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Effect of Foliar Application of Yeast on Yield and Seed Quality of Some Rice Cultivars

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ABSTRACT

Two field experiments were conducted at El-Serw Research Station, Agricultural Research Center, Egypt, during ٢٠١٢ and 2013 seasons to study the effect of 5 concentrations of dry yeast (*Saccharomyces cervisia*) *i.e.* 0, 2, 4, 6 and 8 g/L as foliar application at 25, 55 and 85 days after sowing on growth characters, yield and its components of Giza 178, Sakha 105 and Sakha 106 rice cultivars .The produced seeds obtained from the field experiment were investigated under Laboratory condition to study seed quality characters (seed, seedling vigor and its health) at Seed Technology Research Unit in Mansoura, Egypt . Results revealed that Giza 178 cv. was significantly thumping as compared with other studied cultivars in all studied characters of both growth and yield components. Maximum growth and yield components were produced from foliar spraying with ٦ or ٨ g/L dry yeast where show enhancement in heading date, plant height, number of tillers, and increased dray matter, number of panicles, panicle length, ١٠٠٠ grain weight and grain yield with high significant in both seasons . The data of seed and seedling vigor test showed that Giza ١٧٨ cv. gave the highest values of normal seedlings (GP), speed germination (SG), seedling length (SL), while Sakha ١٠٥ cv. gave the highest values of dry weight followed by Sakha ١٠٦ cv. as compared with other cultivars . On the other hand, foliar spraying with ٦ or ٨ g/L dry yeast were the best treatments of seed and seedling vigor as compared with control and other concentrations of dry yeast and also decreased abnormal seedlings and seed rot percentages with significant effect . Seed health test recorded thirteen fungus species were associated with seeds of three cultivars under study . Giza 178 cv. was the less values of total fungi, followed by Sakha ١٠٦ and Sakha ١٠٥ cvs. *Alternaria padwickii* showed maximum values presented on seeds of three cultivars followed by *Bipolaris oryzae*, *A. longesima*, *Fusarium semitectum*, *A. tenuis*, *F. graminearum* and *Sarocladium oryzae*… et . The beneficial effects of yeast lead to lower the number of seed-borne fungi with increasing concentration from 2 to ٨ g/L especially pathogenic fungi which caused reduction to seed and seedling vigor of rice . It could be recommended that use of foliar spray with dry yeast (*S. cervisia*) at 6 - ٨ g/L at 25, ٥٥ and 85 days after rice sowing gave the highest values of yield, yield components and next enhanced seed, seedling vigor and lower numbers of seed-borne fungi associated with rice seeds(seed quality).

Keywords : Rice, yeast, yield components, seed and seedling vigor, seed health

INTRODUCTION

Rice (*Oryza sativa* L.) is a principal cereal crop of Egypt. Foliar spraying with natural agents during different growth stages of rice plants considered an important way to enhancement vegetative growth, yield components and control of seed-borne fungi especially field fungi and subsequently production of seed related high quality. Microorganisms play an important role in affecting the quality of seed of which fungi are the largest group. These pathogens are disastrous as they reduce seed vigor and weaken the plant at its initial growth stages. The infected seeds may fail to germinate, transmit diseases from seed to seedling and from seedling to growing plants (Fakir *et al*., 2002). Tarp, *et. al*. (1987) found that *Bipolaris oryza* causal agent of seedling blight and brown spot disease, while *Alternaria padwickii* causal agent of seedling blight and stack burn disease and *Fusarium moniliforme* causal agent of bakane disease and foot rot. Sharma and Chahal, (1996) found negative correlation between kernel smut (*Tilletia barclayana*) and seed germination, seedling length and seedling dry weight, also *Curvularia lunata*, *Drechslera tetramera* and *Fusarium moniliforme* were predominant and caused seed rot/seedling mortality. Reyes *et al*., (1933) reported that stunting of seedlings and a reduction in the number of tillers when smutted seeds were sown. Ram *et al*., (1998) stated that kernel smut of rice caused by *T. barclayana* was widespread and causes considerable qualitative and quantitative yield losses of rice.

Environmental conditioning and the use of chemicals to control the plant diseases are expensive remedy and may also reduce populations of beneficial microorganisms, thus the use of safe chemicals control has become more attractive (Cooke, 1993). Nowadays, a great attention has been focused on the possibility of using natural and safe agents for promoting growth of rice and for inducing its resistance against different diseases. *Saccharomyces cerevisiae* is considered a new promising plant growth promoting-factor for different crops. EL-Sirafy, *et al*., (2011) found that inoculation with biofertilizer mixtures along with foliar spray with yeast or yeast + N- solution lead to the highest grain yields, straw yields, weight per plant, dry matter plant and could be used along with application of 50 to 75 % of the recommended rate of N, thus saving 25 - 50 % of N requirement of rice. Mady, (2009) found that foliar application with yeast extract increased many growth aspects as number of leaves per plant, dry weights of both stems and leaves and total leaf area, also increased photosynthetic pigments, total sugars, free amino acids and crude protein content in leaves of faba bean. Yeast treatments were suggested to play a beneficial role in cell division and cell enlargement (Natio, *et al*. (1981). Yeast as a natural stimulator is also characterized by richness in protein, carbohydrates, nucleic acid, lipids and different minerals and Li in addition to thiamin, riboflavin, pyridoxine, hormones and other growth regulating substances, biotin, B12 and folic acid (Nagodawithana,1991). Shalaby and El-Nady (2008) found that seed soaking, foliar spraying or soil

