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INFLUENCE OF SOME STIMULATING COMPOUNDS AND NITROGEN FERTILIZER LEVELS ON GROWTH AND YIELD OF HYBRID RICE

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ABSTRACT

Two field experiments were carried out at the farm of the Rice Research and Training Center (RRTC), Sakha, Kafrelshiekh, Egypt, during 2008 and 2009 rice growing seasons, to determine the effect of some stimulating compound applications and nitrogen fertilizer levels on growth and yield of Hybrid 1 (Egyptian hybrid rice). Nitrogen fertilizer levels were (50,100, 150 and 200 kg N ha^{-1}). Stimulating compounds were ascorbic acid, ascobien (13% citric acid, 25% ascorbic acid plus 62% organic materials), hammer (86% humate potassium), pepton (85% amino acid + 12% organic nitrogen + 3% k_2o) and water as a control. All these compounds were applied twice with the concentration of 1g/litre as a foliar application at 25 and 40 days after transplanting.

Increasing nitrogen level from 50 to 200 kg N ha^{-1} caused significant increase in each of plant height (cm), dry weight (g/m^2), number of tillers hill^{-1}, number of panicles hill^{-1}, panicle weight, panicle length, number of filled grains panicle^{-1}, number of unfilled grains panicle^{-1}, grain and straw yields and nitrogen uptake by grains in both seasons. The levels of 150 and 200 kg N ha^{-1} were statistically at par in most growth measurements and yield attributes in both seasons. The highest grain yield was obtained due to the application of 200 kg N ha^{-1} in both seasons.

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Foliar application of ascobien caused significant increase in each of plant height (cm), dry weight (g/m^2) and number of tillers $hill^{-1}$, number of panicles $hill^{-1}$, panicle weight, number of filled grains $panicle^{-1}$, number of unfilled grains $panicle^{-1}$, 1000-grains weight, grain and straw yields and N uptake compared with other stimulating compounds in both seasons. The differences among foliar spraying with ascorbic acid, humic acid, pepton and water (control) were not significant in most studied traits in both seasons.

The interaction between nitrogen level and stimulating compounds had a significant effect on grain yield in the two seasons.

It can be concluded that, nitrogen level 150 kg N per hectare and foliar application with ascobien could be recommended for optimum grain yield of Hybrid1 at Kafrelshiekh Governorate. This result indicated that foliar application of ascobien can be saved 50kg N ha^{-1} without reduce grain yield.

Keywords: Nitrogen levels, amino acid, humic acid, ascorbic acid, citric acid, foliar application, hybrid rice.

INTRODUCTION

Rice is considered the main food stable for more than 50% of the world's population (Childs, 2004). Because of the importance of rice for supplying food, there is a demand for higher grain yield per unit area. It has been suggested that by 2025, global rice production must increase by more than 50% for mid-1990 levels to meet that demand (Peng and Yang, 2003 and Walker *et al.,* 2008). Optimizing grain yield, reducing production costs and minimizing pollution risks to the environment are considered as the most important in rice production world wide (Koutroubas and Natos, 2003).

Humic acid (HA) is one of the major component of humus. It can be applied directly to the plant foliage in liquid form or to the soil in the form of granules. Humates are natural organic substances, high in humic acid and containing most of known trace minerals necessary to the development of plant life (Senn, 1991). Addition of humic acid enhanced the uptake of N in rice (Govindasamy and Chandrasekaran, 2002 and Bama *et al.,* 2004). Foliar application of humic acid increased the yield of rice (Sivakumar and Devarajan, 2005 and Bing *et al.,* 2009); wheat (Sebastiano *et al.,* 2005) and faba bean (El-Ghamry *et al.,* 2009).

Amino acids as organic nitrogenous compounds are the building blocks in the synthesis of proteins, Davies (1982). The amino acids are particularly important for stimulation cell growth. It is absorbed by the cells as such, and is simply fed into the metabolic machinery of the cell. The important of amino acids came from their widely use for the biosynthesis of large variety of non protein nitrogenous materials i.e., pigments, vitamins, coenzymes, Purine and pyrimidine bases, (Goss, 1973 and Hass, 1975). Studies have proved that amino acids can directly or indirectly influences the physiological activities in plant growth and development. Foliar application of amino acids caused an enhancement in plant growth, yield and its components as reported by Seadh *et al.* (2008) on wheat; El-Ghamry *et al.* (2009) on faba bean and Shaheen *et al.* (2010) on onion.

