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Improving Rice Grain Quality and Yield of Giza 179 Rice Cultivar Using some Chemical Foliar Spray at Late Growth Stages under Salt Stress

Amira M. Okasha ; M. M. Abbelhameed and Omnia M. Elshayb*

Rice Research and Training Center, Field Crops Research Institute, Sakha, kafr elsheikh, ARC, Egypt

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ABSTRACT

Studies were carried in the two seasons of 2017 and 2018 at the Experimental Farm of El-Sirw Agriculture Research Station, Damietta Governorate, Egypt. The main objective of study was to determine the effect of foliar spraying with some chemical substances during panicle initiation+ mid booting stages on rice growth, yield, yield attributes and grains quality characteristics of rice cv. Giza179. The experimental design was performed in randomized complete block design with four replications. Foliar application treatments were 1-Control (non-treated treatment), 2-Di ammonium phosphate spray (DAP 1.5%) 3- Potassium (K_2O 1.5%) 4- $N+K^+$ mixture (1.5% for each) 5- Gibbrilic acid ($GA_3$10ppm)+K^+ (1.5%) 6- Salicylic acid (SA 500ppm)+K(1.5%) 7- Humic acid (HA)+1.5%K). Salinity levels of experimental were 8.4 and 8.5 dSm^{-1} in both seasons, respectively. The plant growth, yield, yield components parameters, and grains quality characteristics were collected. The tested chemical substance significantly improved the studied characteristics rice grain quality, yields and yield contributes compared with the control treatment. Foliar spray with mixture of humic acid $+K^+$ at panicle initiation + mid booting stages was significantly the most efficient treatment in improving rice grain quality, growth and yields without significant difference with the mixture of N+K treatment regarding rice grain quality improvement. The mixture of humic+ K^+ could be recommended for improving rice quality and productivity of Giza 179 under salt stress.

Keywords: foliar spray, K, N, Salicylic acid, Gibbrilic acid, Humic acid, Rice grain quality, Salinity

INTRODUCTION

Rice (Oryza sativa L.) is a vital cereal crop since it is a staple food for more than half of the world's population (Ma *et al*., 2007). There is an urgent need for increasing the crop production, which is decreasing by the negative impact of various environmental stress, including biotic stress and abiotic stresses such as salinity to facing the increasing of world population. In Egypt, rice scientists recently produced many salt tolerance varieties, such as Giza179 rice variety, but this variety had a problem of high broken rice percentage during seed quality processes. This may be due to certain problems like the response of plants to salt stress are different at the cellular level, the tissue level or at the whole plant level. Complex mechanism of salt tolerance is involvement of environmental factors in addition to salt stress, and lack of efficient selection criteria (Flowers, 2004). It is very important to improve methods and strategies to ameliorate deleterious effects of salt stress on rice plant and increase its quality. Spraying of some chemical substances such as salicylic acid (SA), Gibbrilic acid (GA_3). di-ammonium phosphate (DAP), potassium(K^+) and humic acid(HA) is a beneficial way to cope with salt stress. Salicylic acid (SA) participates in the regulation of physiological processes (Hayat *et al*., 2010) although its definite role and the underlying physiological mechanisms have not been fully elucidated (Borsani *et al*., 2001) salicylic acid also prevents the damaging action of various stress factors in many plant species(Afzal *et al*., 2005). The role of GA_3 in improving growth as well as yield and yield components of rice under such conditions might be due to its activation to α-amylase for breakdown of stored starch during germination, enhancing IAA exertion, promoting cell elongation and division particularly mesocotyle length and internodes of rice plants, reducing Na^+ and Cl^- uptake, increased K, P , N uptake and chlorophyll content of rice plants leading to high seedling vigor, reasonable rice growth at early and late stages, improving source-sink relation resulted in high yield components and grain yield under salt stress as compared to traditional treatment (Chen *et al*., 2005). DAP contains both N (18%) and P (46% P_2O_5). Since both N and P plays a great role in yield and growth of rice, foliar spray of both under salt stress might boost up salinity tolerance of rice plants and rice yield. N increases root growth, leaf chlorophyll content, photosynthesis, leaf ATPase, metabolism, translocation and accumulation of photosynthate (Lin *et al*., 1993) and P is important for promoting root growth, tillering and enhancing the chlorophyll content in leaves, soluble sugar and starch content in grains, protein and total nitrogen content in leaves and grains (Tang and Yu, 2002). Potassium (K^+) is an essential nutrient that affects most of the biochemical and physiological processes that influence plant growth and metabolism, enzyme activation, cell elongation and water efficiency, so, it could be considered as a key element in rice nutrition for improving root growth and plant vigor, helping prevent lodging and enhancing rice resistance to pests and diseases (Krishnakumar *et al*., 2005).

