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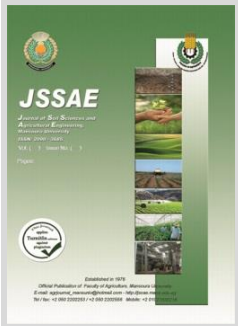
The Effect of Spraying with Ascobein and Soil Addition of Nitrogen Fertilization on the Maize Crop in the Middle Delta

Hanan M. Abu El-Fotoh* ; Samia M.S. El-Kalawy and Lamyaa A. Abd El-Rahman

Soils, Water and Environ. Res. Inst., Agric. Res. Centre, Egypt



ABSTRACT

A field experiment was carried out in the El-Gemmeiza Agricultural Research Station in the Gharbeya Governorate, Egypt, over the summer seasons of 2022 and 2023. This study examined the effects of different rates of nitrogen (0, 50, 75 and 100 of the recommended rate (RRN) equals 00, 60, 90 and 120 kg N/feddan) in the form of urea and spraying with Ascobein (0 and 200 g/150 liter water/fed.) after one and two month of planting on plant growth, productivity, and grain quality of maize cultivar triple hybrid 320 in clay soil. The interaction between fertilizing maize plants at a rate of 75% RRN and foliar spraying with ascobein at a rate of 200 g/150 liters resulted in an increase in plant height, the weight of 100 grains, the yield of both grain and straw, as well as the biological yield/feddan, in addition to harvest index, also, the concentrations of nitrogen, phosphorus, and potassium as well as their uptake by grains and straw in both seasons as well as net return, and beneficial cost ratio. While, the interaction between 50% RRN the recommended rate, and spraying with ascobein to increase the efficiency of nitrogen use. In order to maximize maize production, we can reduce the recommended amount of nitrogen fertilizer for maize from 120 to 90 kg N/feddan by using spraying with ascobein under the same conditions similar to conducting this research.

Keywords: Maize, nitrogen, ascobein, yield, nitrogen use efficiency.

INTRODUCTION

One of the main cereal crops, maize (*Zea mays* L.) is a highly adaptable grain that has numerous uses for humans. In addition to being one of the three most significant cereal crops worldwide, maize is a versatile crop that ranks third in global production, after rice and wheat, according to the Food and Agriculture Organization. According to reports, it is the third most produced crop in the world, behind rice and wheat, (FAO, 2020). In Egypt, maize is the second main crop (7.5×106 tons) with an area of 1.1×10^6 ha that is located in a semiarid region with low-fertility soil (FAO, 2020).

An essential component for plant growth and development is nitrogen. Egypt's maize crop requires a significant amount of nitrogen fertilizer, which raises production costs and contributes to environmental pollution that poses numerous health risks to people. Consequently, there has been a lot of focus on reducing the use of chemical N fertilizers and replacing them with biological fertilizers (Boddey and Dobereiner, 1988).

In this concern, some authors indicated that, fertilizing maize plants with nitrogen superior the growth , productivity and grain quality (Zakaria, 2018, Hassanein *et al*., 2019, Khan *et al*., 2019, El-Gedwy, 2020, El-Sobky and Abdo 2020, EL-Edfawy *et al*., 2023 , Alaamer *et al*., 2024, Ning *et al*., 2024, Ramadan *et al*., 2024).

Ascobein, a fast-acting, hormone-free natural growth stimulant that works to increase plant growth rates by stimulating and activating physiological processes it contains (ascorbic and citric acids). The growth and development of plants, cell division, cell wall metabolism and expansion, the establishment of shoot apical meristems, root development, photosynthesis, florescence regulation, and leaf senescence regulation are all influenced by ascorbic acid. It also affects plant antioxidation capacity, heavy metal removal and detoxification, stress defense, and enzyme activity as a cofactor (Zhang, 2012). Foliar application of ascobein containing citric acid has important effects on physiological and metabolic processes, including cell division and elongation, which increases plant biomass and the process of photosynthesis in many plant species [Fayed 2010].

Spraying with ascorbic acid and /or citric acid had produced the best productivity and grain quality of maize or wheat plants (Sadak, and Orabi 2015 , Abo-Marzoka *et al*., 2016, Osman *et al*., 2017 on wheat , Billah *et al*., 2017, El-Hawary and Nashed 2019, Qasim *et al*., 2019, Kotb *et al*., 2021 and Ismail *et al*., 2024 on maize).

Therefore, the aim of this research was to study the effect of the interaction between nitrogen fertilization levels and spraying using ascobein with the aim of increasing productivity and nutritional value in the grains and straw of maize plants grown in clay soil.

MATERIALS AND METHODS

A field experiment was carried out in the El-Gemmeiza Agricultural Research Station in the Gharbeya Governorate, Egypt, located at (Lat. 30؛ 48´ 752" and Long. 31؛ 81 025") over the summer seasons of 2022 and 2023 (as shown in table 1). This study examined the effects of different rates of nitrogen (0, 50, 75 and 100 of the recommended rate (RR) and spraying with Ascobein and their interaction between them on growth, productivity, and grain quality of maize in clay soil.