Ascorbic acid has effects on many physiological processes including the regulation of growth and metabolism of plants (Foyer, 1993). Ascorbic acid is small, water-soluble molecule, which acts as a primary substrate in the cycling pathway for detoxification and neutralization of superoxide radicals and singlet oxygen (Noctor and Foyer, 1998 and Smirnoff, 2005). These free radicals may cause oxidative stress resulting in cellular damage by oxidation of lipids, proteins and nucleic acids so, ascorbic acid protect metabolic processes, (Noctor and Foyer 1998). Also, latter has important role in vital process in plant growth such as cell division and cell wall expansion (Pignocchi and Foyer, 2003). Moreover, ascorbic acid plays important role in ascorbate-glutathione pathway and scavenges reactive oxygen species in chloroplast (Foyer and Harbinson, 1994). Ascorbic foliar application increased the yield of some crops as found by Ghourab and Wahdan (2000) and El-Shazly and El-Masri (2003) on cotton, Abd El-Hameed *et al.* (2004) on wheat, Taha (2008) on rice.

Nitrogen fertilizer is more urgent for security rice production. Many investigators studied the important of nitrogen fertilizer levels. Rahman *et al.* (2008) found that the maximum grains/panicle and grain yield were obtained with 80 kg N ha^{-1} while nitrogen level 100 kg N ha^{-1} gave the highest straw yield. Higher number of tillers and plant height were obtained when 80 kg N ha-1 was applied compared to the application of 0, and 160 kg N ha^{-1} (Ogbodo *et al.*, 2010). Gorgy (2010) reported that grain yield of hybrid rice increased with application of nitrogen up to 165 kg/ha but dry weight, number of panicles/m^2 and straw yield increased with the N application up to 220 kg/ha. Mikhael (2010) found that increasing nitrogen up to 220 kg N ha^{-1} increased number of panicle/m^2, filled grains, 1000-grains, grain and straw yields and N uptake in grains of hybrid rice.

The objective of current study was to determine the influence of some stimulating compounds application and nitrogen fertilizer level on growth and yield of hybrid rice (Hybrid 1)

MATERIALS AND METHODS

Two field experiments were carried out at the farm of the Rice Research and Training Center (RRTC), Sakha, Kafrelshiekh, Egypt, during 2008 and 2009 rice growing seasons. The experiments were conducted to study the effect of four stimulating compounds plus control under four nitrogen levels on growth and yield and its component of the registered Hybrid1 (Egyptian hybrid rice) under transplanting conditions.

The previous crop was barely 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 design was split plot with four replications. The main plots were assigned to nitrogen fertilizer levels, while the sub-plots were assigned to stimulating compounds foliar applications. Nitrogen fertilizer was used at levels of 50,100,150 and 200 Kg N. h^{-1} in the form of urea (46.5% N). Urea was added in three equal splits application (at basal application before transplanting, 30 and 60 days after transplanting).

Foliar application treatments were 1- control (Tab water), 2- ascorbic acid, 3- ascobien (13% citric acid, 25% ascorbic acid plus 62% organic materials) 4- hammer (86% humate potassium), 5- pepton (85% amino acids + 12% organic nitrogen + 3.5% k_2o). All these compounds were applied twice with the concentration of 1g/litre as a foliar application at 25 and 40 days after transplanting.

Table 1. Some chemical properties of the soil in the experimental sites

Characters	2008	2009
Texture	Clay	Clay
pH	7.7	8.1
EC (ds/m)	1.83	2.3
OM(%)	1.4	1.5
Ca^{++} (meq. L^{-1})	4.80	4.43
Mg^{++} (meq. L^{-1})	5.01	5.12
K^{+} (meq. L^{-1})	4.70	4.68
Available K mg kg^{-1}	350	363
Available P mg kg^{-1}	13	16.5
Total nitrogen , mg kg^{-1}	450	560
Available Zn mg kg^{-1}	0.71	0.93
Available Fe mg kg^{-1}	4.98	6.12
Available Mn mg kg^{-1}	2.29	3.60

Seeds at the level of 24 kg ha^{-1} were soaked in water for 24 hr then incubated for 48hr to hasten early germination. Pre-germinated seeds were uniformly broadcasted in the nursery on 7th and 1st May of the two seasons, respectively.