* **Corresponding author.**
E-mail address: omniaelshayb3434@yahoo.com
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The aim of the current investigation was to improve rice growth, yield, yield attributes and grain quality of Giza179 rice variety, under salt stress conditions by using foliar spray of some chemical substances at late growth stages

MATERIALS AND METHODS

Two field experiments were conducted at the Farm of El-Sirw Agricultural Research Station, Damietta Governorate, Egypt in 2017 and 2018 seasons, to determine the spraying efficiency of some chemical substances at various growth stages on grain quality as well as growth and yield of rice cv. Giza179. The previous crop was Egyptian clover in the two seasons. Representative soil samples were taken from each site at the depth of 0-30 cm from the soil surface. Samples were air-dried then ground to pass through a two mm sieve and well mixed. The procedure of soil analysis followed the methods of Black *et al*. (1965). Results of chemical analysis in both seasons are shown in Table 1. The experimental soil was fertilized with phosphorus in form of calcium superphosphate (15.5 % P_2O_5) at the rate of 50 kg P_2O_5 ha^{-1} before the land preparation. The experiment was performed in randomized complete block design with four replications. Foliar application treatments were 1-Control (non-treated treatment), 2-Di-ammonium phosphate spray (DAP 1.5%) 3- Potassium (K_2O 1.5%) 4- N+K+ mixture (1.5% for each) 5- Gibbrilic acid ($GA_3$10ppm)+K+ (1.5%) 6- Salicylic acid (SA 500ppm)+K(1.5%) 7- Humic acid (HA)+1.5%K). Foliar application treatments were applied during panicle initiation+ mid booting stages.

Table 1. Chemical of the experimental soil (0-30 cm depth) in 2017 and 2018 seasons.

seasons	EC_e ($dS.m^{-1}$)	pH	Na^{+1}	$Ca^{+2}+Mg^{+2}$	K^{+1}	$HCo^{-}3$	Cl	So_4^{+2}	Available (ppm)		
			meq. l^{-1}						N	P	K
2017	8.4	8.4	58.0	26.0	0.32	9.5	43.0	31.5	30	15	287
2018	8.5	8.3	57.0	28.0	0.31	9.0	44.0	32.0	32	13	311

Seeds at the rate of 140 kg ha^{-1} were soaked in water for 48 hr then incubated for 24 hr to hasten early germination. Seeds were uniformly broadcasted in the nursery on 1st and 2nd May of the two seasons, respectively. Seedlings aged 30days were carefully pulled from the nursery days old. Seedlings were manually transplanted into 10 m^2 (2m length X 5m wide)for each plot in 20X20 cm spacing apart at the rate of 2-3 seedlings/hill in ten rows. Seven days after transplanting the herbicide Saturn 50% [S-(4-Chlorophenol methyl) diethyl carbamothioate] at the rate of 4.8L ha^{-1} was mixed with enough sand to make it easy for homogenous distribution. Plots were kept flooded until 2-3 weeks before harvesting. Nitrogen fertilizer was added at the rate of 165 Kg N ha^{-1} in the form of Ammonium sulphate (20% N) in three equal splits application at 15 , 30 and 45 days after transplanting. Soil application of potassium in the form of potassium sulphate (50% K_2O) at the recommended rate (60 kg K_2O ha^{-1}) was added in two equal doses at 30 and 45 days after transplanting. All other agronomic practices were followed as recommended package of rice under saline soil during the growing season.

At heading stage, plants of five hills were randomly taken from each plot to estimate flag leaf area cm^2 leaf area index, and chlorophyll content. Flag leaf area and leaf area of plant samples were measured by Portable Area Meter (Model LI– 3000A). Total chlorophyll content was determined in ten flag leaf using chlorophyll meter (Model–SPAD502) Minolta Camera Co. Ltd., Japan.

At harvest, plant height, tillers numbers $hill^{-1}$, panicle numbers $hill^{-1}$ were estimated. Ten panicles were collected randomly to estimate the panicle weight, panicle length, number of filled grain and unfilled grain per panicle and 1000-grain weight. The six inner rows of each plot were harvested, dried, threshed, and the grain and biological yields were determined based on the moisture content of 14%. The yield converted to grain yield t ha^{-1}.

Grain quality characters:

About 150 grams of grain were taken from each treatment, mixed and sent to the grain quality laboratory of the RRTC to determine some of the grain quality characteristics according to the methods described by: Adair (1952). Juliano (1971) and Kush *et al*. (1979).

