordingly, this study was performed to examine the consequence of foliar sprinkle on growth, yield and its ingredient and chemical constituents of some maize hybrids underneath the ecological circumstances of Dakahlia Governorate, Egypt.

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DOI: 10.21608/jssae.2021.155479

MATERIALS AND METHODS

Throughout summer years of 2019 and 2020, two experimental field in a strip-plot design with four replications were conducted at the Experimental Station Farm, Faculty of Agriculture, Mansoura University, Egypt, to examine the impact of foliar sprinkle treatments on growth, yield and its ingredient and chemical constituents of some maize hybrids.

The vertical-plots were allotted with 3 yellow maize hybrids *i.e.* Three Way Cross 368 (TWC 368), Single Crosses 162 (SC 162) and 168 (SC 168). The horizontal-plots were engaged with the subsequent 5 foliar sprinkle treatments after 30, 37 and 44 days from sowing (DFS); without (control), sprinkle with; commercial fertilizer Fert-plus powder (20-20-20) as a source of NPK at 4 g liter^{-1} water, solution of micro-elements (Zn, Mn and Fe) at 3.0 g of each liter^{-1} water, seaweed extract (SWE) at 1.0 g liter^{-1} water and combination of Fert-plus powder + solution of Zn, Mn and Fe + SWE at the same aforesaid rates in each spraying.

Fert-plus powder and micro-elements in the form of Zn-EDTA, Mn-EDTA and Fe-EDTA were obtained from Gaara Establishment for Import and Export Co. Seaweed extract was obtained from Algal biotechnology Unit, National Research Centre. Main ingredient of the used algas extract (AE) are displayed in Table 1.

Table 1. Chemical composition of used AE.

Components	N	P	K	Mg	Ca	Fe	Zn	Mn	Cu
	%					ppm			
Value	8.00	2.45	0.68	0.20	0.93	1986	31	58	88

Throughout the growing years prior to soil planning, soil samples were held at haphazard from the experimental field (0-30 cm from soil surface) to assess soil properties (physical and chemical) as revealed in Table 2.

Table 2. Physical and chemical soil characteristics of experimental field throughout 2019 and 2020.

Soil analyses	2019 season	2020 season
A: Mechanical analysis		
Fine sand (%)	20.85	20.65
Coarse (%)	2.75	2.86
Silt (%)	26.35	26.45
Clay (%)	50.05	50.04
Texture	Clayey	Clayey
B: Chemical analysis		
EC dS m^{-1} (1 : 5) at 25 ºC	1.93	1.88
pH	7.75	7.70
Organic matter %	1.65	1.61
$CaCo_3$ (%)	3.65	3.59
Available N (ppm)	26.05	25.15
Available P (ppm)	8.85	8.65
Exchangeable K (ppm)	175.50	171.50

The investigational field well prepared for each experiment and then divided into the experimental units (5 ridges, every one of 0.6 m width and 3.5 m length, bring about 10.5 m^2). Maize seeds were hand over sown in hills at a distance of 25 cm make use of dry planting method on one aspect of the ridge throughout the first week of May in 2019 and 2020 time of year. NPK fertilizers as urea (46.0 % N), calcium superphosphate (15.5 % P_2O_5) and potassium sulphate (48 % K_2O) at the suggested dosages (120 kg N + 31 kg P_2O_5 + 24 kg K_2O fed^{-1}) were applied in 2 equivalent portions, one formerly the 1st irrigation and the additional half before the 2nd irrigation, throughout soil preparation and before the first irrigation, respectively. The additional agricultural procedures were held the identical as typically performed for maize matching to the suggestions of Ministry of Agriculture and Land Reclamation, with the exception of for the factors underneath study.

At harvest time, the following characters were determined; plant height (cm), diameter of stem (cm) and ear leaf area (ELA) which was determined in (cm^2) by way of the subsequent formula matching to Gardner *et al.* (1985):

ELA = maximum length of ear leaf × maximum width of ear leaf × 0.75

Ear length (cm) and ear diameter (cm), ear grains weight (g) and 100-kernel weight (g). The studied yields under study were as following; grain yield (ardab fed^{-1}) which was verified of each plot by the grains weight in kg at 15.5 % moisture content, then transferred to ardab per feddan and stover yield (t fed^{-1}).