This experiment included eight treatments as follows: four levels of mineral nitrogen (0, 50, 75, and 100% RRN) equal to 00, 60, 90, and 120 kg N/feddan and spraying with Ascobein (0 and 200 g/150 liter water/fed.). These treatments were arranged in a split-plot design with 3 replications. Nitrogen fertilizer levels were distributed in the

* **Corresponding author.**
E-mail address: hanan.aboelfotoh@yahoo.com
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main plot, while Ascobein concentrations were arranged in the sub plot. Plot area was 10.5 m² which contains five ridges**,** each of 3.5m length and 60cm wide**,** with a hill 30cm apart**.** Sowing date was 25 and 28 May in both seasons and the preceding crop was wheat in the two seasons. The hybrid used in this work was the triple hybrid 321, which was obtained from the Maize Research Department, Field Crops Research Institute, Agricultural Research Center, Egypt.

Table 1. some physical and chemical properties of the experimental soil according to Black *et al.* (1981)

Parameter	Value	
1. physical properties	2022	2023
Corse sand (%)	4.86	5.4
Fine sand (%)	14.47	13.7
Silt (%)	41.46	40.8
Clay (%)	39.21	40.1
Textural class	clayey loam	clayey loam
2. Chemical properties		
EC dSm^{-1} (soil past extract)	2.34	2.36
pH (1: 2.5 soil : water suspension)	8.09	8.05
$CaCO_3$ (%)	2.52	2.49
Organic matter (%)	1.80	1.82
Nitrogen availability (ppm)	36.2	34.8
Phosphorus availability (ppm)	8.03	8.23
Potassium availability (ppm)	238	252

Before the first irrigation (21 days after planting) and before the second irrigation (42 days after sowing) in both seasons, nitrogen fertilizer amounts of 50, 75, and 100% RR were administered as urea (46.5% N) in two proteins. Ascobein contains 38% organic acids (ascorbic and citric acids) and 62% organic substances that stimulate plant growth, it was obtained by the General Foundation for the Agricultural Equality Fund of the Ministry of Agriculture , which are added at (0 and 200 g/150 liters of water/fed.) twice, after one and two months of sowing.

Equal amounts of P and K fertilizers were applied to each experimental unit at rates of 24 kg K_2O/fed. and 30 kg P_2O_5/fed. in the form of calcium super phosphate (15.5% P_2O_5) during land preparation. It was added in one dose along with the second dose of nitrogen fertilizers in the form of potassium sulphate (48% K_2O). In the production of maize, all other cultural customs were adhered to as advised.

Data recorded

1. Growth and yield parameters:

At harvesting stage ten individual plants were taken at random from each plot and the following data were: plant height of plant was measured as centimeter, 100-grains weight (g) , grain yield (ton/ fed.), straw yield (ton/fed.) , biological yield (grain yield+ straw yield) (ton/fed.) and the harvesting index was calculated using the grain yield to biological yield ratio.

2. Nitrogen use efficiency (NUE)

NUE was calculated according to Dobermann, 2007) by the following equation:

$$NUE = \frac{\text{Yield of grains at N treatment} - \text{Yield of grains at zero N}}{\text{Applied N rate at N treatment}}$$

3. Contents of nutrients: A.O.A.C. (2012) states that during harvest time in both seasons, the concentrations of nitrogen, phosphorus, and potassium in grains and straw were measured. Using the approach described by Craswell and Godwin (1984), the N, P, and K uptake (kg/ fed. was calculated by multiplying the grain and straw yield by the appropriate N, P, and K concentrations (%).

Economic analysis

The beneficial cost ratio and net return for each treatment were determined by economic analysis.

1. **Cultivation cost:** Egyptian pounds (L.E.) were used to calculate the cultivation costs for each treatment. Input costs, rental costs, planting, irrigation, fertilizers, weeding, harvesting, and other costs, as well as data.
2. **Gross return:** based on the local market price, the yield of maize was transformed into gross return (L.E.)/fed.
3. **Net return:** It was calculated by subtracting the cost of cultivation from the gross return
4. **The benefit cost ratio was computed using the following formula:** beneficial cost ratio = gross return / cultivation cost.

Statistical analysis: For all data that was gathered, a statistical analysis was done according to Snedecor and Cochran (1980) were used to calculate the analysis of variance, and Duncan (1958) method was used to separate the means at the 5% probability level.

RESULTS AND DISCUSSION

1. Plant height and yield and its components

Effect of nitrogen levels

Data in Table 2 show that fertilizing maize plants grown in clay soil with 50, 75 and 100 of the recommended rate of nitrogen (RRN) increased plants height, 100 grains weight , grain yield , straw yield , biological yield and harvesting index compared control treatment (without nitrogen) in both seasons.

Table 2. Effect of nitrogen levels on plant height and yield and its components of maize in 2022 and 2023 seasons

Treatments	Plant height (cm)	100 grain weight (g)	Grain yield (ton/fed.)	Straw yield (ton/fed.)	Biological yield (ton//fed.)	Harvest index (%)
			2022 season			
0.0 control	221.60 c	29.17 c	2.312 c	3.341 c	5.653 c	40.88 c
50 % RRN	239.00 b	31.00 b	2.812 b	3.905 b	6.718 b	41.83 b
75 % RRN	254.15 a	32.88 a	3.125 a	4.192 a	7.318 a	42.67 a
100 % RRN	253.30 a	33.22 a	3.153 a	4.195 a	7.348 a	42.90 a
			2023 season			
0.0 control	210.95 c	28.40 c	2.282 c	3.306 c	5.589 c	40.79 b
50 % RRN	231.25 b	31.15 b	2.809 b	3.992 b	6.802 b	41.31 ab
75 % RRN	247.75 a	33.23 a	3.071 a	4.220 a	7.291 a	42.08 ab
100 % RRN	251.35 a	33.33 a	3.167 a	4.264 a	7.431 a	42.61 a

50 %RRN= 60kg N /fed., 75 % RR=90 kg N/fed. and 100 %RR= 120 kg N/fed.

