# RESPONSE OF WHEAT (TRITICUM AESTIVUM L.) PLANTS TO FOLIAR SPRAYING OF SOME BIO-STIMULANTS (YEAST EXTRACT, ARGININE, B12 AND THEIR INTERACTIONS)

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## ABSTRACT

*A field experiments were carried out in season of 2013/2014 at Botanical garden, Botany and Microbiology Dept., Fac. of Sci., Al- Azhar Univ., Nasr City, Cairo, to study the effect of foliar applications of some bio-stimulants (dry yeast extracts, arginine, B12 and their interactions) on growth, total yield, quality and some chemical constituents of wheat plants. Results showed that, foliar spraying of wheat plants with bio-stimulants especially yeast extract had a significant effect on vegetative growth, yield and quality. Shoot fresh weight of wheat plants were improved by yeast extract at all doses and B 12 foliar application during the first stage. Results showed that addition of any of these treatments has been significantly increased the dry weight of roots during two stages as compared to the control in almost cases. The contents of pigments of wheat plants showed, significant increases in chlorophyll a, b, a+b and carotenoids content in response to various treatments. Results indicated that foliar application of all these treatments increased amylase activity compared to control during the second stage. Application of yeast (6 g $l^{-1}$) + $B_{12}$ or yeast (6 g $l^{-1}$) + arginine showed the heaviest 100 seeds weight (4.16 and 4.11 g) respectively as a compared with untreated plant(2.9 g). Moreover it could be concluded that foliar spraying of yeast (4g/l) +Arg. led to obtain the highest values of yielded seeds protein, while the highest values of yielded carbohydrates at yeast (4g/l) +$B_{12}$ of wheat plants.*

## INTRODUCTION

Wheat (Triticum aestivum L.), is the most important world's leading cereal crop. In Egypt wheat is considered the main crop used as source for human food. Although wheat production per unit area in Egypt has significantly increased during the past years, wheat production supplies about 40 % of its annual domestic demand only (FAO, 2008).

The ccurrent global scenario firmly emphasizes the need to adopt eco-friendly agricultural practices for sustainable agriculture (Fawzy et al., 2012). Organic farming is 'zero impact' on the environment (www.seedbuzz.com). Biofertilizers are low cost, effective and renewable source of plant nutrients to supplement chemical fertilizers, In addition to their role in enhancing the growth of the plants, biofertilizers can act as biocontrol agents in the rhizosphere at the same time. This synergistic effect, when present, increases the role of application of bio-fertilizers in the sustainable agriculture. Many attempts were made to prepare a bio-fertilizer from wastes using effective microorganism including bacteria and yeasts. Yeasts synthesize antimicrobial and other useful substances required for plant growth from amino acids and sugars secreted by bacteria, organic matter and plant roots (Boraste et al., 2009). Agamy et al., (2013) showed that, the use of yeast as a bio-fertilizer in agriculture has received considerable attention because of their bioactivity and safety for human and the environment. Organic farming strategy is growing rapidly all over the world to conserve human health and the environment, which became under risk because of the unbalance use of pesticides and chemical fertilizers. The dangerous effect is because the repeated use of chemical fertilizers destroys soil biota (Boraste et al., 2009). Saccharomyces cerevisiae is considered as a new promising plant growth promoting yeast for different crops. Recently, it became a positive alternative to chemical fertilizers safely used for human, animal and environment (Omran, 2000). It is known that yeast is considered as a natural source of cytokinins that stimulate cell division and enlargement as well as the synthesis of proteins, nucleic acids and chlorophyll (Fathy and Farid, 1996). Foliar application of yeast extract and ascorbic acid increased vegetative growth of eggplant (El-Tohamy et al., 2008). Also, Abou El-yazied and Mady (2012) found that yeast extract stimulated growth of broad bean and increased amino acid, auxins and cytokinins 75 days after sowing of broad bean.

Growth regulators and vitamins are known to

affect plant growth through primary and secondary metabolism (Ewais et al. 2003 and Reda et al.2007). Rafique, et al. (2011) showed the best results on seedling growth, fresh and dry matter production of pumpkin seedlings due to 30 mg $L^{-1}$ ascorbic acid treatments.