1. Hulling percentage (%)

$$\text{Hulling \%} = \frac{\text{Weight of brown rice (g)}}{\text{Weight of rough rice (g)}} \times 100$$

2. Milling percentage (%)

The percentage of total milled rice was computed according to the methods described by Kush *et al*. (1979) as follows:

$$\text{Milling \%} = \frac{\text{Weight of milled rice (g)}}{\text{Weight of rough rice (g)}} \times 100$$

3.Head rice percentage (%)

$$\text{Head rice \%} = \frac{\text{Weight of whole milled rice (g)}}{\text{Weight of rough rice (g)}} \times 100$$

Amylose content: To 100 mg of flour sample was added 1 ml ethanol (95%) and 9 ml 1N NaOH. The sample was heated for 10 min in boiling water bath to gelatinize starch. Sample was cooled and transferred to 100 ml volumetric flask. 5 ml of starch solution and 1 ml 1 N acetic acid added. Two milliliters of iodine solution (0.2% of re-sublimed iodine in 2% potassium iodide) was added and volume made up to 100 ml. Flask was shaken and allowed to stand for 20 min. Percent transmittance was measured at 620 nm using an Ultraspec spectrophotometer (Ultraspec Plus, model 4054, Pharmacia LICB Biochrom Ltd., England). Total amylose content of sample was determine from a previously calibrated standard amylose (Potato, Sigma) curve

The obtained data were subjected to analysis of variance according to (Gomez and Gomez 1984).

Treatment means were compared by Duncan's Multiple Range Test (Duncan 1955). All statistical analyses were performed using analysis of variance technique by means of "COSTATC" computer software package.

RESULTS AND DISCUSSION

1- Growth parameters:

Data in Tables 2 and 3 show that flag leaf area (cm^2), leaf area index, chlorophyll content (SPAD value) and heading date day^{-1} were significantly affected by foliar spraying with some chemical substances during panicle initiation+ mid booting stages in 2017 and 2018 seasons. The tested chemical substances significantly improved the studied growth characteristics compared with control treatment. Foliar spraying with mixture of humic acid +K significantly gave the highest values of flag leaf area and leaf area index without significant difference with the treatments of (SA+K), (GA+K) (N+K) and K during the study seasons meanwhile, foliar spray with DAP ranked the second order **.** The highest value of chlorophyll content was obtained by humic acid +K without statically differences with foliar spraying with (SA+K), (GA+K) and (N+K) Moreover, no significant differences were recorded between foliar spraying with K and DAP, both of them came in the second order. As for heading date data in (Table3) indicated that foliar spray with humic acid+K significantly prolonged the days from sowing to heading without significant difference with foliar spray with GA_3+K. The second order was in favor foliar spray with N+K treatment without significant difference with SA+K treatment.

Table 2. Effect of foliar spraying with some chemical substances on flag leaf area cm^2, leaf area index and chlorophyll (SPAD value) of Giza179 rice variety in 2017 and 2018 seasons

Traits	Flag leaf area cm^2		Leaf area index		Chlorophyll (SPAD value)	
Treatments	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**
Control	25.07c	24.97c	4.42c	3.78c	30c	31c
DAP(1.5%)	27.56b	27.34b	5.05b	4.84b	33b	35b
K^+ (1.5%)	28.60ab	28.00ab	5.51ab	5.08ab	34b	35b
N+K^+ mix (1.5%) for each	28.65ab	28.43ab	5.70a	5.32a	39a	38ab
GA (10ppm)+K^+ (1.5%)	28.26ab	28.60ab	5.60ab	5.42a	.40a	39a
SA(500ppm)+K^+ (1.5%)	28.55ab	28.67ab	5.61ab	5.23ab	40a	40a
HA (2 L^{-1}) +1.5%K	29.75a	29.70a	5.80a	5.52a	41a	41a
F test	*	*	**	**	**	**
LSD 0.05	2.1	2.02	0.50	0.41	2.0	3.0

DAP=di ammonium phosphate, K= potassium, N=nitrogen ,Gibberellic acid, SA= salicylic acid, DAP=di ammonium phosphate and HA=humic acid

The other treatments did not significantly differ with control in both seasons. When nutrients are applied to the leaves, the nutrient elements might penetrate into the leaves and restrict the inhibition due to toxic effects of Na^+ and Cl^- or minimizes the salinity induced Flowers *et al*. (2004) . Humic acid has role as a plant growth stimulator through increasing cell division as well as optimized uptake of nutrients and water moreover, Humic acid stimulated the soil microorganisms or soil conditioner and has a positive effect on salt tolerance. These results are in agreement with those obtained by Osman *et al*., (2013), Heba *et al*., (2013) and Mohmed *et al*.,(2015). The beneficial influences of salicylic acid might be due to it is role as endogenous growth regulator of phenolic nature influences many physiological processes ion permeability photosynthesis and plant growth rate, salicylic acid also prevents the damaging action of various stress factors in many plant species (Afzal *et al*., 2005 and Rafique *et al*., 2011). Di-ammonium phosphate (DAP) or GA_3 might be increased nutrient content of leaves, biochemical compounds and energy compound such as ATP, increased some biochemical formation related to growth process resulted in increasing cell division and elongation increasing mineral nutrients which play a critical role in plant stress resistance (Gavino *et al*., 2008). Nitrogen is one of the most important plant nutrients and plays a vital role in plant photosynthesis and biomass production, nitrogen influenced cell division and cell elongation (Laroo and Shivay., 2011). As mentioned above, the substances which used in this study have a vital role inside the plant, all of this material work in harmony with potassium which absorbed by plant leaves under saline conditions. The improvement of studied growth characters might be due to the participation of potassium in mechanism of stomata movement, photosynthesis and osmo regulatory adaptation of plants to water stress in saline soil (Reyhaneh *et al*., 2012 and Su *et al*.,2018).