The permanent field was well prepared, i.e. plowed twice followed by good wet leveling. Seedlings were carefully pulled from the nursery after 30 days from sowing and distributed through the plots. Seedlings were manually transplanted into 15 m^2 subplots in 20X20 cm spacing at the level of 2-3 seedlings/hill. Seven days after transplanting the herbicide Saturn 50% [S-(4-Chlorophenol methyl) diethyl carbamothioate] at the level of 4.8L ha-1 was mixed with enough sand to make it easy for homogenous distribution. Plots were kept flooded till 2-3 weeks before harvesting. All other agronomic practices were followed as recommended.

Plant sample (five hills each) were taken randomly from each plot at heading to estimate the Plant height (cm), Dry matter (g/m^2) and number of tillers per hill. At harvest, number of panicles per hill were counted. Ten panicles were collected randomly to estimate the panicle weight (g), panicle length (cm), number of filled grains and unfilled grains per panicle and 1000-grains weight.

The total weight of both grain and straw was recorded as tons per hectare. The weight of grains was adjusted to 14% moisture content. Rough rice nitrogen content was determined according to the standard Kjeldahl method. Nitrogen uptake by grain yield kg. ha^{-1} was calculated. Nitrogen uptake in rice grains kg ha^{1}= grain yield (kg/ha) x nitrogen % in rice grains.

The obtained data were subjected to analyses of variance according to Gomez and Gomez (1984). Treatment means were compared by Duncan's Multiple Range Test (Duncan, 1955). All statistical analysis was performed using analysis of variance technique by means of "MSTATC" computer software package.

RESULTS AND DISCUSSION

Growth

Means of plant height, dry weight per m^2 and number of tillers per hill of hybrid rice cv. Hybrid 1 as affected by nitrogen levels and foliar spraying of stimulating compounds in 2008 and 2009 are presented in Table 2.

Effect of nitrogen levels

Increasing nitrogen level from 50 to 200 kg N ha^{-1} causd a significant increase in plant height, dry weight m^{-2} and number of tillers $hill^{-1}$ in the two seasons.

A significant increase in plant height was accompanied with each increment of applied nitrogen in the 2^{nd} season. The levels of 150kg and 200 kg N ha^{-1} were statistically at par in dry weight m^{-2} and number of tillers $hill^{-1}$ in the two seasons. Such effect of nitrogen could be attributed mainly to its indirect role in the stimulation of various physiological processes including cell division and cell elongation of internodes, promoting more tillers formation, leaf numbers and photosynthetic area (leaf area), which caused in more photosynthetic production and consequently increased dry matter accumulation.

These promoting effects of nitrogen on plant height and number of tillers were reported by Manzoor *et al.* (2006), Hossain *et al.* (2008), Mannan *et al.* (2010) and Mikhael (2010). In this respect, Hegazy (2007) and Rahman *et al.* (2007) found that increasing nitrogen level increased dry weight (g m^{-2}) and number of tillers of rice sown after wheat.

Table 2. Plant height, dry weight and tillers number of hybrid rice cv. Hybrid 1 as affected by nitrogen levels and stimulating compounds in 2008 and 2009 seasons

Treatments	Plant height (cm)		Dry weight (g m^{-2})		Tillers (No hill^{-1})	
	2008	2009	2008	2009	2008	2009
Nitrogen fertilizer level (Kg/ha)						
50	93.28c	95.93d	726.6c	888.6c	22.83c	24.63c
100	93.36c	98.98c	848.8b	987.2b	24.62b	26.82bc
150	101.95b	101.93b	982.7a	1044.2a	26.42a	28.85ab
200	106.4a	104.30a	1005.2a	1091.0a	27.11a	30.55a
F-test	**	**	*	*	*	*
Stimulating compounds						
Control (water)	97.11c	98.33b	845.4b	941.3b	24.59b	25.13c
Ascorbic acid	99.78b	100.21b	880.3b	947.5b	24.58b	27.06b
Ascobien	103.00a	103.48a	1017.6a	1168.1a	27.79a	32.81a
Humic acid	98.30bc	99.72b	862.5b	980.3b	24.68b	27.69b
Pepton	98.86bc	99.68b	848.2b	976.6b	24.58b	25.87c
F-test	*	*	*	**	*	*
Interaction	N.S.	N.S.	*	*	*	**

*,** and N.S. indicate $P < 0.05$, $P < 0.01$ and not significant, respectively. Means of each factor designated by the same latter are not significantly different at 5% level using Duncan's Multiple Range Test.