Plant height, 100 grains weight, grain yield, straw yield, biological yield and harvesting index of maize significantly increased with increasing nitrogen rates up to 100 % RRN with no significant differences with 75 %RRN in both seasons.

This means that fertilizing with 75 %RRN (90 kg N/fed.) increased plants height (254.15 and 247.75 cm) , 100 grain weight (32.88 and 33.23 g), grain yield (3.125 and 3.071 ton /fed.) , straw yield (4.192 and 4.220 ton /fed.) , biological

yield (7.318 and 7.291 ton /fed.) and harvesting index (42.67 and 42.08 %) of maize in the 1st and 2nd seasons, respectively.

The relative increase due to fertilizing with 75 % RRN were about 35.16 and 34.57 for grain yield, 29.45 and 30.45 % for biological yield over unfertilized treatment in the 1st and 2nd seasons.

The fact that nitrogen is a necessary nutrient for numerous physiological processes in plants may be the cause of these findings. One of these is the synthesis of chlorophyll and carotenoids (Hammad *et al.* 2011), which raises photosynthesis rates and, in turn, increases the vegetative development of maize plants, or the area and number of leaves per plant, which raises yield and its constituent parts eventually. Additionally, one of the minerals that limits maize crop output the most globally is nitrogen. Additionally, it is a nutrient that is administered to the majority of cereal crops and has a major impact on maize's growth, production, and yield components (Huber and Thompson, 2007).

These results are in agreement with those Khafagy, *et al*., 2018, Hassanein *et al*., 2019, El-Gedwy, 2020, EL-Edfawy *et al*., 2023 and Alaamer *et al*., 2024 all on maize. They indicated that plant height, 100 grains weight, grain, straw and biological yield significantly increased with increasing N rates.

Effect of Ascobein

Foliar spray with ascobein contains 38% organic acids (ascorbic and citric acids) and 62% organic substances that stimulate plant growth, which are added at (0 and 200 g/150 liters of water/fed.) twice, after one and two months of sowing increased plant height (245.87 and 240.42 cm) , 100 grain weight (32.00 and 32.05 g), grain yield (2.991 and 2.963 ton /fed.), straw yield (4.003 and 4.051 ton /fed.) biological yield (6.994 and 7.014 ton /fed.) and harvesting index (42.69 and 42.19%) in both seasons compared to without ascobein (control) as shown in (Table 3).

Table 3. Effect of Ascobein as foliar application on plant height and yield and its components of maize in 2022 and 2023 seasons

Treatments	Plant height (cm)	100 grain weight (g)	Grain yield (ton/fed.)	Straw yield (ton/fed.)	Biological yield (ton//fed.)	Harvest index (%)
			2022 season			
Without	238.15 b	31.14 b	2.710 b	3.814 b	6.524 b	41.45 b
Ascobein	245.87 a	32.00 a	2.991 a	4.003 a	6.994 a	42.69 a
			2023 season			
Without	230.23 b	31.00 b	2.702 b	3.840 b	6.542 b	41.20 b
Ascobein	240.42 a	32.05 a	2.963 a	4.051 a	7.014 a	42.19 a

Ascobein at 200 g /150 liter/ fed.

The relative increase due to spraying with ascobein at (200 g /150 liter) were about 10.36 and 9.65 % for grain yield, 7.20 and 7.21 % for biological yield over unsprayed treatment in the 1st and 2nd seasons.

The beneficial effects of ascobein, which contains the antioxidants ascorbic acid and citric acid, on growth may be explained by their ability to promote cell divisions and shield plant cells from free radicals, which cause plant senescence. They may also be linked to their ability to combat diseases and stressors and their auxinic action, which improves plant growth characteristics and productivity (Elade, 1992). Foliar application of ascobein containing citric acid has important effects on physiological and metabolic processes, including cell division and elongation, which increases plant biomass and the process of photosynthesis in many plant species (Fayed 2010].

These results are harmony with those Seif El-Yazal, 2007, Billah *et al*., 2017, El-Hawary, and Nashed, 2019, Qasim *et al*., 2019, Kotb *et al.*, 2021 and Ismail *et al.*, 2024 . All on maize they showed that plant height , 100-grain weight, grain yield, straw yield and harvest index of maize crop were significantly increased with foliar application of ascobein which containing ascorbic acid and citric acid as compared with untreated plants (control) in the two seasons **.**

Effect of the interaction

Data in Table 4 and Fig 1 indicated that under different levels of nitrogen (50, 75 and 100%RRN) spraying maize plants with ascobein at 200 g /150 liter increased plants height (cm), 100 grains weight (g) , grain yield , straw yield , biological yield and harvesting index (%) compared to without ascobein under the same nitrogen levels .