To determine nitrogen (N), phosphorus (P) and potassium (K) percentages in maize grains and straw, the oven-dried maize straw and grains were digested as illustrated by Peterburgski, (1968). The content of N, P and K in maize grains were explored by the subsequent methods as defined by Page *et al.* (1982); nitrogen (N %) and phosphorus contents (P %) were determined as described by Jackson (1967) and potassium content (K %) was determined according to Black (1965). Total nitrogen (N), phosphorus (P) and potassium (K) uptake (kg fed^{-1}) by maize grains and straw were calculated by multiplying N, P and K % in dry grains and straw by grain and stover yields fed^{-1}.

As issued by Gomez and Gomez (1984), statistical analysis for all acquired data was done by technique of analysis of variance (ANOVA) of strip-plot design by way of "MSTAT-C" computer software package. As explained by Snedecor and Cochran (1980), least significant of difference (LSD) procedure was exploited to assess the variations amongst means of treatment at 5 % level of possibility.

RESULTS AND DISCUSSION

Maize hybrids performance:

Significant variations among the three studied maize hybrids *i.e.* TWC 368, SC 162 and SC 168 were noticed in height of plant, diameter of stem, ELA, length and diameter of ear, weight of ear grains, 100-grain weight, grain and stover yields fed^{-1}, N %, P% and K% in maize grains and straw and total uptakes of N, P and K by maize grains and straw throughout the two growing years as shown from data in Tables 3, 4, 5 and 6. From obtained results it could be noticed that SC 168 hybrid surpassed other studied hybrids (TWC 368 and SC 162) in diameter of stem, ELA, length and diameter of ear, weight of ear grains, 100-grain weight, grain yield fed^{-1}, N %, P% and K% in maize grains and straw and total uptakes of N, P and K by maize grains and straw, which recorded the uppermost means of these characters in dual seasons. However, SC 162 hybrid registered the tallest plants and the uppermost means of stover yield fed^{-1} in jointly seasons. Whereas, TWC 368 hybrid recorded the lowest values of all examined characters in jointly years of this study.

These outcomes might be recognized to the variations in their genetical makeup. Hassaan (2018), El-Mekser *et al.* (2020) and Ul-Allah *et al.* (2020) approved these findings.

Effect of foliar sprinkle treatments:

The impact of foliar fertilization treatments *i.e.* without, sprinkle with; Fert-plus powder (20-20-20) at 4 g liter^{-1} water, Zn, Mn and Fe combination at 3.0 g of each liter^{-1} water, seaweed extract (SWE) at 1.0 g liter^{-1} water and combination of

Fert-plus powder + solution of Zn, Mn and Fe + SWE at the same aforesaid rates in each spraying on maize growth (height of plant, diameter of stem and ELA), yields and its attributes (length and diameter of ear, ear grains weight, 100-grain weight, grain and stover yields/ha), chemical constituents and uptakes (percentages of nitrogen (N), phosphorus (P) and potassium (K) in maize grains and straw and total N, P and K uptake by maize grains and straw) was significant in jointly years (Tables 3, 4, 5 and 6). Foliar sprinkle maize plants three times with combination of Fert-plus + solution of micro-elements + seaweed extract (SWE) at 1.0 g liter^{-1} water, exceeded additional foliar sprinkle treatments and produced the uppermost means of growth, yields and its attributes, chemical constituents and uptakes in the 1st and 2nd seasons. Whereas, foliar sprinkle plants with seaweed extract (SWE) at 1.0 g liter^{-1} water in each sprinkle gave the best growth, yields and its attributes, chemical constituents and uptakes after the combination treatment, tailed by foliar sprinkle plants with Fert-plus powder and then foliar sprinkle plants with solution of micro-elements in dual years. On conflicting, the lowest growth, yields and its attributes, chemical constituents, and uptakes resulted from control treatment in jointly seasons.

Table 3. Plant height, stalk diameter, ear leaf area, ear length and diameter as affected by foliar sprinkle treatments of some maize hybrids and their interaction throughout 2019 and 2020 seasons.