Effect of stimulating compounds

Foliar application of stimulating compounds had a significant effect on plant height, dry weight m^{-2} and number of tillers hill^{-1} in both seasons. Plants sprayed with ascobien significantly exceeded those sprayed with water (control) or the other stimulating compounds in the two seasons. There were no significant differences among plants sprayed with water, ascorbic acid, humic acid and pepton in plant height, dry weight m^{-2} and number of tillers hill^{-1} in both seasons. The stimulating effect of ascobien (13% citric acid, 25% ascorbic acid plus 62% organic materials) on these growth traits may be due to auxinic action of both ascorbic and citric acid on enhancing cell division and cell enlargement which reflected positively on number of tillers, plant height and dry matter accumulation. These results are in agreement with those obtained by Taha, (2008), who found that foliar spraying with ascobien at the beginning of rice tillering stage resulted in a significant increase in dry matter accumulation and number of tillers/m^2 of rice compared with the control treatment. She added that foliar spraying with ascobien at different growth stages revealed no significant difference in plant height at harvest in both seasons. In this respect, Abd El-Hameed *et al* (2004), on wheat, reported that spraying citric and ascorbic acids at 1500 ppm increased plant height.

Effect of interaction

Interaction had insignificant effect on plant height in the two seasons (Table 2). However, dry weight m^{-2} and number of tillers $hill^{-1}$ were significantly influenced by the interaction between nitrogen levels and stimulating compounds in the two seasons.

Data in Table 3 show that plants received 150 or 200 kg N ha^{-1} along with ascobien produced higher dry weight m^{-2} and number of tillers $hill^{-1}$ than those of other combinations of nitrogen level and stimulating compounds in both seasons.

Yield Attributes

Means of panicle numbers/hill, panicle weight, panicle length, filled grains, unfilled grains and 1000 grains weight of hybrid rice cv. Hybrid 1 as affected by nitrogen levels and foliar application of stimulating compounds in 2008 and 2009 are presented in Tables 4 & 5.

Effect of nitrogen levels

Most of yield attributes were significantly affected by nitrogen levels in both seasons. Number of panicle $hill^{-1}$, panicle weight, number of filled grains $panicle^{-1}$ and number of unfilled grains $panicle^{-1}$ were increased by increasing nitrogen level from 50 to 200 kg N ha^{-1} in the two seasons, except panicle length in the first season, only. The inverse was true in 1000-grains weight in both seasons.

No significant differences were found between the two higher nitrogen levels in number of panicle m^{-1}, panicle weight, panicle length and number of filled grains $panicle^{-1}$ in the two seasons. However, the two

Table 3. Dry weight (g/m^2) and tillers number of hybrid rice cv. Hybrid 1 as affected by the interaction between nitrogen levels and stimulating compounds in 2008 and 2009 seasons

Stimulating compounds	Nitrogen fertilizer level (Kg/ha)	Dry weight (g m^{-2})		Tillers (No hill^{-1})	
		2008	2009	2008	2009
Control (water)	50	700.3jk	782.6gh	21.5h	22.9f
	100	779.8ghj	904.6f	23.5e-h	24.1def
	150	933.2de	1035.4cde	26.4bc	26.0b-e
	200	968.3cde	1042.5cde	26.7bc	27.5bc
Ascorbic acid	50	724.3jk	886.9fg	22.3gh	24.7def
	100	787.3ghj	953.9e	24.1d-g	26.7bcd
	150	927.7de	927.7f	26.2bcd	27.7bc
	200	1082.0ab	1021.4cde	25.6bc	29.0b
Ascobien	50	802.7gh	1045.9cde	23.6e-h	26.2b-e
	100	1037.0abc	1160.0ab	27.2b	28.7bc
	150	1116.5a	1205.1a	29.5a	36.0a
	200	1114.2a	1261.4a	30.7a	40.0a
Humic acid	50	739.4g-k	769.9h	23.7efg	25.7c-f
	100	822.6fg	989.1c-f	23.3e-h	28.0bc
	150	937.1de	1076.0bcd	24.8c-f	28.7bc
	200	951.1cde	1086.1bc	26.7bc	28.2bc
Pepton	50	666.3k	957.8e	22.8fgh	23.5ef
	100	817.2g	928.3f	24.8c-f	26.5b-e
	150	999.0bcd	976.9de	25.0cde	25.7cdf
	200	910.3ef	1043.3cde	25.5b-e	27.7bc