Table 3. Effect of foliar spraying with some chemical substances on heading date day^{-1}, plant height (cm) and number of tillers (hill) of Giza179 rice variety in 2017 and 2018 seasons

Traits Treatments	heading date day^{-1}		Plant height cm		Number of tillers $hill^{-1}$	
	2017	**2018**	**2017**	**2018**	**2017**	**2018**
Control	92.1c	92.00c	84.00c	83.12c	17.68d	16.9d
DAP(1.5%)	92.5c	92.25c	86.87b	86.37ab	23.0bc	21.5bc
K^+ (1.5%)	92.5c	92.50c	87.25b	86.75ab	26.0a	23.75ab
N+K^+ mix (1.5%) for each	93.5b	93.70b	87.06b	86.56ab	24.43ab	24.00b
GA_3(10ppm)+K^+ (1.5%)	94.20a	94.25a	88.25ab	87.75a	26.12ab	24.6ab
SA(500ppm)+K^+ (1.5%)	93.20b	93.25b	89.62a	87.12a	26.25a	24.7ab
HA (2 L^{-1}) +1.5%K	94.2a	95.75a	89.76a	87.81a	27.12a	25.12a
F test	**	**	**	**	**	**
LSD 0.05	0.397	0.56	2.0	2.35	3.68	3.2

DAP=di ammonium phosphate, K= potassium, N=nitrogen , Gibberellic acid, SA= salicylic acid, DAP=di ammonium phosphate and HA=humic acid.

2- Yield attribute characteristics:

Data in Tables 3,4,5 and 6 show that plant height , number of tillers, number of panicle, panicle weight , number of filled grains panicle^{-1}, number of unfilled grains panicles^{-1} and 1000-grain weight were affected by foliar spray with some substances in both seasons and panicle length in first season only. The tested chemical substances improved yield attributes compared with control (untreated treatment). The tallest plants were produced by foliar spray with humic acid +K without statically differences with the treatments foliar spray of (SA+K) and (GA+K). Moreover, foliar spray with DAP came in the second of order without significant differences with foliar spray of K and N+K mixture in the first season. In the second season, all tested chemical substance spray was at the same level of significances with respect to plant height in spite, all treatment, surpassed the control treatment (Table3). The highest values of number of tillers hill^{-1} and number of panicle hill^{-1} panicle weight and panicle length was noticed by foliar application with humic acid +K without statically differences with foliar spray by(SA+K), (GA_3+K),(N+K) and(K) Tables (3,4and 5). Foliar spray with DAP ranked the second for above-mentioned growth characters in the two seasons. Control treatment gave the lowest values of the studied growth characteristics in both seasons. Regarding to filled and unfilled grains panicle^{-1} data in Table 5 showed that foliar spray with some chemical substances had a positive impact on number of filled and unfilled grains panicle^{-1} compared with control treatment.

Table 4. Effect of foliar spraying with some chemical substances on number of panicles hill^{-1}, panicle weight (gm) and panicles length (cm) of Giza179 rice variety in 2017 and 2018 seasons

Traits / Treatments	Number of panicles (hill^{-1})		Panicle weight (g)		Panicles length (cm)	
	2017	2018	2017	2018	2017	2018
Control	13.06c	13.0c	2.44c	2.14c	17.5c	16.13
DAP(1.5%)	18.87b	19.5b	2.95b	2.81b	18.8b	16.96
K^+ (1.5%)	22.60ab	21.00ab	3.14ab	3.09ab	19.5a	16.86
N+K^+ mix (1.5%)for each	22.75ab	21.25ab	3.63a	3.32a	19.2a	16.81
GA (10ppm)+K^+ (1.5%)	23.75ab	22.25ab	3.64a	3.51a	19.5a	16.86
SA(500ppm)+K^+ (1.5%)	25.82a	24.05a	3.48a	3.43a	19.9a	17.26
HA (2 L^{-1}) +1.5%K^+	26.68a	24.56a	3.65a	3.44a	20.05a	17.36
F test	**	**	**	**	*	Ns
LSD 0.05	4.00	3.30	0.31	0.37	1.08	-

DAP=di ammonium phosphate, K= potassium, N=nitrogen , Gibberellic acid, SA= salicylic acid, DAP=di ammonium phosphate and HA=humic acid.