inoculation with *S. cerevisiae* increased germination rate, survival of sugar beet plants and reduction of pre-, post emergence damping off and inhibited *Fusarium oxysporum* liner growth in Lab. studies. El-Emery (2004) reported that germination rate of different seeds of barley, maize, pea and been was great enhanced by using different yeast dilutions and growth of plumules, root lets and cotyledon enlargement was also stimulated. Elwakil, *et al*., (2009) showed that the yeast was effective in reducing the liner growth of *Cephalosporium* sp., *F. oxysporum* and *F. solani*, also they found that pre- and post- emergence damping off was reduced significantly when seeds of faba bean were coated with a water suspension of the yeast (10^9 cfu mL^{-1}). Mohamed, *et al*., (2015) showed that foliar application with yeast extract significantly increased all investigated morphological characters of vegetative growth and yield, also induced favorable enhancements in most of included tissues of the main stem and leaves especially in conducting tissues (phloem and xylem) of Basil plant (*Ocimum basilicum* L.). Abdel-Hakim *et al*., (2012) revealed that foliar application with different concentrations of yeast enhanced growth, yield and yield components along with the chemical composition of fresh and/or dry plants and green pods of snap bean (*Phaseolus vulgaris* L.). Said, *et al*., (2012) reported that foliar application with yeast increased significantly the vegetative growth, yield and its quality of cucumber. Amer, (2004) indicated that the yeast is a natural source of cytokinins and has stimulatory effects on bean plants. Yeast extract was suggested to participate in a beneficial role during vegetative and reproductive growth through improving flower formation and their set in some plants due to its high auxin and cytokinins content and enhancement carbohydrates accumulation (Barnett, *et al*., 1990). In this connection, yeasts have been reported to rich source of phytohormones (cytokinins), vitamins, enzymes, amino acids and minerals (Fathy and Farid, 1996; Khedr and Farid, 2000 and Mahmoud, 2001). Darweesh, *et al*., (2003) reported that yeast contains tryptophane which is the precursor of indol acetic acid which promotes plant growth. The present study amid to evaluate foliar application with yeast (*Saccharomyces cerevisiae*) and its effect on characteristics of growth yield, its components, seed and seedling vigor and its health of some rice cultivars.

MATERIAILS AND METHODS

This investigation was carried out in El-Serw Agricultural Research Station Farm, ARC during two successive summer seasons of ٢٠١٢ and 2013 to study the effects of foliar application of dry yeast (*Saccharomyces cerevisiae*) was identified in the Microbiology Department, Facility of Agriculture, Mansura University on growth characters , yield and its components of three rice cultivars known as; Giza 178, Sakha ١٠٥and Sakha ١٠٦ was used .Yeast was applied as foliar application with five concentrations *i.e* 0,2 ,4 , 6 and 8 g/L.

The experiment were arranged in strip plot design with four replicates. The vertical plots were denoted for rice cultivars, while the horizontal plots were arranged for yeast treatments. The area of each experimental plot (2×5 m^2). Rice grain of the three cultivars at rate of 60 kg/ fed. were soaked in fresh water for 24 h and incubated for 48 h for pre-germination, the seeds were sown directly (Broadcast) at 25th May in the first and second seasons. The foliar spraying treatments of yeast were prepared by dissolved active dry yeast in water, followed by adding sugar at ratio 1 : 1 and kept for two days for activation and reproduction of yeast before application on the plants. The control plants were sprayed with tap water. The foliar spraying was repeated three times *i.e.* 25, 55 and 85 days after sowing for each concentration. The chemical fertilizers and weed herbicide were added as recommended doses .

Studied characters:-

Heading date was recorded at following time for each cultivar, as the number of days from the date of up to 50% heading. At harvest, plant height was recorded for every plot, number of tiller /m^2 was counted, number of panicles/m^2, dried and weighted as dry matter production g/m^2. Ten random panicles were collected from each plot for estimating panicle length, number of filled grains /panicle and weight, number of unfilled grains/panicle and 1000 grain weight. Ten guarded square matters were harvested for grain, straw yield estimation, grain yield was adjusted to 14% moisture content.

Quality of seed production test

Seed vigor test :-

Rice seed samples of field experiment for all treatments of the two seasons were collected and transferred to investigate in Lab. of Seed Technology Research Unit, Mansoura, Egypt. Seeds were sown on Petri-dishes (12 cm) contained three layers of moistened blotters, eight replicates of 25 seeds/Petri (200 seeds) from each treatment and incubated in the growth chamber (Seedburo Equipment company, USA) for 14 days night lengths 15/9 h at 25 $^oC \pm 2$ and evaluated the following characters :-

1 - Mean germination percentage (MGP %) (normal seedlings) it was calculated by counting only normal seedlings (ISTA, rules 1999) .

$$MGP = \frac{n1 - n2}{n1} \times 100$$

The mean germination percentage (MGP) . , n1 is total number of treated seed plated, n2 the number of abnormal seedlings plus seed rot.

2 -Speed germination index (SGI): It was calculated as described in the (AOSA, 1983) by the following formula :

$$SG\ I = \frac{\text{No. of germinated seed}}{\text{Days of first count}} + \ldots\ldots + \frac{\text{No. of germinated seed}}{\text{Days of final count}}$$

3- At the final count, five normal seedlings from each replicate were randomly taken to measure seedling characters, seedling length (cm), dry weight (g) of seedlings (ISTA rules ,1999).

4- Seedling vigor index (SVI) = MGB × seedling dry weight

Seed health testing by blotter method :-

Two hundred rice seeds of each cv. and treatment were planted on three layers of filter paper will soaked

in distilled sterilized water in eight replicates (25 seeds / Petri dish 9 cm). Another two hundred un treated seeds as a control were incubated at 25 °C ± 2 for seven days under alternating cycles of 12 hours near ultraviolet (NUV) light and darkens. Percentage of fungi under investigation were calculated by stereo-binocular microscope (Wild Heerbrugg 6.3 – 32x), whenever necessary the compound microscope (Jenaval 3.2 – 100x) was used for details and confirmation. Seed-borne fungi were identified morphologically on the basis of colony color, shape and size, mycelial growth, spore shape and size as described in the technical bulletin on seed-borne diseases and seed health testing (Chidambaram, 1973; Ellis, 1980; Booth, 1985; Burgess *et al*. 1988; Agarwal *et al*., 1989) and recorded to the following formula:-

$$\text{Fungal \%} = \frac{n1}{n2} \times 100$$

n1 the seeds with fungal growth . , n2 the number of treated seeds.