In each column means followed by a common letter are not significantly different at the 5% level by DMRT

Table 4. Number of panicles per hill, panicle weight and panicle length of hybrid rice cv. Hybrid 1 as affected by nitrogen levels and stimulating compounds in 2008 and 2009 seasons

Treatments	Panicles (No hill^{-1})		Panicle weight (g)		Panicle length (cm)	
	2008	2009	2008	2009	2008	2009
Nitrogen fertilizer level (Kg/ha)						
50	19.02b	20.07c	3.43c	3.47b	21.03c	21.79
100	20.60ab	21.01b	3.80b	3.73ab	21.94bc	22.34
150	21.47a	23.34a	4.30a	3.91a	22.39ab	22.65
200	21.73a	24.14a	4.28a	3.99a	22.49a	22.67
F-test	*	**	**	*	*	N.S.
Stimulating compounds						
Control	20.19b	19.89c	3.97b	3.50c	21.83	22.18
Ascorbic acid	20.53b	21.83b	3.93b	3.67bc	21.88	22.38
Ascobien	21.86a	25.00a	4.31a	4.25a	21.84	22.83
Humic acid	20.25b	22.23b	3.90bc	3.83b	21.97	22.33
Pepton	20.69b	21.73b	3.65c	3.62bc	22.29	22.11
F-test	*	*	*	*	N.S.	N.S.
Interaction	*	**	N.S.	N.S.	N.S.	N.S.

*,** and N.S. indicate $P< 0.05$, $P<0.01$ and not significant, respectively. Means of each factor designated by the same latter are not significantly different at 5% level using Duncan's Multiple Range Test

Table 5. Number of filled and unfilled grains per panicle and 1000-grain weight of hybrid rice cv. Hybrid 1 as affected by nitrogen levels and stimulating compounds in 2008 and 2009 seasons

Treatments	Filled grains (No/panicle)		Unfilled grains (No/panicle)		1000-grain weight (g)	
	2008	2009	2008	2009	2008	2009
Nitrogen fertilizer level (Kg/ha)						
50	135.5c	163.9c	6.0d	6.3d	24.9a	23.8a
100	165.0b	171.7b	8.3c	7.5c	24.9a	23.7a
150	170.8ab	176.6ab	9.9b	9.2b	23.94b	23.1b
200	178.4a	184.9a	10.5a	11.3a	23.4b	22.8b
F-test	**	**	**	**	*	*
Stimulating compounds						
Control	153.4c	166.9 b	7.9cd	8.2b	24.0b	23.2b
Ascorbic acid	158.0b	168.4b	7.5d	8.3b	24.2ab	22.9b
Ascobien	181.5a	195.8a	10.6a	10.3a	24.9a	24.8a
Humic acid	160.1b	169.0b	8.5bc	7.7b	24.1b	23.0b
Pepton	159.2bc	171.2b	9.0b	8.3b	24.2ab	22.9b
F-test	*	*	*	*	*	*
F test of interaction	N.S.	N.S.	N.S.	N.S.	*	**

*,** and N.S. indicate $P < 0.05$, $P < 0.01$ and not significant, respectively. Means of each factor designated by the same latter are not significantly different at 5% level using Duncan's Multiple Range Test.

lower nitrogen levels (50 and 100 kg N ha^{-1}) caused significant increase in 1000-grains weight compared with the two higher levels. Such result indicates that, with higher nitrogen level, more tillers develop a panicle. The reduction in 1000-grains weight may be due to excessive content of nitrogen in plant, may really be due to a shortage of carbohydrate supplied per grain which is directly caused by an excessive number of grains produced by heavy N fertilization. Similar findings were reported by Manzoor *et al.* (2006); Hegazy (2007); Rahman *et al.* (2007); Hossain *et al.* (2008); Mannan *et al.* (2010) and Mikhael (2010).