Table 5. Effect of foliar spraying with some substances on number of filled grains panicle^{-1} and number of unfilled grains panicles^{-1} of Giza179 rice variety in 2017 and 2018 seasons

Traits	No of filled grains		No of unfilled grains	
Treatments	2017	2018	2017	2018
Control	89.3c	100.1c	23.75a	24.25a
DAP(1.5%)	101.9b	102.9bc	11.65b	11.90b
K^+ (1.5%)	109.7ab	108.2b	9.50bc	10.00bc
N+K^+ mix (1.5%) for each	108.3ab	106.8bc	11.7b	12.25b
GA_3(10ppm)+K^+ (1.5%)	108.9ab	107.9bc	11.3b	11.55b
SA(500ppm)+K^+ (1.5%)	109.9ab	107.9bc	8.00bc	12.00b
HA (2 L^{-1}) +1.5%K^+	118.05a	118.5a	6.00c	6.50c
F test	*	**	**	**
LSD 0.05	11.76	8.04	4.67	4.38

DAP=di ammonium phosphate, K= potassium, N=nitrogen , Gibberellic acid, SA= salicylic acid, DAP=di ammonium phosphate and HA=humic acid.

Foliar spray with mixture of humic acid +K significantly produced the greatest number of filled grains panicle^{-1} and the lowest value of unfilled grains panicle^{-1}in both seasons without significant difference with the treatments of (SA+K), (GA+K),(N+K) and (K). while DAP ranked the second order in the first season only. On the other side, potassium foliar spray ranked the second order in the second season followed by foliar spraying with (SA+K), (GA+K),(N+K) and DAP. Foliar spraying with humic acid +K significantly decreased number of unfilled grains panicle^{-1} as compared with control treatment which gave the highest number of unfilled grain panicle^{-1} during the two seasons (Table 5). Data in Table6 clarified that 1000-grain weight significantly improved with foliar spray using some chemical substances in both seasons as compared to control treatment. Foliar spraying with humic acid +K significantly produced the heaviest 1000-grain weight in both seasons, without significant difference with the treatments of (SA+K), (GA_3+K),(N+K) and (K) in both seasons and DAP in the first season only but, in the second season DAP ranked the second order. On the other hand, control treatment significantly produced the lightest 1000-grain weight in both seasons. Salinity effect may be due to reduced growth as a result of decreased water uptake, Na^+ and Cl^- toxicity in the shoot cell as well as reduced photosynthesis and salicylic, humic acids, Gibberellic acid and di ammonium phosphate with potassium enhanced the salt stress resistance of plants. similar data finding by El-Ekhtyar *et al* .,(2014) , Mohmed *et al*.,(2015) and Zayed *et al*.,(2016).

Yields:

Data documented in Table 6 clarified that foliar spraying with some chemical substances had a positive impact on grain yield, but it did not affect the biological yield in the two study seasons. Chemical substances foliar application during panicle initiation+ mid booting stages resulted in higher yield as compared with control treatment. The highest value of grain yield was produced

by foliar spray with humic acid +K without significant difference of (SA+K), (GA+K),(N+K) and (K). The second rank was in favor foliar spray with DAP in both seasons. (Chan *et al*., 2010) demonstrated that spraying nitro- humic acid at the rate of 6 litres/ha at 10% days of flowering and 10 days later significantly increased rice grain yield owing to increased panicle weight, 1000 -grain weight, filled grains/panicle and reducing sterility%. The increase in grain yield with foliar application of humic acid +K ,(SA+K), (GA_3+K),(N+K) and (K) may be due to the considerable increase in early growth, which reflected on higher grain yield attributes (number of panicles $hill^{-1}$, panicle weight, number of filled grains $panicle^{-1}$ and 1000-grain weight) and in turn increased grain yield. These results are confirmed with the findings of El-Ekhtyar *et al*. (2014) , Mohmed *et al*. (2015) , Zayed *et al*. (2016) and Su *et al*. (2018).

Table 6. Effect of foliar spraying with some substances on 1000-grain weight(gm), grain yield t $ha^{-1}$and biological yield t $ha^{-1}$of Giza179 rice variety during 2017 and 2018 seasons

Traits	1000-grain weight		Grain yield		Biological yield	
Treatments	2017	2018	2017	2018	2017	2018
Control	22.07c	22.97c	4.01c	3.98c	10.00	10.37
DAP(1.5%)	24.27ab	24.05b	4.46b	4.34b	11.30	11.55
K^+ (1.5%)	24.72ab	24.48ab	4.7ab	4.58ab	11.60	11.90
N+K^+ mix (1.5%) for each	24.15ab	24.60ab	4.81a	4.86a	12.75	11.50
GA_3(10ppm)+K^+ (1.5%)	24.37ab	24.60ab	4.70ab	4.65ab	11.50	11.25
SA(500ppm)+K^+ (1.5%)	24.67ab	24.67ab	4.73ab	4.78ab	12.50	11.63
HA (2 L^{-1}) +1.5%K^+	25.8a	25.20a	4.90a	5.05a	12.00	11.50
F test	*	*	**	**	Ns	Ns
LSD 0.05	1.49	1.02	0.30	0.48	-	-

DAP=di ammonium phosphate, K= potassium, N=nitrogen , Gibberellic acid, SA= salicylic acid, DAP=di ammonium phosphate and HA=humic acid.