Seed health testing for kernel smut (*Tilletia baraclayana*):-

Soaking 2000 seeds from each treatment and cultivar in two replicates of 1000 each in 0.2 % solution of sodium hydroxide (NaOH) for 24 h at 18-25 °C. Decant the solution ; spread the swollen seeds on a filter paper. Examine the seeds visually. Infected seeds will show shiny, jet-black discoloration while seeds with only brown or dull black discoloration are not infected. Bunt spores will be released from the infected, shiny, jet-black seeds, while no spores will come out form healthy seeds or those with dull black discoloration. The number of infected seeds was recorded and percentage of infection was calculated (Agarwal & Srivastava, 1981, 1985).

Statistical analysis :-

Collected data for each seasons were statistically analyzed by the technique analyses of variance for strip plot design and the least significant differences (L S D) was used to test the differences among treatments (Gomez and Gomez ,1984). Bartlett test was done to the homogeneity of error variances. The test was significant for all field traits, while was in significant for all Lab. traits, thus the data of both seasons were combined .

RESULTS AND DISCUSSION

Results of growth characteristics, yield and its components of the three rice cultivars as affected by application of different concentrations of yeast are presented in Tables 1 and 2 Rice cultivars were significantly varied among them in the two seasons regarding with all characters under study. Giza 178 cv. produced the highest values of number of tillers (m^2), dry matter (g/m^2), number of panicles (m^2), panicle length (cm), number of filled grains/panicle, panicle weight (g), grain yield (t/ha) and straw yield (t/ha), followed by Sakha 106 cv., while Sakha105 gave the highest values of 1000 grain weight (g) in both seasons compared with other cultivars .

Table 1: Effect of application of different yeast concentrations on heading date, plant height, number of tillers, dry matter, number of panicles and panicle length of some rice cultivars in the two seasons

Characters	Heading date (day)		Plant height (cm)		Number of tillers (m^2)		Dry matter (g/m^2)		N. of panicles (m^2)		Panicle length (cm)	
	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣
Cultivars:												
Giza 178	٩٥	٩٨	٩٤.٧	٨٥.٩	٤٥١	٣٧٧	٥٩٧	٤٨٧	٤١٧	٣٦٦	٢٢.٧	٢٠.٤
Sakha 105	٨٨	٨٩	٩٢.٦	٨٤.٨	٤١٠	٣١٦	٥٣٤	٣٩٠	٣٦٤	٢٩٢	١٩.٦	١٧.٤
Sakha 106	٩٢	٩٤	٩٥.٦	٨٧.٧	٤١٥	٣٢١	٥٦٩	٤٠٢	٣٨٥	٣٠٤	١٧.٤	١٦.٠
F test	*	*	*	*	*	*	*	*	*	*	*	*
L S D 5%	١.٠	٢.٠	١.٤	١.٦	٣٦	٢٧	١٧	٤٣	٢٨	٢٠	٠.٤	١.١
Yeast Treatments:												
Control	٩١	٩٣	٩٣.٢	٨٤.٨	٣٨١	٣١٥	٤٩٧	٤٠٩	٣٥٨	٢٩٨	١٩.٥	١٧.٦
٢g/L	٩١	٩٤	٩٤.١	٨٥.٢	٤٠٩	٣٣٤	٥٣٣	٤١٩	٣٦٨	٣١٦	١٩.٧	١٧.٧
٤g/L	٩١	٩٤	٩٤.٤	٨٦.٢	٤٢٤	٣٤٢	٥٧٠	٤٢٤	٣٨٦	٣٢٥	١٩.٧	١٨.٠
٦g/L	٩١	٩٤	٩٤.٦	٨٦.٨	٤٤١	٣٥٦	٦٠٥	٤٣٨	٣٩٧	٣٣٦	٢٠.٠	١٨.٠
٨g/L	٩٢	٩٤	٩٥.٥	٨٨.٠	٤٦٣	٣٥٧	٦٢٧	٤٤٥	٤٣٥	٣٣٨	٢٠.٤	١٨.٥
F test	*	*	*	*	*	*	*	*	*	*	*	*
L S D 5%	١	١	١.٥	١.٨	٣١	١٧	٢٤	٣٥	٢٦	١٨	٠.٥	٠.٧
Interaction	NS	NS	NS	NS	*	*	NS	NS	*	*	NS	NS

Regarding to the effect of yeast concentrations on the studied characteristics, data in Tables 1 and 2 indicated that foliar application of *S. cervisia* at 8g/L gave maximum values of number of panicles (m^2), 1000 grain weight (g) and grain yield (t/ha) as (435), (26.3) and (6.0), respectively in the first season, followed by 6 g/L then 4 g/L compared to other concentrations and control. Increased foliar application of yeast concentrations from 2 to 8 g/L gave enhancement of growth characters and yield components with different significant for all characteristics under study in both seasons. Similar results were reported by Natio, *et. al*., (1981) and Mady, (2009). El-Ghamriny, *et. al.* (1999) found that dry bread yeast (*S. cerevisiae*) is a kind of the used biofertilizers in soil fertilization or in foliar application on the shoots of vegetable crops. This is may be due to it's content of many nutrient elements and being productive of semi growth regulator compounds like auxins, gibberellins and cytokinins, the positive effects caused by the addition of yeast suspension in improving shoot characteristics might be due to direct or indirect effect of the yeast throughout its ability in changing the environment of roots or because the development of the yeast after analysis into wide groups of amino acids and vitamins (Glick, 1995) .

Table 2: Effect of application of different yeast concentrations on n. of filled grains/p., n. of unfilled g/p., panicle weight, 1000-grain weight, grain yield and straw yield of some rice cultivars in the two seasons .