Table 4. Effect of the interaction between nitrogen levels and Ascobein as foliar spray on plant height and yield and its components of maize in 2022 and 2023 seasons

Treatments		Plant height (cm)	100 grain weight (g)	Grain yield (ton/fed.)	Straw yield (ton/fed.)	Biological yield (ton//fed.)	Harvest index (%)
Nitrogen	Bio			2022 season			
0.00	Without	214.70 f	28.85 d	2.220 g	3.290 d	5.510 g	40.29 e
	Ascobein	228.50 e	29.50 d	2.404 f	3.392 c	5.796 f	41.48 cd
50 % RRN	Without	236.30de	30.65 c	2.553 e	3.622 b	6.175 e	41.35 d
	Ascobein	241.70 cd	31.35 c	3.072 c	4.189 a	7.261 c	42.31 bc
75% RRN	Without	249.30 bc	31.57 c	2.954 d	4.155 a	7.109 d	41.55 cd
	Ascobein	259.00 a	34.20 a	3.297 a	4.230 a	7.527 a	43.80 a
100 % RRN	Without	252.30 ab	33.50 ab	3.115 c	4.190 a	7.305 bc	42.63 b
	Ascobein	254.30 ab	32.95 b	3.192 b	4.200 a	7.392 b	43.18 ab
				2023 season			
0.00	Without	204.20 e	28.05 g	2.180 f	3.262 d	5.442 f	40.01 c
	Ascobein	217.70 d	28.75 f	2.385 e	3.351 d	5.736e	41.58 abc
50 % RR	Without	225.30 c	30.45 e	2.598 d	3.710 c	6.308 d	41.21 abc
	Ascobein	237.20 b	31.85 d	3.021 b	4.275 a	7.296 b	41.41 abc
75% RR	Without	240.10 b	31.72 d	2.874 c	4.100 b	6.974 c	41.21 bc
	Ascobein	255.40 a	34.75 a	3.268 a	4.340 a	7.608 a	42.95 a
100 % RR	Without	251.30 a	33.78 b	3.156 a	4.289 a	7.445 ab	42.39 ab
	Ascobein	251.40 a	32.88 c	3.178 a	4.240 a	7.418 b	42.84 ab

50 %RRN= 60kg N /fed., 75 % RR=90 kg N/fed. and 100 %RR= 120 kg N/fed.
Ascobein at 200 g /150 liter/ fed.

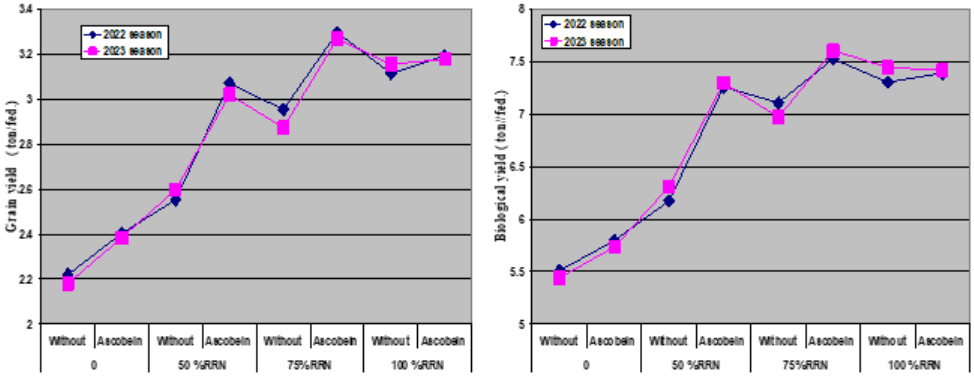

Fig 1. Impact on grains and biological output of maize in the 2022 and 2023 seasons of the combination of nitrogen levels and Ascobein as foliar spray

The interaction between 75 %RRN (90 kg N/fed.) and foliar spray with ascobein at 200 g /150 liter increased plants height (259.0 and 255.40 cm), 100 grains weight (34.20 and 34.75 g) , grain yield (3.297 and 3.268 ton /fed.), straw yield (4.230 and 4.340 ton/fed.) , biological yield (7.527 and 7.608 ton/fed.) and harvesting index (43.80 and 42.95 %) in the 1st and 2nd seasons, respectively.

The relative increase due to the interaction between fertilizing with 75 %RRN and spraying with ascobein at (200 g /150 liter) were about 48.51 and 49.90 % for grain yield, 36.60 and 39.80 % for biological yield over zero nitrogen and zero ascobein in the 1st and 2nd seasons.

The stimulate effect of the interaction between N at 75 %RR and ascobein at 200 g /150 liter /fed. on grain yield may be due to that 75 % RRN and ascobein increased 100 grain weight and straw yield of maize.

Form the forgoing results, it could be concluded that fertilizing maize plants with 75 % recommended rate of nitrogen (90 kg N/fed.) and foliar spray with ascobein at 200 g /150liter/fed. was the best treatment for enhancing yield and its components .

These results agree with Osman *et al.*(2017) on wheat they found that 100 grain weight, grain, straw, biological yield and harvest index as well as NPK uptake of wheat grain, straw, biological were the best with spraying wheat plants with ascorbic acid or citric acid are the two main components of ascobein under 75 % RRN.

2. Nitrogen use efficiency (NUE)

Effect of nitrogen levels

Data in Table 5 illustrate that 75 %RRN gave the highest NUE by maize plants (9.039 and 8.761 kg grains / kg N), followed by fertilizing with 50 % RRN (8.341 and 8.738 kg grains / kg N) in both seasons.

These results are in harmony with those reported by El-Sobky and Abdo 2020. They found that fertilizing maize plants with low rate of nitrogen produced the highest nitrogen use efficiency.

Effect of ascobein

Foliar spray with ascobein increased NUE (9.206 and 9.006 kg grains /kg N) agnist zero ascobein which produced (7.055 and 7.604 kg grains / kg N) in each of the two seasons as shown in Table 5. The relative increase in NUE due to spraying with ascobein at (200 g /l) were about 30.49 and 18.44 % over unsprayed treatment in the 1st and 2nd seasons.