Effect of stimulating compounds

Foliar application of stimulating compounds exerted a significant effect on all yield attributes except panicle length in the two seasons. Foliar application of ascobien caused significant increase in number of panicles hill^{-1}, panicle weight, number of filled grains panicle^{-1}, number of unfilled grains panicle^{-1} and 1000-grains weight compared with control and other stimulating compounds in both seasons. The differences among foliar application with ascorbic acid, humic acid, pepton and water (control) were not significant in most yield attributes. The increase in all yield attributes with foliar application of ascobien was possibly due to promote the growth of hybrid rice (number of tillers and dry matter accumulation). These results are confirmed with the findings of Taha (2008).

Effect of interaction

The interaction between nitrogen level and stimulating compounds had a significant effect only on number of panicle hill^{-1} and 1000-grain weight in the two seasons. Data in Table 6 show that addition of 150 or 200 kg N ha^{-1} along with foliar application of ascobien increased number of panicles per hill compared with the other combinations in both seasons. The relative ranking of the interaction between nitrogen levels and stimulating compounds for 1000-grain weight was inconsistent in both seasons. Rice plants received 150 or 200 kg plus foliar ascobien were among those having high 1000-grain weight, being insignificant, in both seasons.

Grain and Straw Yields

Means of grain and straw yield ha^{-1} of hybrid rice cv. Hybrid 1 as affected by nitrogen levels and foliar application of stimulating compounds in 2008 and 2009 are presented in Table 7.

Effect of nitrogen levels

There was a substantial difference in grain and straw yields (t ha^{-1}) obtained among nitrogen levels in both seasons. Increasing nitrogen level from 50 to 200 kg N per hectare caused significant progressive increase in grain and straw yields. The levels of 150kg and 200 kg N ha^{-1} were statistically

Table 6. Number of panicles per hill and 1000-grains weight of hybrid rice cv. Hybrid1 as affected by the interaction between nitrogen levels and Stimulating compounds in 2008 and 2009 seasons

Stimulating compounds	Nitrogen fertilizer level (Kg/ha)	Panicles (No hill^{-1})		1000-grains weight (g)	
		2008	2009	2008	2009
Control	50	19.00h	18.17g	24.15a-f	23.34efg
	100	19.56fgh	19.67f	25.26ab	23.33efg
	150	15.67c-f	20.67def	23.65c-g	22.85fgh
	200	16.56b-e	21.07def	23.21d-g	23.54efg
Ascorbic acid	50	19.00h	20.67def	25.39ab	24.00cde
	100	20.33e-h	21.17de	25.38ab	23.94cde
	150	21.78bcd	22.83bc	23.82b-g	22.13hj
	200	21.00b-e	22.67bc	22.48g	21.56j
Ascobien	50	19.11gh	20.83def	24.26a-e	24.35bcd
	100	22.00bc	21.83cd	24.92a-d	24.67abc
	150	22.78ab	28.00a	25.09abc	24.99ab
	200	23.55a	29.33a	25.67a	25.26a
Humic acid	50	19.00h	20.83def	25.49a	23.90cde
	100	20.67c-f	21.67cd	24.14 a-f	23.61efg
	150	20.56def	22.60bc	23.64 c-g	22.89fgh
	200	20.78c-f	23.83b	23.19efg	21.65j
Pepton	50	19.00h	19.83ef	25.38ab	23.84de
	100	20.43d-g	20.70def	25.04abc	23.16efg
	150	21.56b-e	22.60bc	23.54c-g	22.76gh
	200	21.77bcd	23.80b	22.92fg	22.10h

In each column means followed by a common letter are not significantly different at the 5% level by DMRT.