Characters:	N. of filled grains/P		Panicle weight (g)		N. of unfilled . g/p		1000-grain weight (g)		Grain yield (t/ha)		Straw yield (t/ha)	
	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	2012	٢٠١٣	٢٠١٢	٢٠١٣
Cultivars:												
Giza 178	١٤٦	١٠١	٣.٠	٢.٠	٨	١٣	٢١.٦	٢٠.١	٦.٨	٥.١	٨.٨	٥.٩
Sakha 105	٨٦	٧٢	٢.٤	١.٩	١٥	١٥	٢٨.٥	٢٦.٤	٤.٧	٣.٢	٧.٤	٥.٠
Sakha 106	١٠٤	٧٧	٢.٢	١.٧	١٠	١٣	٢٧.٤	٢٤.١	٥.٣	٣.٦	٧.٩	٥.٤
F test	*	*	*	*	*	*	*	*	*	*	*	*
L S D 5%	٤	٩	٠.٢	٠.٢	٩	١	٠.٧	١.٢	٠.٥	٠.٢	٠.٤	٠.٦
Yeast Treatments:												
Control	١٠٧	٧٧	٢,٣	١.٨	١٢	١٥	٢٥.١	٢٣.٠	٥.١	٣.٦	٧.٥	٥.١
٢g/L	١١٢	٨١	٢.٥	١.٧	١٢	١٥	٢٥.٨	٢٣.١	٥.٥	٣.٨	٧.٩	٥.١
٤g/L	١١٣	٨٣	٢.٥	١.٩	١٢	١٤	٢٥.٧	٢٣.٩	٥.٥	٤.٠	٨.٠	٥.٤
٦g/L	١١٤	٨٣	٢.٦	٢.٠	١٠	١٢	٢٦.٢	٢٣.٧	٥.٩	٤.٠	٨.٣	٥.٩
٨g/L	١١٤	٩٢	٢.٧	٢.٠	١٠	١٣	٢٦.٣	٢٤.٠	٦.٠	٤.٣	٨.٤	٦.٠
F test	*	*	*	*	*	*	*	*	*	*	*	*
L S D 5%	٥	٦	٠.٢	٠.٢	١	١	٠.٦	٠.٨	٠.٣	٠.٢	٠.٦	٠.٦
Interaction	NS	NS	NS	NS	NS	NS	*	*	NS	NS	NS	NS

The results in Table 3 indicated that interaction between cultivars and yeast concentrations had significant effect on number of tillers (m^2), number of panicles (m^2), 1000-grain weight (g) and grain yield (t/ha) of three cultivars under study, the treatment with foliar application 8 gm/L was the best of concentrations, which gave the highest values followed by 6 gm/L with all characters under study in both seasons. These results are in agreement with those obtained by (Barnett, *et. al*., 1990; Amer, 2004; El-Sirafy, *et. al*., 2011; Said, *et. al*., 2012 and Mohamed, *et. al*., 2015) . The major effect of foliar spray of yeast might be due to that yeast induces nutrient minerals absorption through general improvement due to the ability of yeast to increase the production of stimulants for plant growth, especially gibberellins, auxins and cytokinins which act to improve the plant cell division and its growth (El-Bassiony, *et. al*.,2014). Also, Ghoname, *et. al.* (2010) found that promoted plant vegetative growth *i.e.* plant height, number of leaves and branches, fresh and dry weight, compared to control by used yeast (1, 2 and 3 g/L) as sprayed on sweet pepper. Rania, *et. al*., (2011) found that foliar application with relatively used concentration 50 and 100 ml/L induced significant promotive effects on all investigated morphological plant characters (plant height, number of branches/plant, number of leaves/plant, total leaf area/plant and shoot dry weight/plant) and yield components of kidney bean. Abdel-Hakim, *et. al*., (2012) showed that spraying the snap bean plants with yeast in different concentrations enhanced plant growth and most of the studied characteristics and reported that yeasts is a rich source of phytohormones (especially cytokinins) vitamins, enzymes, amino acids and minerals .

Table 3: Means of number of tillers, number of panicles, 1000-grain weight and grain yield as affected by the interaction between cultivars and yeast concentrations during two seasons .

Cultivars	Yeast Treatments	Number of tillers (m^2)		Number of panicles (m^2)		1000-grain weight (g)		Grain yield (t/ha)	
		٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣
Giza 178	Control	٤٠٦	٣٥٨	٣٨٨	٣٤٠	٢٠.٦	١٩.٧	٦.٣	٤.٧
	2 g/L	٤٢٨	٣٧٠	٣٩٦	٣٦٧	٢١.٧	١٩.٤	٦.٨	٤.٩
	4 g/L	٤٥٢	٣٧٩	٤١٨	٣٦٨	٢١.١	٢٠.٩	٦.٨	٥.٠
	6 g/L	٤٨٤	٤٠١	٤٥٩	٣٨٦	٢٢.١	٢٠.١	٦.٩	٥.٤
	8 g/L	٤٨٦	٤٠٢	٣٩٦	٣٩٠	٢٢.١	٢٠.٤	٧.١	٥.٤
Sakha 105	Control	٣٤٠	٢٩٦	٣٣٢	٢٧٥	٢٧.٨	٢٥.٦	٤.٠	٢.٨
	2 g/L	٤٠٤	٣١٧	٣٣٤	٢٨٢	٢٨.٧	٢٥.٧	٤.٢	٣.١
	4 g/L	٤١٤	٣١٧	٣٦٣	٢٩٦	٢٨.٤	٢٦.٤	٤.٤	٣.١
	6 g/L	٤٣٠	٣٢٩	٣٨٨	٣٠٤	٢٨.٦	٢٦.٥	٥.٣	٣.٥
	8 g/L	٤٣٦	٣٣٠	٤٠٥	٣٠٥	٢٨.٨	٢٧.٦	٥.٥	٣.٧
Sakha 106	Control	٣٩٦	٢٩٠	٣٥٤	٢٧٩	٢٦.٨	٢٣.٧	٥.٠	٣.٣
	2 g/L	٣٩٦	٣١٤	٣٧٣	٣٠٠	٢٦.٩	٢٤.١	٥.٢	٣.٤
	4 g/L	٤٠٥	٣٣٠	٣٧٩	٣١١	٢٧.٦	٢٤.٣	٥.٢	٣.٧
	6 g/L	٤١٠	٣٣٧	٣٨٠	٣١٨	٢٧.٨	٢٤.٣	٥.٦	٤.٠
	8 g/L	٤٦٨	٣٤٠	٤٤٠	٣٢٠	٢٧.٩	٢٤.١	٥.٦	٤.٠
L S D 5%		٥٤	٢٩	٤٤	٣١	١.١	١.٣	٠.٥	٠.٣