Effect of the interaction

The interaction between N at 50 %RR (60 kg /fed.) and spraying with ascobein at 200 g /150 liter/fed. gave the highest value of NUE (11.130 and 10.600 kg grains / kg N), followed by The interaction between N at 75 %RR (90 kg /fed.) and spraying with ascobein at 200 g /150 liter/fed. (9.922 and 9.811 kg grains / kg N) in the both seasons, respectively Table 5.

Table 5. Effect of the interaction between nitrogen levels and ascobein as foliar spray on nitrogen use efficiency (kg grains/ kg N) of maize in 2022 and 2023 seasons

N levels	Ascobein rates)		Mean
(kg/feddan	Without	With	(N)
		2022 season	
0.0 Control	0.000 g	0.000 g	0.000 d
50 % RRN	5.550 f	11.13 a	8.341 b
75 % RRN	8.156 c	9.922 b	9.039 a
100 % RRN	7.458 d	6.567 e	7.012 c
Mean (Ascobein)	7.055 b	9.206 a	
		2023 season	
0.0 Control	0.000 g	0.000 g	0.000 c
50 % RRN	6.967 f	10.600 a	8.783 a
75 % RRN	7.711 d	9.811 b	8.761 a
100 % RRN	8.133 c	6.608 f	7.370 b
Mean (Ascobein)	7.604b	9.006a	

50 %RRN= 60kg N /fed., 75 % RR=90 kg N/fed. and 100 %RR= 120 kg N/fed. Ascobein at 200 g /150 liter/ fed.

3. N, P and K contents and uptake by grains and straw

Effect of nitrogen levels

Data show that N, P and K concentrations and their uptake by grains significantly increased with increasing N levels up to 75 %RR (90 kg N/fed.) which recorded (0.793 and 0.776 %, 0.246 and 0.248 % and 2.575 and 2.515 for N, P and K concentrations in grain and 33.38 and 32.0, 10.49 and 10.42 and 108.00 and 105.40 kg /fed. for N, P and K uptake by grains followed by N at 100 %RR. Nitrogen levels at 50, 75 and 100 %RR increased N, P and K concentration and uptake by grains of maize compared to control (without nitrogen) Table 6.

The relative increase in N, P and K concentrations due to fertilizing with 75 % RRN were about 34.29 and 28.86 %, 49.00and 66.88%, 39.90 and 40.75 % for N, P and K concentrations in grain in both seasons and 77.19and 73.42 %, 97.59 and 138.75 % and 89.11 and 89.40 % for N, P and K uptake by grains over zero nitrogen in the 1st and 2nd seasons, respectively .

As for the concentrations of N, P and K and the uptake of N, P and K by straw , the data in Table 7 indicate that, fertilizing maize plants under clay soil with nitrogen at

75 %RR produced the highest values of three macroelements and their uptake by straw in both seasons (Table7), while control treatment (0 nitrogen) produced the lowest values of these elements in both seasons.

The relative increase in N, P and K concentrations due to fertilizing with 75 % RRN were about 49.62 and 49.81 %, 38.20 and 51.15 %, 75.17 and 70.51 % for N, P and K concentrations in straw in both seasons and78.18 and 89.90%, 76.30 and 107.98 % and 119.82 and 115.94 % for N, P and K uptake by straw over no fertilizing with nitrogen in the 1st and 2nd seasons, respectively .

Table 6. Effect of nitrogen levels on N, P and K concentration and its uptake by grain of maize in 2022 and 2023 seasons

Treatments	Concentration (%)			Uptake (kg /fed.)		
	N	P	K	N	P	K
			2022 season			
0.00	1.40 c	0.351 d	0.579 d	33.19 c	8.30 d	13.41 c
50 % RR	1.68 b	0.460 c	0.615 c	47.40 b	12.96 c	17.43 b
75% RR	1.88 a	0.523 a	0.810 a	58.81 a	16.40 a	25.36 a
100 % RR	1.84 a	0.492 b	0.788 b	58.38 a	15.60 b	25.02 a
			2023 season			
0.00	1.49 d	0.320 d	0.557 c	34.08 c	6.89 d	12.74 c
50 % RR	1.70 c	0.455 c	0.652 b	46.37 b	12.82 c	18.18 b
75% RR	1.92 a	0.534 a	0.784 a	59.10 a	16.45 a	24.13 a
100 % RR	1.86 b	0.494 b	0.783 a	58.90 a	15.66 b	24.79 a

50 %RRN= 60kg N /fed., 75 % RR=90 kg N/fed. and 100 %RR= 120 kg N/fed.

Table 7. Effect of nitrogen levels on N, P and K concentration and its uptake by straw of maize in 2022 and 2023 seasons

Treatments	Concentration (%)			Uptake (kg /fed.)		
	N	P	K	N	P	K
			2022 season			
0.00	0.530 d	0.178 c	1.470 c	17.78 d	5.95 c	49.13 d
50 % RR	0.633 c	0.197 b	2.145 b	25.04 c	7.75 b	86.42 c
75% RR	0.793 a	0.246 a	2.575 a	33.28 a	10.49 a	108.00 a
100 % RR	0.762 b	0.238 a	2.455 a	31.99 b	10.00 a	102.99 b
			2023 season			
0.0000	0.518 d	0.163 c	1.475 c	17.13 c	5.01 c	48.81 d
50 % RR	0.628 c	0.200 b	2.195 b	25.11 b	8.10 b	82.73 c
75% RR	0.776 a	0.248 a	2.515 a	32.53 a	10.42 a	105.40 a
100 % RR	0.767 b	0.248 a	2.425 a	32.72 a	10.59 a	103.39 b

50 %RRN= 60kg N /fed., 75 % RR=90 kg N/fed. and 100 %RR= 120 kg N/fed.