Characters	Plant height (cm)		Stem diameter (cm)		Ear leaf area (cm^2)		Ear length (cm)		Ear diameter (cm)	
Treatments / Seasons	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
A. Maize hybrids:										
TWC 368	285.5	289.3	2.310	2.165	793.6	783.2	23.76	23.60	4.96	4.91
SC 162	309.7	313.8	2.484	2.328	853.5	842.3	25.55	25.38	5.33	5.28
SC 168	307.0	311.1	2.505	2.349	860.9	849.6	25.78	25.61	5.38	5.32
LSD (0.05)	0.2	0.2	0.005	0.003	2.5	2.7	0.03	0.05	0.01	0.01
B. Foliar sprinkle treatments:										
Without	262.8	275.2	2.019	1.626	647.9	646.5	22.15	21.32	4.68	4.65
NPK	307.9	309.3	2.387	2.393	852.4	810.1	25.48	25.48	5.34	5.26
Zn, Mn and Fe	292.4	294.9	2.271	2.298	785.8	774.1	24.64	24.92	5.12	5.06
Seaweed extract	316.5	317.6	2.567	2.476	903.4	902.1	26.03	26.03	5.28	5.37
Mixture of NPK + Zn, Mn and Fe + Seaweed extract	324.0	326.7	2.922	2.611	990.6	992.2	26.86	26.58	5.70	5.50
LSD (0.05)	8.7	7.6	0.185	0.201	59.0	61.9	1.49	1.51	0.31	0.29
C- Interaction:										
A × B	*	*	NS	NS	NS	NS	*	*	*	*

The looked-for effect of sprinkle maize plants with combination of NPK + micro-elements (Zn, Mn and Fe) + seaweed extract (SWE) might have been because of foliar fertilization may in part reward for deficient uptake by roots (Ling and Moshe, 2002), furthermore combined the advantageous possessions of macro-elements (NPK), micro-elements and seaweed extract. Where, foliar nutrition plants with fertilizers contains macro-elements lead to balance on plant hormones, activation of physiological and biochemical procedures. Also, seaweed extract is rich in micro and macronutrients, polysaccharides, proteins, poly unsaturated fatty acids, polyphenols, phytohormones, and osmolytes. These compounds elicit multiple beneficial effects in plants, including enhanced establishment, plant growth and productivity (Dudas *et al.*, 2016). In addition, micronutrients like; Zn, Mn and Fe are accompanying in metabolism of carbohydrate, photosynthesis and activating enzymes. These results were parallel with those stated by Attia *et al.* (2012), Basavaraja *et al.* (2018), Brankov *et al.* (2020) and Stewart *et al.* (2020).

Table 4. Ear grains weight, 100-grain weight, grain and stover yields fed^{-1} as affected by foliar sprinkle treatments of some maize hybrids and their interaction throughout 2019 and 2020 seasons.

Characters	Ear grains weight (g)		100-grain weight (g)		Grain yield (ardab fed^{-1})		Stover yield (t fed^{-1})	
Treatments / Seasons	2019	2020	2019	2020	2019	2020	2019	2020
A. Maize hybrids:								
TWC 368	269.2	237.8	41.33	40.97	24.368	24.370	9.413	9.379
SC 162	289.5	255.7	45.20	44.82	26.208	26.208	10.211	10.175
SC 168	292.0	257.9	45.68	45.30	26.435	26.435	10.123	10.087
LSD (0.05)	0.5	0.4	0.18	0.21	0.026	0.027	0.117	0.124
B. Foliar sprinkle treatments:								
Without	185.8	158.3	32.58	31.11	17.258	17.265	7.033	6.805
NPK	302.3	261.9	43.30	42.31	26.978	26.978	10.079	10.172
Zn, Mn and Fe	281.6	239.8	39.48	39.14	25.190	25.190	8.890	8.972
Seaweed extract	313.8	279.9	47.22	51.88	28.355	28.355	10.752	10.628
Mixture of NPK + Zn, Mn and Fe + Seaweed extract	334.2	312.3	57.78	54.06	30.570	30.570	12.824	12.824
LSD (0.05)	9.2	10.6	2.80	3.10	0.809	0.812	2.941	3.024
C- Interaction:								
A × B	*	*	*	*	*	*	*	*

Effect of interaction:

There were significant possessions of the interaction amongst maize hybrids and foliar sprinkle on plant height, length and diameter of ear, weight of ear grains, 100-grain weight, grain and stover yields fed^{-1}, total N, P and K uptakes by maize grains and straw in jointly years (Tables 3, 4, 5 and 6). We just represent grain and stover yields fed^{-1} in jointly seasons.