Quality of seed production from field experiment :-

Seed and seedling vigor :-

Table 4 shows the effects of cultivars and yeast concentrations on seed and seedlings vigor, Giza 178 cv. recorded the highest percentage of normal seedlings (germination percentage) (85%), speed germination (SG) (27.8), seedling length (11) cm and less value of seed rot (6%), dry weight (0.18) g, followed by Sakha 105 and 106 cvs with high significant differences for the studied characters between cultivars. The effect of foliar spray of yeast was statistically significant for normal and abnormal seedlings, seed rot, speed germination, seedling length and dry weight as seed and seedling vigor, sprayed at 8 g/L gave the highest values of normal seedlings (91%), lower abnormal seedlings (6%), seed rot (3%), (27.7) speed germination, (0.23) g

dry weight while 6 g/L gave (11) cm seedling length as compared with control and other concentrations. Perceiver from the treatments that increased foliar spraying of concentrations with yeast lead to improved of vigor characters of seed and seedling of rice, also the interaction of cultivars and treatments was found statistically significant in case of normal, abnormal seedlings and dry weight. This was in agreement with the data obtained by Muller and Leopold, (1966) who demonstrated that enhancing effect of yeast application might be due to yeast cytokinins enhancing the accumulation of soluble metabolites. Also, the enhancing effect of yeast on germination rate and on the vegetative growth parameters was strongly supported by Entian and Fröhlich (1984), they stated that increased enzyme activity regulating catabolic productions in eukaryotic cells treated with *S . cerevisiae*. El-Emery (2004) who reported that germination rate of different seeds of barley, maize, pea and bean was greatly enhanced by using different yeast dilutions and growth of plumules, rootlets and cotyledon enlargement was also stimulated. Aml and Abd El-Hai (2011) showed that peanut seed treatments with *S . cerevisiae* improved germination criteria, seed quality, morphological and physiological characters of seedlings .

Table 4: Effect of application of different yeast concentrations on seed and seedlings vigor of some rice cultivars .

Characters	+ Normal seedlings	++ Abnormal seedlings	+++ Seed rot	Speed germination	Seedling length	Dry weight
			Cultivars (A)			
Giza 178	٨٥	٩	٦	٢٧.٨	١١.٠	٠.١٨
Sakha 105	٨٣	٩	٨	٢٦.٨	٨.٣	٠.٢٥
Sakha 106	٨٣	٧	١٠	٢٢.٨	٩.٢	٠.٢٠
F test	*	*	*	NS	*	*
L S D 5%	١	١	٢	-	١.٠	٠.٠١
			Yeast Treatments (B)			
Control	٧٥	١٤	١١	٢٣.٠	٧.٦	٠.١٨
2 g/L	٨٢	٩	٩	٢٥.٠	٨.٩	0.20
4 g/L	٨٣	٧	١٠	٢٥.٧	٩.٤	٠.٢١
6 g/L	٨٦	٧	٧	٢٧.٧	١١.٠	٠.٢٢
8 g/L	٩١	٦	٣	٢٧.٧	١٠.٦	٠.٢٣
F test	*	*	*	NS	*	*
L S D 5%	٢	٣	٣	-	١.٥	٠.٠٢
Interaction A×B	٤	٤	NS	NS	NS	٠.٠٢

+ Normal seedlings :Plumules , roots well developed ++ . Abnormal seedlings :Decay in shoot and root, primary root showing browning no branching or secondary developed shoot usually appearing weak +++ . Seed rot :Consisted of non-germinated seeds covered with hyphal growth of the tested pathogen (Guerrero.*et. al* ٠ . ١٩٧٢).

The results gave evidence of infection by seed-borne fungi Table 5 thirteen fungal species among the tested three rice cultivars; *Alternaria padwickii* was the highest percentage on seeds of Sakha 105 cv. with (20.5%) followed by Giza 178 cv. (12%) thin Sakha 106 cv. (11%) with high significant differences. *Bipolaris oryza* recorded on S. 105 cv. seeds the highest value (19.7%) followed by Sakha 106 cv. (9%) and Giza 178 cv. (8.8%) with high significant. *Fusarium graminearum* was (4.5%) for each Sakha 105 cv. and Giza 178 cv. seeds. *F. moniliforme* was (2.1%) for Sakha105 cv. followed by Sakha 106 (1.3%) and (0.8%) with Giza 178 cv. of seeds. *Sarocladium oryzae* recorded (3.7%) on Sakha 106 cv., (2.1%) on Giza 178 cv. and (1.6%) on Sakha 105cv. seeds, *Tilletia barclayana* was for Sakha 105 cv. (1.1%), Giza 178 cv. (0.7%) and (0.3%) on Sakha 106 cv. seeds with high significant . Sakha 105 cv. recorded the highest total fungi on seeds was (77.1) followed by Sakha 106cv. (49), while Giza 178 cv. was the lowest (45.4) as compared of cultivars.

Effect of yeast concentrations on frequency of seed borne- fungi, the results showed that *Alternaria longesima* decreased from (15%) as control to (0.4%) with 8 g/L as concentration, *A. padwickii* recorded the highest percentage of infected seeds (26.2%) as control and decreased to (4.9%) with 8 g/L yeast, *B. oryza* was (20.4%) in control and reduced to (4%) with 8 g/L dry yeast.

Fusarium semitectum was decreased from (11%) to (o.4%), *F. graminearum* was from (7.1%) to (%٠.٤) and *F. moniliforme* was from (3.1%) to (0.4%), *Sarocladium oryzae* from (5.3%) to (0.0%), *Curvularia oryzae* from (3.6%) to (0.0%), *Tillieta barclayana* from (0.7%) to (0.2%).Total fungi decreased with increasing concentrations of yeast from (113.9) as control to (82.3) with 2 g/L, to (51) with 4 g/L, to (24.9) with ٦ g/L, to (11.6) with 8 g/L as foliar spray. The observed increasing of yeast concentrations (2, 4, ٦ and 8 g/L) leads to increasing reduction of the disease incidence with high significant of all fungi except *Cladosporium* sp. and *F. moniliforme* .