Table 7. Grain and straw yields and N uptake by grains of hybrid rice cv. Hybrid1 as affected by nitrogen levels and stimulating compounds in 2008 and 2009 seasons

Treatments	Grain yield ($t\ ha^{-1}$)		Straw yield ($t\ ha^{-1}$)		N uptake ($kg\ N\ ha^{-1}$)	
	2008	2009	2008	2009	2008	2009
Nitrogen fertilizer level (Kg/ha)						
50	7.66d	8.05d	10.09c	10.27c	79.9c	85.7c
100	8.95c	9.74c	13.43b	11.10b	103.9b	106.2b
150	9.83b	10.33b	14.41a	12.85a	110.2b	120.2a
200	10.40a	11.05a	14.58a	13.06a	116.8a	124.7a
F-test	**	**	**	**	*	*
Stimulating compounds						
Control	8.51c	9.36b	12.74b	11.89ab	95.7b	89.8c
Ascorbic acid	9.03b	9.47b	13.42ab	11.93ab	97.9b	110.2b
Ascobien	9.88a	10.97a	13.66a	12.42a	114.0a	130.6a
Humic acid	9.29b	9.63b	13.16ab	11.32b	101.8b	108.4b
Pepton	9.34b	9.52b	12.66b	11.56b	104.2b	107.1b
F-test	**	**	*	*	*	*
Interaction	**	**	N.S.	N.S.	N.S.	N.S.

*,** and N.S. indicate $P< 0.05$, $P<0.01$ and not significant, respectively. Means of each factor designated by the same latter are not significantly different at 5% level using Duncan's Multiple Range Test.

at par in straw yield in the two seasons. Thus, the high nitrogen level increased grain yield through increasing number of panicles $hill^{-1}$, panicle weight and number of filled grains $panicle^{-1}$. The 1000-grain weight appeared to be independent of grain yield. However, the increase in straw yield by increasing nitrogen level was due to the increase in growth, i.e. plant height, the number of tillers per hill and dry weight per unit area. Similar conclusion was previously drawn by Chopra and Chopra (2004); Singh *et al.* (2004) and Mhaskar *et al.* (2005). Similar increase in grain yield due to nitrogen fertilization was reported by Manzoor *et al.* (2006); Hegazy

(2007); Rahman *et al.* (2007); Hossain *et al.* (2008); Mannan *et al.* (2010) and Mikhael (2010).

Effect of stimulating compounds

Grain and straw yields (t ha^{-1}) were significantly affected by foliar application of stimulating compounds in both seasons. The relative ranking of stimulating compounds treatments for straw yield was inconsistent in the two seasons. Plants sprayed with ascobien and ascorbic acid were among those having high straw yield, being insignificant, in both seasons. The plants treated with ascobien outyielded control and the other stimulating compounds plants in grain yield per hectare in both seasons. This may be due to the considerable increase in early growth which reflected in higher grain yield attributes (number of panicles $hill^{-1}$, panicle weight, number of filled grains $panicle^{-1}$ and 1000-grains weight) and in turn increased grain yield. A positive association between foliar application of ascobien and grain yield has been reported by Taha, (2008).

Effect of interaction

The interaction between nitrogen level and stimulating compounds had a significant effect on grain yield in the two seasons. Data in Table 8 show that addition of 150 or 200 kg N ha^{-1} along with foliar ascobien produced the highest grain yield in the two seasons. The lowest grain yield was obtained by of 50 kg N ha^{-1} and foliar application with water in both seasons. This result indicated that foliar application of ascobien can be saved 50 kg N ha^{-1} without reduction in grain yield.

Nitrogen Uptake by Grain

Means of N uptake by grain (Kg N ha^{-1}) of hybrid rice cv. Hybrid 1 as affected by nitrogen levels and foliar of stimulating compounds in 2008 and 2009 are presented in Table 7.

Effect of nitrogen levels

Increasing nitrogen levels from 50 to 150 kg N ha^{-1} caused significant progressive increase in N uptake by grain in both seasons. Further addition of nitrogen was without significant effect. These results are in agreement with those of Kumar and Prasad (2004).