Nitrogen may have a positive impact on grain quality because it enhances the number of photosynthetic pigments and the pace of photosynthesis, which raises the amount of metabolites produced and, ultimately, the amount of dry matter that accumulates in grains. The significance of nitrogen in the activation synthesis of protein and numerous other substances, such as glucose, sugar, cellulose, cell walls, and vitamins, may also be the cause of these outcomes (Ewais *et al*., 2015).

These findings hold true for both research seasons and are consistent with those published by El-Sobky, 2016, Niaz *et al.*, 2016, Zakaria, 2018, Khan *et al*., 2019, Golla *et al*., 2020, Ning *et al*., 2024 and Ramadan *et al.*, 2024 on maize. They mentioned that N, P, and K contents and their uptake by grain and straw had been affected by the increase in nitrogen levels.

Effect of ascobein

The obtained results in Table 8 show that foliar spray with ascobein at 200 g /150 liter/fed. gave the highest concentrations of N (1.73 and 1.80%), P (0.467 and 0.464 %) and K(0.714 and 0.714 %) as well as the grains uptakes of N (52.94 and 54.01), P (14.20 and 13.80) and K (21.71 and 21.46) kg /fed. while control treatment produced the lowest values of all abovementioned traits in both seasons.

The relative increase in N, P and K concentrations due to spraying with ascobein at 200 g /150 liter/fed. were about 4.22 and 7.14%, 4.71 and 5.94 %, 4.96 and 5.93 % for N, P and K concentrations in grain in both seasons and 15.21 and 19.46 %, 14.24 and 13.96 % and 14.84 and 16.25 % for N, P and K uptake by grains over zero ascobein in the 1st and 2nd seasons, respectively .

Concerning the concentrations of N, P and K as well as the uptakes of N, P and K by straw, the data in Table 9 mentioned that, spraying maize plants with nitrogen ascobein at 200 g/150 liter/fed. recorded the maximum N, P and K concentrations as well as the uptakes of N, P and K by straw, control treatment scored the lowest values of N, P and K concentrations and their uptake in both seasons .

Table 8. Effect of Ascobein as foliar spray on N, P and K concentration and its uptake by grain of maize in 2022 and 2023 seasons

Treatments	Concentration (%)			Uptake (kg /fed.)		
	N	P	K	N	P	K
			2022 season			
Without	1.66 b	0.446 b	0.682 b	45.95 b	12.43 b	18.90 b
Ascobein	1.73 a	0.467 a	0.714 a	52.94 a	14.20 a	21.71 a
			2023 season			
Without	1.68 b	0.438 b	0.674 b	45.21 b	12.11 b	18.46 b
Ascobein	1.80 a	0.464 a	0.714 a	54.01 a	13.80 a	21.46 a

Ascobein at 200 g /150 liter/ fed.

Table 9. Effect of Ascobein as foliar spray on N, P and K concentration and its uptake by straw of maize in 2022 and 2023 seasons

Treatments	Concentration (%)			Uptake (kg /fed.)		
	N	P	K	N	P	K
			2022 season			
Without	0.656 b	0.2018 b	2.08 b	25.58 b	7.905 b	81.24 b
Ascobein	0.703 a	0.2280 a	2.23 a	28.46 a	9.200 a	92.02 a
			2023 season			
Without	0.653 b	0.2047 b	2.06 b	25.39 b	8.005 b	80.57 b
Ascobein	0.691 a	0.2255 a	2.24 a	28.35 a	9.060 a	89.59 a

Ascobein at 200 g /150 liter/ fed.

Possible explanations for these increases in three element concentrations and their uptake include the role of ascorbic acid and citric acid in reducing environmental stress on maize plants and enhancing the redox system to effectively protect plants, particularly against potential anomalies caused by ROS and its products (Hamood *et al*., 2021).

Similar findings were obtained by Mohamed, 2013, Ali *et al*., 2015, Abo-Marzoka *et al*.,2016, Osman *et al*., 2017 on wheat. In this regard, high concentration of nitrogen, phosphorus and potassium in grains of maize under foliar spray with citrine (citric acid) comparing to control plants (Seif El-Yazal, 2007).

Effect of the interaction

There were significant differences between the interaction treatments for the concentrations of N, P and K in grains and the uptake of N, P and K by grains (Table 10 and Fig 2). The interaction between 75 % RRN (90 kg N/fed.) and foliar spray with ascobein at 200 g /150 liter /fed. gave the highest concentrations of N (1.91 and 1.99 %), P (0.547 and 0.552%) and K (0.837 and 0.807 %) and the uptake of N(62.97 and 65.03), P (18.03 and 18.04) and K (27.60 and 26.37) kg/ fed.

The relative increase in N, P and K concentrations due to the interaction between 75 %RRN and spraying with

ascobein at 200 g /150 liter were about 39.42 and 40.14 %, 58.09 and 81.58 %, 48.67 and 48.62 % for N, P and K concentrations in straw in both seasons and 107.07 and 110.05 %, 124.53 and 172.10 % and 120.80 and 122.72 % for N, P and K uptake by straw over no fertilizing with nitrogen in the 1st and 2nd seasons, respectively .