Table 5. Nitrogen (N), phosphorus (P) and potassium (K) percentages in maize grains and total N, P and K uptakes as affected by foliar sprinkle treatments of some maize hybrids and their interaction throughout 2019 and 2020 seasons.

Characters Treatments	N (%) in grains		P (%) in grains		K (%) in grains		N uptake (kg fed^{-1})		P uptake (kg fed^{-1})		K uptake (kg fed^{-1})	
Seasons	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**
A. Maize hybrids:												
TWC 368	1.495	1.501	0.270	0.268	0.589	0.585	51.00	51.21	9.21	9.14	20.09	19.96
SC 162	1.541	1.529	0.289	0.295	0.627	0.633	56.54	56.10	10.60	10.82	23.01	23.23
SC 168	1.586	1.590	0.325	0.329	0.725	0.718	58.70	58.84	12.03	12.18	26.83	26.57
LSD (0.05)	0.048	0.051	0.025	0.028	0.085	0.092	1.38	1.29	0.87	0.79	1.18	1.12
B. Foliar sprinkle treatments:												
Without	1.437	1.432	0.245	0.248	0.535	0.532	34.72	34.61	5.92	5.99	12.93	12.86
NPK	1.561	1.569	0.295	0.291	0.675	0.679	58.96	59.26	11.14	10.99	25.49	25.65
Zn, Mn and Fe	1.485	1.475	0.268	0.274	0.567	0.556	52.37	52.02	9.45	9.66	20.00	19.61
Seaweed extract	1.585	1.590	0.315	0.320	0.701	0.695	62.92	63.12	12.50	12.70	27.83	27.59
Mixture of NPK + Zn, Mn and Fe + Seaweed extract	1.639	1.635	0.352	0.350	0.759	0.761	70.15	69.97	15.06	14.98	32.48	32.57
LSD (0.05)	0.062	0.068	0.035	0.038	0.115	0.108	1.05	1.11	0.61	0.59	1.06	1.99
C- Interaction:												
A × B	NS	NS	NS	NS	NS	NS	*	*	*	*	*	*

As shown from results graphically illustrated in Figs. 1, extreme means of grain yield fed^{-1} were formed from SC 168 hybrid that sprayed 3 times after 30, 37 and 44 DFS with combination of NPK + micro-elements + seaweed extract (SWE), followed by SC 162 hybrid plants that foliar sprayed also with the mixture treatment and SC 168 hybrid plants that foliar sprayed with seaweed extract (SWE) throughout jointly growing seasons. However, determined values of stover yield fed^{-1} were produced from SC 162 hybrid plants that foliar sprayed with combination of NPK + micro-elements + seaweed extract (SWE) at the recommended rate of them, followed by SC 168 hybrid plants that foliar sprayed also with the mixture treatment and TWC 368 hybrid plants that foliar sprayed with the combination treatment at the recommended rate of them in jointly years as graphically demonstrated in Figs. 2. While, growing TWC 368 hybrid plants not including foliar sprinkle ensued the lowest means of grain and stover yields fed^{-1} in jointly seasons.

Table 6. N, P and K % in maize stover and total N, P and K uptakes as affected by foliar sprinkle treatments of some maize hybrids and their interaction throughout 2019 and 2020 seasons.