Table 7. Effect of foliar spraying with some substances on hulling%, milling% and head rice% of Giza179 rice variety during 2017 and 2018 seasons

Traits	Hulling%		Milling%		head rice%	
Treatments	2017	2018	2017	2018	2017	2018
Control	77.66c	76.41b	65.00d	65.50d	46.47d	47.72d
DAP(1.5%)	79.16ab	77.41b	67.66c	68.66c	50.61c	50.01c
K^+ (1.5%)	79.5ab	78.25ab	70.33b	70.33b	53.08b	53.33b
N+K^+ mix (1.5% for each	79.66ab	79.91ab	71.16a	71.41a	54.31ab	55.81ab
GA_3(10ppm)+K^+ (1.5%)	78.0ab	78.5ab	69.33ab	69.58ab	54.32b	54.02b
SA(500ppm)+K^+ (1.5%)	78.66b	77.16b	68.6b	68.16b	53.2b	54.45b
HA (2 L^{-1}) +1.5%K	80.83a	80.83a	71.91a	72.66a	55.73a	56.81a
F test	**	*	**	*	**	**
LSD 0.05	2.75	2.90	1.17	1.35	2.15	2.02

DAP=di ammonium phosphate, K= potassium, N=nitrogen , Gibberellic acid, SA= salicylic acid, DAP=di ammonium phosphate and HA=humic acid.

Table 8. Effect of foliar spraying of some substances on amylose% and gelatinization% of Giza179 rice variety during 2017 and 2018 seasons

Traits	Amylose		Gelatinization	
Treatments	2017	2018	2017	2018
Control	16.00c	16.09c	3.50b	3.75c
DAP(1.5%)	16.66b	16.95b	3.75ab	4.00b
K (1.5%)	16.80b	17.05b	4.25ab	3.80c
N+K^+ mix (1.5%) for each	17.16ab	17.47ab	4.25ab	4.50ab
GA_3(10ppm)+K^+ (1.5%)	17.69a	17.90a	4.25ab	5.05a
SA(500ppm)+K^+ (1.5%)	16.86b	17.11b	3.75ab	4.00b
HA (2 L^{-1}) +1.5%K	17.68a	17.98a	5.00a	5.25a
F test	**	**	*	*
LSD 0.05	0.32	0.54	1.4	1.05

DAP=di ammonium phosphate, K= potassium, N=nitrogen , Gibberellic acid, SA= salicylic acid, DAP=di ammonium phosphate and HA= humic acid.

Grains quality characters:

Data related to hulling %, Milling%, head rice%, amylose and gelatinization of Giza179 rice variety as affected by foliar spray with some chemical substances at various growth stages in 2017and 2018 seasons are presented in Tables7 and 8. The superiority for the treatment of humic acid+K mixture was clear in all studied grains quality criteria and ameliorate the harmful effect of salinity by increasing the grains quality as compared with control treatment in the two seasons. The highest value of hulling% was noticed by foliar spraying with humic acid+K without significant difference with the mixture of N+K in all grain quality but with GA_3+K and K alone I some grain quality. The treatments of N+K mixture did not appear any significant difference with humic acid+K in increasing milling% and head rice% during the two seasons. The highest values of amylose content were produced by humic acid+K without significant difference with the treatments of GA_3+K, while the rest treatment except ranked the second order without significant differences among them in both study seasons. Applying chemical substances showed significant improvement in rice growth and rice grains quality as it is detected particularly humic plus potassium showed high significant positive effect in improving both

growth and grains quality of rice especially reducing rice broken%. The beneficial impact of those substances including humic might be attributed to its positive effect on improving rice growth salt tolerance, rising pre-heading and current heading photosynthesis as well as net assimilation rate and its translocation to rice grain. Furthermore, improving the net assimilation rate and its translocation enhanced grain filling and starch cell of endosperm showed significant improvement in rice grain quality, particularly reducing broken rice%. High net assimilation rate, more carbohydrate translocation from current photosynthesis and pre-heading photosynthesis, the highest starch and full filling of starch cell lead more head rice grain with less broken ones, because less chalkiness% that hold true with current investigation. Above all, the adding such chemical substances at late growth stages of rice in the terms of mid booting stage. Delaying early aging and prolonging active filling period resulted in apparent improvement of grain filling reflected on very grain quality. As for, humic acid+ K without significant difference with N+ K and K alone produced the highest value of gelatinization in the second season, but in the first season the chemical substances did not differ with control. Under stress conditions, plants produced grains containing aberrant starch, along with small granules and decreased levels of amylose and amylopectin, imitating a related phenotype. Globally, rice with intermediate amylose content is mostly preferred. Most importantly, the synthesis of storage carbohydrates, minerals, oils, and proteins during grain filling contribute to the nutritional value of rice. The abiotic stresses affect both rice production and quality. During the grains-filling stage, stress generates a deleterious influence on starch quality (Yamakawa *et al*., 2007).