Table 10. Effect of the interaction between nitrogen levels and foliar spray with Ascobein on N, P and K concentration and its uptake by grain of maize in 2022 and 2023 seasons

Treatments		Concentration (%)			Uptake (kg /fed.)		
		N	P	K	N	P	K
Nitrogen	Bio	2022 season					
0.00	Without	1.37 d	0.346 e	0.563 f	30.41 f	8.03 f	12.50 g
	Ascobein	1.43 d	0.357 e	0.596 e	35.98 e	8.58 f	14.33 f
50 % RR	Without	1.62 c	0.453 d	0.607 e	41.36 d	11.57 e	15.50 e
	Ascobein	1.74 bc	0.467 cd	0.623 d	53.45 c	14.35 d	19.37 d
75% RR	Without	1.85 ab	0.500 b	0.783 c	54.65 c	14.77 cd	23.13 c
	Ascobein	1.91 a	0.547 a	0.837 a	62.97 a	18.03 a	27.60 a
100 % RR	Without	1.82 ab	0.487 bc	0.777 c	57.39 b	15.35 bc	24.50 b
	Ascobein	1.86 ab	0.497 bc	0.800 b	59.37 b	15.86 b	25.54 b
		2023 season					
0.00	Without	1.42 e	0.304 g	0.543 h	30.96 g	6.63 f	11.84 g
	Ascobein	1.56 d	0.337 f	0.572 g	37.21 f	7.16 f	13.64 f
50 % RR	Without	1.62 d	0.443 e	0.617 f	38.97 e	11.51 e	15.59 e
	Ascobein	1.78 c	0.468 d	0.688 e	53.77 d	14.14 d	20.78 d
75% RR	Without	1.85 bc	0.517 b	0.762 d	53.17 d	14.86 cd	21.90 c
	Ascobein	1.99 a	0.552 a	0.807 a	65.03 a	18.04 a	26.37 a
100 % RR	Without	1.83 bc	0.490 cd	0.777 c	57.75 c	15.46 bc	24.52 b
	Ascobein	1.89 b	0.499 bc	0.789 b	60.06 b	15.86 b	25.07 b

50 %RRN= 60kg N /fed., 75 % RR=90 kg N/fed. and 100 %RR= 120 kg N/fed. Ascobein at 200 g /150 liter/ fed.

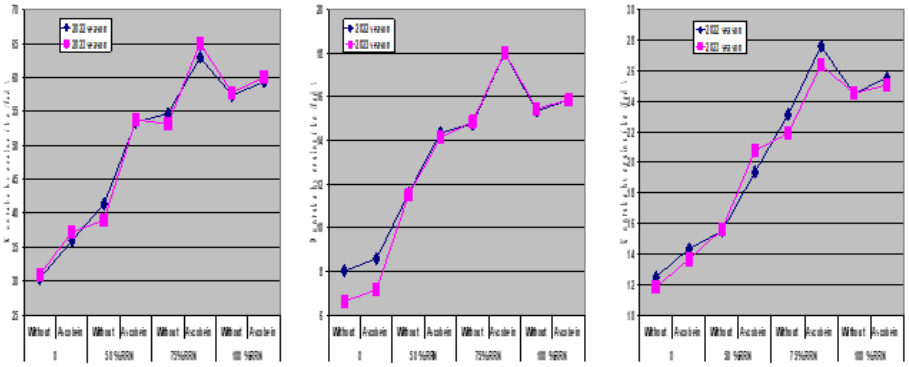

Fig 2. Impact of the relationship between nitrogen levels and Ascobein foliar spray on maize grains' uptake of N, P, and K in the 2022 and 2023 seasons

As for the chemical constituents in straw such as N, P and K concentrations and N, P and K uptake , data in Table 11 indicate that maximum concentrations of N, P and K as well as N, P and k uptake were recorded with the interaction between 75 %RRN and spraying with 200 g/ 150 liter/fed. ascobein.

Table 11. Effect of the interaction between nitrogen levels and foliar spray with Ascobein on N, P and K concentration and its uptake by straw of maize in 2022 and 2023 seasons

Treatments		Concentration (%)			Uptake (kg /fed.)		
		N	P	K	N	P	K
		2022 season					
0.00	Without	0.513 h	0.163 f	1.44 e	17.02 g	5.36 e	47.38 e
	Ascobein	0.547 g	0.193 de	1.50 e	18.55 f	6.55 d	50.88 e
50 % RR	Without	0.617 f	0.187 e	2.02 d	22.85 e	6.84 d	73.98 d
	Ascobein	0.650 e	0.207 d	2.27 c	27.23 d	8.67 c	98.86 c
75% RR	Without	0.760 c	0.225 c	2.47 b	31.58 c	9.69 b	102.63 bc
	Ascobein	0.827 a	0.267 a	2.68 a	34.98a	11.29 a	113.36 a
100 % RR	Without	0.737 d	0.232 bc	2.41 bc	30.88 c	9.72 b	100.98 c
	Ascobein	0.788 b	0.245 b	2.50 ab	33.10 b	10.29 b	105.00 b
		2023 season					
0.00	Without	0.504 g	0.153 g	1.39 e	16.44 f	4.99 e	45.34 g
	Ascobein	0.532 f	0.173 f	1.56e	17.83 f	5.03 e	52.28 f
50 % RR	Without	0.612 e	0.189 e	2.12d	22.27 e	7.01 d	78.65 e
	Ascobein	0.644 d	0.212 d	2.27 cd	27.95 d	9.20 c	86.80 d
75% RR	Without	0.752 c	0.235c	2.42bc	30.83 c	9.64 bc	99.22 c
	Ascobein	0.801a	0.262a	2.61 a	34.24 a	11.20 a	111.58 a
100 % RR	Without	0.747 c	0.242 bc	2.31 c	32.04 bc	10.38 ab	99.08 c
	Ascobein	0.788 b	0.255 ab	2.54ab	33.41 ab	10.81 a	107.70 b

50 %RRN= 60kg N /fed., 75 % RR=90 kg N/fed. and 100 %RR= 120 kg N/fed.
Ascobein at 200 g /150 liter/ fed.