Data Table 6 show that *A. padwickii* recorded the highest value on Sakha 105, Giza 178 and Sakha 106 cvs by (36), (21.3) and (21.3%) respectively, followed by *B. oryza* with (29.3), (17.3) and (16%) on Sakha 105, Sakha 106 and Giza 178 cvs seeds respectively, *A. longesima* recorded on seeds Sakha 105 cv.(22.6%), Sakha 106 cv. (13.3%) and Giza 178 cv. (9.3%), *F. semitectum* was (13.3%) on Sakha 105 cv., (10.6%) on Giza 178cv. and (9.3%) on Sakha 106 cv. seeds, *F. graminearum* recorded (8%) on each Giza 178 and Sakha 106 cvs and (5.3%) on Sakha 105 cv. seeds. *Fusarium moniliforme, S. oryzae* and *T. barclayana* recorded on Giza 178 cv. (1.3), (4) and (1%), respectively for the control . On the other hand, the data showed that seed treatment with different from yeast concentrations lowered in general number of seed- borne fungi with increasing the concentrations with all cultivars, where *A. padwickii*, *B. oryzae*, *F. graminearum* and *T. barclayana* were decreased to (5.3), (2.7), (0.0) and (0.2 %) on seeds of Giza 178cv., (5.3), (8.0), (1.3) and (0.3%) for Sakha 105 cv. and (4.0), (1.3), (0.0) and (0.1%) for

Sakha 106 cv. seeds respectively with treatment 8 g/L. *A. padwickii* was the most spread on seeds of three rice cvs under study which recorded (221.2) as total fungi followed by *B. oryzae* (187.9), *A. longesima* (112.5), *F. semitectum* (71.6), *A. tenuis*, (65.9), *F. graminearum* (65.1), *S. oryza* (37.1) and *Curvularia oryzae* were (26.5), *Cladosporium* sp. (24), *F. moniliforme* (21.1), *Nigrospora oryzae* (14.6), *Stemphylium botryosum* (10.6) and *T. barclayana* (7.5) respectively.

Table 5: Effect of application of different yeast concentrations on frequency of seed- borne fungi of rice by Blotter method .

Fungi	*A. longesima*	*A .padwickii*	*A . tenuis*	*B. oryza*	*Cladosporium* sp.	*Curvularia oryza*	*F. graminearum*	*F. moniliforme*	*F. semitectum*	*Nigrospora oryzae*	*S. oryzae*	*Stemphylium botryosum*	*Tilletia barclayana*	Total Fungi
Cultivars:														
Giza 178	٣.٥	١٢.٠	٥.٩	٨.٨	٢.١	٠.٥	٤.٥	٠.٨	٣.٧	٠.٨	٢.١	٠.٠	٠.٧	٤٥.٤
Sakha 105	١٢.٠	٢٠.٥	٤.٠	١٩.٧	١.٣	٢.٧	٤.٥	٢.١	٥.٨	٠.٧	١.٦	١.١	١,١	٧٧.١
Sakha ١٠٦	٥.٠	١١.٠	٣.٥	٩.٠	١.٣	٢.١	٤.٠	١.٣	٤.٨	١.٩	٣.٧	١.١	٠.٣	٤٩.٠
F test	*	*	NS	*	NS	NS	NS	NS	NS	*	*	NS	*	-
L S D 5%	٢.٤	٣.٠	-	٣.٨	-	-	-	-	-	١.٢	١.٧	-	٠.٢	-
Yeast Treatments:														
Control	١٥.٠	٢٦.٢	١٢.٠	٢٠.٤	٣.١	٣.٦	٧.١	٣.١	١١.٠	٣.٦	٥.٣	٢.٦	٠.٧	١١٣.٧
٢g/L	١٠.٢	١٩.٠	٤.٤	٢٢.٠	2. 7	٣.١	٦.٧	٢.٢	٥.٣	١.٣	٤.٤	٠.٤	٠.٦	٨٢.٣
٤g/L	٤.٤	١٤.٠	٣.٦	١١.٠	١.٨	١.٧	٥.٧	٠.٨	٤.٤	٠.٠	٢.٦	٠.٤	٠.٦	٥١.٠
٦g/L	٤.٠	٨.٨	١.٣	٤.٨	٠.٤	٠.٤	١.٨	٠.٤	٢.٧	٠.٠	٠.٠	٠.٠	٠.٣	٢٤.٩
٨g/L	٠.٤	٤.٩	٠.٩	٤.٠	٠.٠	٠.٠	٠.٤	٠.٤	٠.٤	٠.٠	٠.٠	٠.٠	٠.٢	١١.٦
F test	*	*	*	*	NS	*	*	NS	*	*	*	*	*	-
L S D 5%	٣.١	٣.٩	٣.٢	٣.٣	-	٢.٤	٣.٠	-	٣.٩	١.٦	٢.٢	١.٥	٠.٢	-

Table 6: Interaction between cultivars, concentrations of yeast and the effect on percentages of seed-borne fungi associated of some rice cultivars .