The mixture of humic+ K and/ or mixture of N+K could be recommended for improving rice quality and productivity of Giza 179 under salt stress .

REFERENCES

Adair, C.R.(1952). The McGill miller method for determining the milled quality of small samples of rice .Rice J.,55(2):21-23.

Afzal, I.; M. Shahzad; B.N. Ahmad and M.F. Ahmad (2005). Optimization of hormonal priming techniques for alleviation of salinity stress in wheat (*Triticum aestıvumL.*). Caderno de Pesquisa Sér. Bio. Santa Cruz do Sul., 17:95-109.

Black, C.A., (1965). Methods of soil analysis part II. Amer. Soc. Agro. Madison, Wisconsin, USA.

Borsani, O.; V .Valpuesta and M. A. Botella (2001). Evidence for a role of salicylic acid in the oxidative damage generated by NaCl and osmotic stress in Arabidopsis seedlings. Plant Physiol., 126(3): 1024–1030.

Chan, C.S; N.C. Wong and A. M. Syahren (2010). Performance of formulated nitro humic acid-based rice grain booster J. Trop. Agric. and Fd. Sc., 38(2): 239–247

Chen, D.; T.A. Gunawardena; B.P. Naidu; S. Fukai and J. basnayake (2005). Seed treatment with gibberellic acid and glycinebetaine improves seedling emergence and seedling vigor of rice under low temperature. Seed Sci. and Tech., 33(2):471-479

Ding, C.K.; C.Y. Wang and D.L Smith (2002). Jasmonate and salicylate induce expression of pathogenesis-related protein genes and increase resistance to chilling injury in tomato fruit. Planta, 214: 895-901.

Duncan, D.B.(1955). Multiple range and multiple F. Test .Biometrics, 11:1-24.

El-Ekhtyar, A.M.; S.M. Bassiouni; B.B. Mikhael and W.M. Elkhoby (2014) Effect of gibberellic acid and potassium applications in improving salinity tolerance. Ale. sci. exch. j., 35: 1

Flowers, T. J. (2004). Improving crop salt tolerance. J. Exp.Bot., 55: 307–319.

Gavino, B. R.; Y. Pi and C. C. Abon (2008). Application of gibberellic acid (GA_3) in dosages for three hybrid rice seed production in the Philippines. J. of Agric.Tech., 4(1): 183-192

Gomez, K .A. and A.A Gomez (1984). Statistical procedures for agricultural research. 2nd Ed. John Wiley and Sons, New York, USA.

Hayat, Q.; S. Hayat; M. Irfan and A. Ahmad (2010). Effect of exogenous salicylic acid under changing environment: A review. Environ Exp Bot., 68(1): 14–25.

Heba, M.A.; M.M.I. Khalil; Y.S.El-Akshar and G.A.M. El-Sayed (2013) Effect of bio- organic fertilizers on barley plants in a saline soil. J. Appl. Sci. Res., 9(8): 5337-5343

Juliano B.O.(1971) . A simplified assay for milled rice amylose Cereal .Sci .Today 16: 334-338.

Khush, G.S. ; C.M. Paule and N. M. Dela-Cruze (1979) . Rice grain quality evaluation and improvement at IRRI, Workshop on chemical aspects of rice grain quality. IRRI. Manila, Philippines.

Krishnakumar, S.; R. Nagarajan; S. Natarajan; D. Jawahar and B. Pandian (2005). NPK fertilizers for hybrid rice (Oryza sativa L.) productivity in Alfisols of Southern Districts of Tamil Nadu. Asian J. of Plant Sci., 4(6): 574-576.

Laroo, N. and Y.S. Shivay (2011). Effect of nitrogen and sulphur levels on growth and productivity of scented rice. Current Advances in Agric. Sci., 3(1): 45- 48.

Lin, Q.M.; K.C. Zhang; J.G. Pan and Y.Q. Ke (1993). The effect of zinc foliar nutrient solution on rice yield and its mechanism. J.of Fijian Agric. College, 22(2):199-202.

Ma, H.; K.Chong and X .W. Deng (2007). Rice research: Past, present and future. J Integr Plant Biol, 49: 729–730

Mohamed, A.A.; B.A.Zayed; S.Gh.R. Sorour and Amira M. Okasha (2015). Effect of foliar spray of antioxidants on rice growth under saline soil conditions. J.Agric.Res.Kafr El-Sheikh Univ.,41(1)

Osman, E. A. M.; A. A. EL- Masry and K. A. Khatab(2013). Effect of nitrogen fertilizer sources and foliar spray of humic and/or fulvic acids on yield and quality of rice plants Pelagia Research Library Advances in Applied Science Research, 4(4):174-183

Rafique, N.; H. Raza; M. Qasim and N. Iqbal (2011). Pre-sowing application of ascorbic acid and salicylic acid to seed of pumpkin and seedling response to salt. *Pak.* J. Bot., 43: 2677-2682.