Characters Treatments	N (%) in stover		P (%) in stover		K (%) in stover		N uptake (kg fed^{-1})		P uptake (kg fed^{-1})		K uptake (kg fed^{-1})	
Seasons	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**
A. Maize hybrids:												
TWC 368	1.495	1.501	0.270	0.268	0.589	0.585	46.22	45.77	10.35	11.72	124.63	123.33
SC 162	1.541	1.529	0.289	0.295	0.627	0.633	62.80	63.09	18.89	19.84	141.42	140.21
SC 168	1.586	1.590	0.325	0.329	0.725	0.718	66.31	66.37	23.28	21.69	144.66	142.73
LSD (0.05)	0.048	0.051	0.025	0.028	0.085	0.092	3.62	3.54	1.98	1.82	3.45	3.39
B. Foliar sprinkle treatments:												
Without	1.437	1.432	0.245	0.248	0.535	0.532	31.79	30.08	7.88	8.30	93.19	88.53
NPK	1.561	1.569	0.295	0.291	0.675	0.679	60.78	62.05	17.64	17.09	139.59	139.15
Zn, Mn and Fe	1.485	1.475	0.268	0.274	0.567	0.556	50.76	52.04	12.89	12.47	121.35	121.30
Seaweed extract	1.585	1.590	0.315	0.320	0.701	0.695	67.20	66.11	22.36	23.49	149.99	148.90
Mixture of NPK + Zn, Mn and Fe + Seaweed extract	1.639	1.635	0.352	0.350	0.759	0.761	87.84	88.49	30.14	30.78	182.74	182.61
LSD (0.05)	0.062	0.068	0.035	0.038	0.115	0.108	2.98	2.87	1.54	1.49	3.15	3.05
C- Interaction:												
A × B	NS	NS	NS	NS	NS	NS	*	*	*	*	*	*

CONCLUSION

It can be decided that foliar fertilizing maize hybrids SC 168 or SC 162 with combination of Fert-plus powder + solution of micro-elements + seaweed extract (SWE) in order to maximize productivity, NPK contents and uptakes under the environmental conditions of Dakahlia Governorate, Egypt.

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تأثر الإنتاجية والمكونات الكيميائية لبعض هجن الذرة الشامية بمعاملات الرش الورقي

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أجريت تجربتان حقليتان بالمزرعة البحثية بكلية الزراعة، جامعة المنصورة، مصر خلال موسمي 2019 و2020 لدراسة تأثير معاملات الرش الورقي (بدون، الرش الورقي بالمغذيات الكبرى "NPK"، العناصر الصغرى "الزنك والمنجنيز والحديد" ومستخلص الطحالب البحرية وخليط من المغذيات الكبرى "NPK" + العناصر الصغرى "الزنك والمنجنيز والحديد" + مستخلص الطحالب البحرية) على النمو والمحصول ومكوناته والمكونات الكيميائية لبعض هجن الذرة الشامية (هجين ثلاثي 368، هجين فردي 162 وهجين فردي 168). نفذت كل تجربة فى تصميم الشرائح المتعامدة في أربع مكررات. تم تخصيص الشرائح الرأسية لهجن الذرة الشامية، بينما تم تخصيص الشرائح الأفقية لمعاملات الرش الورقي. أوضحت النتائج أن الهجين الفردي 168 تفوق على الهجن الأخرى المدروسة في جميع الصفات المدروسة ما عدا صفتي ارتفاع النبات ومحصول القش للفدان في كلا الموسمين. أدى الرش الورقي لنباتات الذرة الشامية ثلاث مرات بخليط من السماد الورقي Fert-plus كمصدر لـ NPK بمعدل 4 جم / لتر ماء + محلول العناصر الصغرى (الزنك والمنجنيز والحديد) بمعدل 3.0 جرام لكل لتر ماء + مستخلص الطحالب البحرية بمعدل 1.0 جرام / لتر محلول رش للحصول على أقصى نتائج لصفات النمو والمحصول ومكوناته والمكونات الكيميائية والامتصاص متفوقاً على معاملات الرش الورقية الأخرى في كلا الموسمين. من نتائج هذه الدراسة يمكن التوصية بالتسميد الورقي للذرة الشامية هجين فردي 168 أو 162 بخليط من السماد الورقي Fert-plus كمصدر لـ NPK بمعدل 4 جم / لتر ماء + محلول العناصر الصغرى (الزنك والمنجنيز والحديد) بمعدل 3.0 جرام لكل لتر ماء + مستخلص الطحالب البحرية بمعدل 1.0 جرام / لتر ماء فى كل رشة من أجل زيادة الإنتاجية ومحتويات وامتصاص NPK تحت الظروف البيئية لمحافظة الدقهلية ، مصر.