Cultivars	Treatments	Fungi: *A. longesima*	*A .padwickii*	*A . tenuis*	*B . oryza*	*Cladosporium* sp.	*Curvularia oryza*	*F. graminearum*	*F. moniliforme*	*F. semitectum*	*Nigrospora oryzae*	*S. oryzae*	*S. botryosum*	*Tilletia barclayana*
	control	٩.٣	٢١.٣	١٢.٠	١٦.٠	٥.٣	١.٣	٨.٠	١.٣	١٠.٦	٢.٧	٤.٠	٠.٠	١.٠
	2 g/L	٢.٦	١٤.٧	١٠.٦	١٣.٣	٢.٧	١.٣	٨.٠	١.٣	٤.٠	١.٣	٤.٠	٠.٠	٠.٩
	4 g/L	٢.٧	١٢.٠	٤.٠	٨.٠	١.٣	٠.٠	٥.٣	١.٣	٢.٦	٠.٠	٢.٦	٠.٠	١.٠
Giza	6 g/L	٢.٧	٦.٧	١.٣	٤.٠	١.٣	٠.٠	١.٣	٠.٠	١.٣	٠.٠	٠.٠	٠.٠	٠.٥
178	8 g/L	٠.٠	٥.٣	١.٣	٢.٧	٠.٠	٠.٠	٠.٠	٠.٠	٠.٠	٠.٠	٠.٠	٠.٠	٠.٢
	control	٢٢.٦	٣٦.٠	١٣.٣	٢٩.٣	٢.٧	٤.٠	٥.٣	٤.٠	١٣.٣	١.٣	٤.٠	٤.٠	٠.٦
	2 g/L	٣١.٣	٢٦.٧	٤.٠	٣٦.٠	٤.٠	٤.٠	٣..٥	٢.٧	٣..٥	٠.٠	٢.٦	1.3	٠.٥
Sakha	4 g/L	٦.٧	٢١.٣	٢.٠	١٧.٣	٠.٠	٤.٠	٦.٦	٢.٦	٦.٦	٠.٠	١.٣	٠.٠	٠.٥
105	6 g/L	٩.٣	١٣,٣	٠.٠	٨.٠	٠.٠	١.٣	٤.٠	١.٣	٤.٠	٠.٠	٠.٠	٠.٠	٠.٣
	8 g/L	٠.٠	٣..٥	٠.٠	٨.٠	٠.٠	٠.٠	١.٣	٠.٠	٠.٠	٠.٠	٠.٠	٠.٠	٠.٣
	control	١٣.٣	٢١.٣	١٠.٧	١٧.٣	٤.٠	٥.٣	٨.٠	٤.٠	٩.٣	٦.٦	٨.٠	٤.٠	٠.٦
	2 g/L	٦.٧	١٦.٠	٢.٧	١٦.٠	٢.٧	٤.٠	٦.٧	٢.٧	٦.٧	٢.٧	٦.٦	١.٣	٠.٥
Sakha	4 g/L	٤.٠	١٠.٦	٢.٧	٨.٠	٠.٠	١.٣	٥.٣	٠.٠	٤.٠	٠.٠	٤.٠	٠.٠	٠.٣
106	6 g/L	١.٣	٦.٧	١.٣	٢.٧	٠.٠	٠.٠	٠.٠	٠.٠	٢.٦	٠.٠	٠.٠	٠.٠	٠.٢
	8 g/L	٠.٠	٤.٠	٠.٠	١.٣	٠.٠	٠.٠	٠.٠	٠.٠	١.٣	٠.٠	٠.٠	٠.٠	٠.١
Total Fungi		١١٢.٥	٢٢١.٢	٦٥.٩	١٨٧.٩	٢٤	٢٦.٥	٦٥.١	٢١.١	٧١.٦	١٤.٦	٣٧.١	١٠.٦	٧.٥
F test		*	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
L S D 5%		٥.٣٤	-	-	-	-	-	-	-	-	-	-	-	-

These results agree with earlier studies reported by El- Abbasi, (1990) and Ibrahim, (2003). Aml and Abd El-Hai, (2011) showed that peanut seeds treatment with *S. cerevisiae* inhibited the different seed-borne fungal genera and diseases development under storage conditions up to 6 months . The beneficial effects of yeast extract may be due to the anti fungal activity of its metabolites (Hassanein, *et al*., 2002), so the application of yeasts as plant pathogens control is recommended where it was found to produce proteinaceous killer lethal to fungal strains (Hodgson. *et al*., 1995; Marquina, *et al*., 2002 and Santos, *et al*., 2004). Moreover, El-wakil, *et al*., (2009) stated that disease severity of pre- and post-emergence damping of caused by *Cephalosporium* sp., *F. oxysporum*, *F. solani*, *R. solani* and *Verticelium dahliae* reduced significantly when seeds of faba bean were coated with water suspension (10^9 cfu mL^{-1}) of *S. cerevisiae* before sowing due to activity in disease suppression. Also, El-Tarabily (2004) reported that the fungi activities of *Rhizoctonia solani* diseased sugar beet

plants were well suppressed by using different yeasts. Shalaby, *et al*., (2008) found that liner growth of *F. oxysporum* was inhibited with (39.52%) and (50%) by using 5 g/L and 6.35 g/L of the yeast, respectively. Wide variety of yeasts have been extensively used for the biological control of post-harvest fruits and vegetables diseases (Punja, 1997 and Zheng, *et al*., 2003), against moulds of stored grains (Petrsson, *et al*., 1999) and to control powdery mildews (Urquhart and Punja, 1997) .

Results in Table 7 illustrated that increase of total fungi lead to decreased in germination percentage and seedling vigor index, Giza 178 cv. seeds total fungi was (92.8), germination percentage (GP) (80%) and seedling vigor index (SVI) (10.4) for the control, while foliar spray with 2, 4, 6, and 8 g/L yeast lead to lower the number of total fungi to (64.7), (40.8), (19.1) and (9.5), respectively and increased (GP) to (90%) and SVI to (18), also on S. 105 cv. seeds was total fungi (140.4), GP (72%) and SVI (17.3) for control and recorded after treatment the less of total fungi with the same concentrations reached to (14.9) for total fungi and increased for GP to (92%) and SVI to (26.7) at 8g/L yeast. On seeds of S. 106 cv. was total fungi (112.4), GP (74) and SVI (13.3) for control, reduction the number of fungi on seeds to (6.7) of total fungi and increased GP to (90%), SVI to (18) with 8 g/L treated. Generally in this table showed that foliar spray with high concentrations of dry yeast increased GP, SVI and reduction numbers of seed-borne fungi associated to rice seeds. These results are similar as of Nagodawithana (1991); Madi *et al*., (1997); El-Trabily (2004), Shalaby and El-Nady (2008) who reported that *R. solani* and *Sclerotium rolfsii* were effectively suppressed by some plant growth promoting yeasts. Hassan and Abd-Rehim (2002) observed that increasing yeast concentrations (0.05 to 1%) decreased the diseases incidence and controlling onion neck rot disease. *Fusarium* spp. was also inhibited and seed germination of watermelon was induced by several taxa included yeast genera as plant growth promoters and as biocontrol agents (Lokesh, *et al*., 2007) .

CONCLUSION

It could be concluded that use of foliar spray with dry yeast(*S. cervisia*) at 6 - 8 g/L at 25, 55 and 85 days after rice sowing gave the highest values of yield, yield components and next enhanced seed, seedling vigor and lower numbers of seed-borne fungi associated with rice seeds (seed quality).