While, maize plants which received 0 nitrogen and 0 ascobein recorded the lowest values of N, P and K concentrations and N, P and K uptake by straw in both seasons. These results are harmony with Osman *et al.*

(2017) they found that the interaction between fertilizing plants with 75 % RRN and spraying with ascorbic acid or citric acid, which are the two major components of ascobein produced the maximum N,P and K concentrations and their uptake of grain and straw of wheat.

6. Economic analysis

The findings in Table 12 demonstrated that average of cost cultivation, gross return, net return and beneficial cost ratio of four nitrogen levels as affected by ascobein as the means of two growing seasons. Nitrogen at 75% + ascobein produced the highest gross return (29.538 L.E.), net return (8.913 L.E.), and beneficial cost ratio (1.43), according to the results, which showed that the values of cost cultivation, gross return, net return, and beneficial cost ratio varied due to the differences between treatments. Conversely, all ascobein treatments had the highest cultivation costs, but the treatments with no ascobein and no nitrogen had the lowest cultivation costs, gross returns, net returns, and advantageous cost ratios when compared to all other treatments.

Table 12. Averages cost of cultivation, gross return, net return and beneficial cost ratio of the interaction between nitrogen levels and foliar spray with Ascobein (average of the two seasons)

Treatments		Cost of cultivation (L.E./feddan)	Gross return (L.E.)	Net return (L.E.)	Beneficial cost ratio
Nitrogen	**Bio**				
0.00	Without	17.850	19.800	1.950	1.11
	Ascobein	18.000	21.546	3.546	1.20
50 % RRN	Without	19.600	23.175	3.575	1.18
	Ascobein	19.750	27.414	7.664	1.39
75% RRN	Without	20.475	26.226	5.751	1.28
	Ascobein	20.625	29.538	8.913	1.43
100 % RRN	Without	21.350	28.215	6.865	1.32
	Ascobein	21.500	28.660	7.165	1.33

50 %RRN= 60kg N /fed., 75 % RR=90 kg N/fed. and 100 %RR= 120 kg N/fed. Ascobein at 200 g /150 liter/ fed.

CONCLUSION

The following can be recommended under the same conditions, using nitrogen fertilizer at a rate of 75% of the recommended rate, which is equivalent to 90 kg nitrogen/fed.) and foliar spraying with ascobein at a rate of 200 g/150 liters in order to obtain the best production of grain, straw , and biological yields as well as the concentrations of nitrogen, phosphorus, and potassium and their uptake by grains and straw as well as net return , and beneficial cost ratio.

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تاثير الرش بالاسكوبين مع الإضافة الأرضية للتسميد النيتروجينى فى محصول الذره الشامية فى وسط الدلتا

حنان محمد أبو الفتوح ، ساميه محمد سعد الكلاوى ولمياء عبد الحليم عبد الرحمن

معهد بحوث الاراضى والمياه والبيئة – مركز البحوث الزراعية.

الملخص

تم تنفيذ تجربة حقلية بمحطة البحوث الزراعية الجميزة بمحافظة الغربية بمصر خلال صيف 2022 و 2023 تناولت هذه الدراسة تأثير معدلات مختلفة من النيتروجين (0، 50، 75، 100) من المعدل الموصى به والذى يساوي 00 و60 و90 و120 كجم ن/فدان) فى صوره يوريا والرش بالأسكوبين (0 و 200 جم/150 لتر ماء/فدان) بعد شهر وشهرين من الزراعة على نمو النبات والإنتاجيه وجوده الحبوب لصنف الذرة الهجين الثلاثي 321 النامى في الارض الطينية . سجل التفاعل بين تسميد نباتات الذره بمعدل 75% من الموصى به والذى يعادل 90 كجم نيتروجين/فدان) والرش الورقي بالأسكوبين بمعدل 200 جم / 150 لتر إلى زيادة فى ارتفاع النبات ،وزن 100 حبة ومحصول كل من الحبوب والقش وكذلك المحصول البيولوجي/ للفدان بالإضافة إلى دليل الحصاد وذلك تركيزات كل من النيتروجين والفوسفور والبوتاسيوم والممتص منهم بواسطه الحبوب والقش في كلا الموسمين وكذلك صافي العائد ونسبة العائد الصافى الى التكاليف . بينما سجلت معامله التفاعل بين التسميد ب50 % من الموصى به والرش بالأسكوبين ب الى زياده كفاءه استخدام النيتروجين . من أجل تعظيم إنتاج الذرة، يمكننا خفض الكمية الموصى بها من الأسمدة النيتروجينية للذرة من 120 إلى 90 كجم ن /فدان عن طريق استخدام الرش بالأسكوبين ب تحت نفس الظروف المشابهه لاجراء هذ البحث.