Reyhaneh F.E.; P. Rahdari; H. Shokri Vahed; P. Shahinrokhsar and S.Babazadeh(2012). Rice response to different methods of potassium application under salinity stress condition American-Eurasian J. Agric. & Environ. Sci., 12 (11): 1441-1445

Su. M.Y.; S. S. Mar; A. A. Than and K. Sa (2018). Effect of nitrogen and potassium on yield and yield components of rice https:// www.researchgate. net/publication/328474616

Tang, X.R. and T.Q. Yu (2002). Effects and mechanisms of P and K nutrients on yield and protein content of fodder rice. Agricultural Sciences in China, 1(4):432-437.

Yamakawa, H.; T.Hirose; K.Kuroda and M.T. Yamaguchi (2007). Comprehensive expression profiling of rice grain filling-related genes under high temperature using DNA microarray. Plant Physiol., 144: 258277.

Zayed, B.A.; Amira M.okasha; M.M.Abdelhameed and G.A. Deweeder (2016). Effect of different phosphorous sources on Egyptian hybrid one productivity under two types of salt soils. The 6 th conference of field crops research, 22-23Nov., FCRi ARC, Egypt

تحسين جوده الحبوب و المحصول للصنف جيزة 179 باستخدام رش بعض الكيماويات في مراحل متأخرة تحت ظروف الإجهاد الملحي

أميرة محمد السعيد عكاشة ، محمد محمد عبد الحميد و أمنيه محروس الشايب

مركز البحوث و التدريب في الأرز – معهد بحوث المحاصيل الحقلية – سخا – كفر الشيخ – مركز البحوث الزراعية – مصر.

أقيمت تجربتان حقليتان بمحطة بحوث السرو الزراعية –دمياط لموسمي 2017 و 2018 . الهدف الرئيسي لهذه التجربة تحديد تأثير الرش الورقي ببعض المواد الكيماوية و السمادية خلال مرحله بداية تكوين السنبلة و مرحله منتصف الجنبله علي جوده حبوب الأرز و النمو و المحصول للصنف جيزة 179 . أقيمت هذه التجربة في تصميم القطاعات الكاملة العشوائية في أربعة مكررات وتضمنت المعاملات 1- المعاملة الكنترول بدون أي أضافه 2- الرش بالداي امونيوم فوسفات2% 3- الرش بالنتروجين و البوتاسيوم كمخلوط بتركيز 1.5% لكل عنصر 5- الرش بحمض الجبريللك اسد(10 جزء في المليون) +و البوتاسيوم (1.5%) 6- الرش بحمض السلسيلك 250 جز ء في المليون+ البوتاسيوم(1.5%)و 7- الرش بالهيومك اسد(1.5 كجم/فدان) + البوتاسيوم كانت مستويات الملوحة لأرض التجربة كانت8.4 و8.5 ملليموز /سم في كلا موسمي الدراسة علي التوالي. كانت اهم النتائج المتحصل: وجد أن المواد التي تم رشها في كلا موسمي الدراسة أثرت بصورة معنوية و ايجابيه علي صفات الجودة و المحصول و مكوناته مقارنة بالكنترول(المعاملة بدون رش). ووجد أن الرش بمخلوط الهيومك اسد و البوتاسيوم عند مرحله بداية تكوين السنبلة و مرحله منتصف مرحله الحنبلة أعطي اعلى القيم لمساحه ورق العلم ودليل مساحة الورقة و محتوي الكلوروفيل و عدد أيام من الزراعة حتى الطرد و طول النبات و والسنبلة ووزن السنبلة و عدد الأفرع و عدد السنابل و عدد الحبوب الممتلئة ووزن الألف حبة و محصول الحبوب و اعلي نسبه تقشير و تبيض و حبوب سليمة و اميلوز بدون فرق معنوي مع المعاملات مخلوط الجبريلك+بوتاسيوم و مخلوط حمض السلسيلك + بوتاسيوم ومخلوط النتروجين + بوتاسيوم . وفي معظم الصفات وجد أن مخلوط الهيومك مع البوتاسيوم و مخلوط النتروجين مع البوتاسيوم كان علي نفس الدرجة من المعنوية في نسبه التبييض و الحبوب السليمة في كلي موسمي الدراسه. بينما تلي تلك المعاملات البوتاسيوم منفردا ثم الداي أمونيوم فوسفات. علي الجانب الأخر وجد أن معامله الكنترول بدون رش أي مواد أعطت اقل القيم في كل الصفات المذكورة و أعلاها في الحبوب الفارغة. ويكمن التوصية بالرش بالهيومك اسد مع البوتاسيوم أو البوتاسيوم مع النتروجين لتحسن الإنتاجية و الجوده لصنف الأرز جيزة 179 تحت مثل هذه الظروف او الظروف المماثله.