Table 7 : Effect of foliar spray with yeast concentrations on the total fungi, germination percentage ,and seedling vigor index of three rice cultivars.

Yeast Concentrations	Giza 178			Sakha 105			Sakha 106		
	Total fungi	Germination (%)	Seedling vigor index (SVI)	Total fungi	Germination (%)	Seedling vigor index (SVI)	Total fungi	Germination (%)	Seedling vigor index (SVI)
Control	٩٢.٨	٨٠	١٠.٤	١٤٠.٤	٧٢	١٧.٣	١١٢.٤	٧٤	١٣.٣
2 g/L	٦٤.٧	٨٢	١٤.٨	١٢٣.٧	٨٠	١٦.٨	٧٥.٣	٨٢	١٦.٤
4 g/L	٤٠.٨	٨٤	١٦.٠	٦٨.٩	٨٤	٢٢.٧	٤٠.٢	٨٢	١٤.٨
6 g/L	١٩.١	٨٨	١٦.٧	٤١.٥	٨٤	٢١.٠	١٤.٨	٨٦	١٨.٩
8 g/L	٩.٥	٩٠	١٨.٠	١٤.٩	٩٢	٢٦.٧	٦.٧	٩٠	١٨.٠

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تأثير الرش الورقي بالخميرة على محصول وجودة تقاوي بعض أصناف الأرز

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أجريت تجربتي حقل ومعمل لدراسة تأثير الرش الورقي بالخميرة الجافة بتركيزات صفر , ٢ , ٤ , ٦ , ٨ جم/ لتر في أعمار ٢٥ , ٥٥ , ٨٥ يوم من الزراعة على نمو المحصول ومكوناته وجودة التقاوي المنتجة من أصناف الأرز جيزة ١٧٨ وسخا ١٠٥ وسخا ١٠٦ لموسمين ٢٠١٢ – ٢٠١٣ وذلك بمحطة بحوث السرو– مركز البحوث الزراعية أجريت التجربة ألحقليه في أربع مكررات بتصميم شرائح متعامدة والتجربة ألمعمليه لاختبارات جودة التقاوي على ناتج التجربة ألحقليه بتصميم التام العشوائية في أربع مكررات بوحدة بحوث تكنولوجيا البذور بالمنصورة – معهد بحوث المحاصيل ألحقليه – مركز البحوث الزراعية وأدت النتائج إلى الآتي :- ١- أظهرت النتائج بالرش الورقي بالخميرة خاصة التركيزات الأعلى ٦ , ٨ جم/لتر إلى زيادة معنوية على العديد من صفات النمو والمحصول وخاصة مع صنف جيزة ١٧٨ مثل عدد الأفرع /م٢ وطول النبات (سم) والوزن الجاف (جم/ م٢) وعدد السنابل / م ٢ وطول النبات (سم) وعدد الحبوب الممتلئة /السنبلة ووزن السنبلة (جم) ومحصول الحبوب (طن/هكتار) ومحصول القش (طن/هكتار) يليه صنف سخا ١٠٦ ثم صنف سخا ١٠٥ كمقارنة أصناف . ٢- أدى الرش الورقي بالخميرة بزيادة التركيزات من صفر إلى ٢ , ٤ , ٦ , ٨ جم/ لتر إلى زيادة وتحسن في صفات مكونات المحصول مثل عدد الأفرع /م٢ وأيضا تاريخ الطرد (يوم) وزيادة الوزن الجاف (جم/ م٢) وعدد السنابل / م٢ وطول النبات (سم) ووزن الألف حبه بالجرام ومحصول الحبوب (طن/هكتار) بفروق معنوية عاليه مقارنة بالكنترول لكلا الموسمين وأيضا كان التفاعل معنوي مع صفات عدد الأفرع / م٢ وعدد السنابل / م٢ ووزن الألف حبه بالجرام ومحصول الحبوب (طن/هكتار) مع كل الأصناف تحت الدراسة . ٣- اختبار حيوية التقاوي :- حيث كان صنف جيزة ١٧٨ هو أعلى الأصناف لصفات البادرات الطبيعية (نسبة الإنبات) وسرعة الإنبات وطول البادرات بينما يليه صنف سخا ١٠٥ ثم سخا ١٠٦ كمقارنة أصناف ومن ناحية أخرى كان استخدام تركيز ٦ و ٨ جم/لتر خميرة كرش ورقى أعطى تحسن معنوي لحيوية البذور و البادرات وأيضا أدى إلى خفض معنوي للنسبة المئوية للبادرات الغير طبيعيه. ٤- اختبار صحة التقاوي :- تم تعريف عدد ١٣ جنس ونوع فطرى تم ملازمتهم لتقاوي كل الأصناف تحت الدراسة وسجل صنف جيزة ١٧٨ اقل الأصناف حملا للفطريات يليه صنف سخا ١٠٦ ثم سخا ١٠٥ كمقارنة أصناف ومن ناحية أخرى كان فطر *Alternaria padwickii* أكثر الفطريات تواجدا على البذور يليه فطر *Bipolaris oryza* ثم *Alternaria longesima* ثم *A. Fusarium semitectum* ,*tenuis* ,*F. graminearum* ,*Sarocladium oryza* وأدت الزيادة في تركيز الخميرة كرش ورقى من صفر إلى ٢ , ٤ , ٦ , ٨ جم/ لتر إلى نقص معنوي في أعداد الفطريات ألملازمه للتقاوي وخاصة الممرض منها والمسبب للنقص في حيوية البذور والبادرات .

التوصية :-

توصى هذه الدراسة باستخدام الخميرة الجافة كرش ورقى على نباتات الأرز في أعمار ٢٥ , ٥٥ , ٨٥ يوم من ألزراعه بتركيز ٦ – ٨ جم/لتر حيث يؤدى ذلك إلى تحسن في صفات النمو والمحصول ومكوناته وارتفاع في قيم حيوية البذور والبادرات ونقص في أعداد الفطريات المصاحبة للتقاوي ألمنتجه .