Effect of stimulating compounds

Nitrogen uptake (kg N ha^{-1}) was significantly affected by foliar application of stimulating compounds in both seasons. Foliar application of ascobien caused significantly more nitrogen uptake than the other

Table 8. Grain yield (t ha^{-1}) as affected by the interaction between nitrogen levels and Stimulating compounds in 2008 and 2009 seasons

Nitrogen fertilizer level (Kg/ha)	Stimulating compounds				
	Control	Ascorbic acid	Ascobien	Humic acid	Pepton
			2008 season		
50	7.14h	7.65g	7.91g	7.89g	7.69g
100	8.68f	8.95f	9.15def	8.91f	9.07ef
150	8.73f	9.49de	11.21a	9.79cd	9.93cd
200	9.50de	10.03c	11.25a	10.55b	10.66b
			2009 season		
50	7.93j	8.03ij	8.42h	8.11hi	7.76j
100	9.25g	9.66f	10.43d	9.66f	9.71ef
150	9.53fg	9.77ef	12.48a	9.89ef	9.99e
200	10.73bc	10.43cd	12.56a	10.86b	10.63bcd

Means followed by a common letter are not significantly different at the 5% level by DMRT.

stimulating compounds treatments in both seasons. This may be due to the considerable increase in grain yield.

Effect of interaction

None of the interactions had a significant effect on nitrogen uptake in the two seasons.

Conclusion

It can be concluded that application of 150kg N ha^{-1} in combined with ascobien as foliar application could be recommended for optimum grain yield of hybrid rice cv. Hybrid1 at Kafrelsheikh Governorate. This result indicated that foliar application of ascobien can be save 50 kg N ha^{-1} without reduction in grain yield.

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تأثير بعض المركبات المحفزة للنمو و معدلات السماد النتروجينى على نمو ومحصول الأرز الهجين

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أجريت تجربتان حقليتان بالمزرعة البحثية بمركز البحوث و التدريب بسخا – كفر الشيخ، فى موسمى ٢٠٠٨ و٢٠٠٩، لدراسة تأثير بعض المركبات المحفزة للنمو و معدلات السماد النتروجينى على النمو و محصول صنف الارز الهجين "هجين١". كانت معدلات السماد النتروجينى (٥٠، ١٠٠، ١٥٠و٢٠٠ كجم ن للهكتار) والمركبات المحفزة للنمو هى حمض الاسكوربيك و مركب الاسكوبين (١٣% حمض ستريك + ٢٥% حمض اسكوربيك + ٦٢% مواد عضوية) ومركب هامر (٨٦% هيومات بوتاسيوم) و مركب بيبتون (٨٥% أحماض أمينية + ١٢% نتروجين عضوى + ٣% بو٢ أ) والماء (كنترول). تم الرش الورقى لهذه المركبات بمعدل ١جم/لتر مرتين عند ٢٥ و ٤٠ يوما بعد الشتل.

أدت زيادة معدل السماد النتروجينى من ٥٠ إلى ٢٠٠ كجم ن للهكتار الى زيادة معنوية فى ارتفاع النبات، الوزن الجاف م$^{-2}$، عدد الأشطاء والداليات بالجورة، طول ووزن الدالية، عدد الحبوب الممتلئة و الفارغة بالدالية، محصول القش و الحبوب و كمية النتروجين الممتص بالحبوب فى كلا الموسمين. لم يوجد فروق معنوية بين معدلى النتروجين ١٥٠ و٢٠٠ كجم ن للهكتار فى معظم صفات النمو المدروسة و محصول القش ومعظم مكونات المحصول فى كلا الموسمين. وقد أدى التسميد بمعدل ٢٠٠ كجم ن للهكتار إلى الحصول على أعلى محصول حبوب.

وقد سجل الرش الورقى بمركب الاسكوبين زيادة معنوية فى ارتفاع النبات، الوزن الجاف م$^{-2}$، عدد الأشطاء والداليات بالجورة، طول ووزن الدالية، عدد الحبوب الممتلئة والفارغة بالدالية، ووزن ١٠٠٠ حبة، محصول القش و الحبوب و كمية النتروجين الممتص بالحبوب مقارنة بالمركبات المحفزة الاخرى فى كلا الموسمين.

وقد أثر التفاعل بين معدلات النتروجين والمركبات المحفزة للنمو معنويا على محصول الحبوب فى كلا الموسمين.

ويستنتج من نتائج هذه الدراسة أنة يمكن استخدام معدل التسميد ١٥٠ كجم ن للهكتار مع الرش الورقى بمركب الاسكوبين لتعظيم انتاجية محصول صنف الارز الهجين "هجين١" بمحافظة كفرالشيخ. وبذلك يمكن توفير ٥٠ كجم ن للهكتار باستخدام الرش الورقى بمركب الاسكوبين بدون نقص فى المحصول.