Arginine is one of the essential amino acids (considered the main precursor of polyamines which produced by decarboxylation of arginine via arginine decarboxylase to form putrescine (Bocherueu, 1999). Amino acids are well known as bio-stimulants, which have positive effects on plant growth, yield and significantly mitigate the injuries caused by abiotic stresses (Kowalczyk and Zielony, 2008). Polyamines and their precursor arginine have been implicated as vital modulators in a variety of growth, physiological and developmental processes in higher plants (Glastone and Kaur-sahney, 1990). Fawzy et al., 2012) showed that, foliar spraying of Chinese garlic plants with bio-stimulants especially amino acids compound had a significant effect on vegetative growth, yield and quality. The application of arginine significantly promoted the growth and increased the fresh and dry weights in bean (Nassar et al., 2003); in wheat Abd El-Monem, 2007) and El-Bassiouny et al., 2008). Therefore, the purpose of this study is an attempt for investigating the effect of yeast extract, arginine, B12 and their interaction on growth, yield and some biochemical constituents of wheat plant in order to select a suitable bio stimulant to the applied fairly to enhance growth and yield quality.

## MATERIALS AND METHODS

Seeds of wheat "Triticum aestivum L.)" (Var. suds 1) was obtained from Agricultural Research Centre, Ministry of Agriculture, Giza, Egypt. Uniform wheat seeds were planted in natural loamy soil conditions in a plot (12 m width and 15 m. length) containing 12 groups representing the following treatments: yeast at 29 /liter, 4 g/liter and 6 g/liter were applied to the 2nd, 3rd and 4th groups, respectively; Arginine at 200 ppm was applied to the 5th groups. The 6th group was treated with $B_{12}$ at 200ppm. The 7th and 8th groups were treated with (yeast at 2 g/liter+ Arg at 200 ppm) and (yeast at 2 g/liter+ $B_{12}$ at 200 ppm) respectively. yeast at 4 g/liter+ Arg at 200 ppm and yeast at 4 g/liter+ $B_{12}$ at 200 ppm , respectively were applied to the 9th and 10th . The 11th and 12th groups were treated with yeast at 6 g/liter+ Arg at 200 ppm and yeast at 6 g/liter+ $B_{12}$ at 200 ppm, respectively. The first group was left aside untreated serving as control. The seeds were sown on one side of the ridge, with 10 cm apart between the hills. In the Botanical garden, Botany and Microbiology Dept., Fac. of Sci., Al- Azhar Univ., Nasr City, Cairo, Egypt, developed plants were irrigated whenever required. Concentrations of the used yeast extract, arginine and vitamin $B_{12}$ were chosen according to a preliminary experiment in which they caused a maximum germination percentage. The plants were sprayed twice with the above mentioned treatments, the first and second were added at 33 and 70 days of plant age respectively. The plant samples were collected for analysis when the plants were 40 (Stage I) and 77 (Stage II) days old. At the end of the growth season, analysis of the seeds yielded from the different treatments and the control were done. Chlorophylls contents were estimated using the method of Vernon and Selly (1966). Carotenoids contents of were estimated according to Lichtentahler (1981). Soluble carbohydrates were measured according to the method of Umbriet et al. (1969). Contents of soluble proteins were estimated according to the methods of lowery et al. (1951). A phenolic compound (mg/100 g of dry wt) was carried out according to that method described by Daniel et al. (1972). Activities of amylases were determined using the method of Afifi et al. (1986). Statistical analysis of the obtained results was done using (L.S.D.) according to Snedecor and Cochran (1982).

## RESULTS AND DISCUSSION

### *1. Growth parameters*

Our results in table (1) showed that, shoot length of wheat plants were significantly enhanced as a result of application of yeast (2g/l), yeast (2 g/l)+$B_{12}$ and yeast (6 g/l)+arginine foliar application for the first growth stage. On the other hand, foliar application had no significant effect on root growth and number of leaves parameter during all stages and shoot length during

the second stages. Data in Table (2) indicated that the overall fresh weights of shoot of wheat plants were improved by yeast extract at all doses and $B_{12}$ foliar application during the first stage. Results showed that addition of any of this treatments has been significantly increased the dry weight of roots during two stages as compared to the control in almost cases. Increase in fresh and dry weight of the root is a good indicator for enhancement of the yield. A growing number of studies indicate that plant root growth may be directly or indirectly enhanced by yeasts in the rhizosphere (Nassar et al., 2005; El-Tarabily and Sivasithamparam, 2006; Cloete et al., 2009). Increase in vegetative growth of plants because of the application of bio-fertilizers was reported in previous works (Mahdi et al., 2010). In agreement with our results, Wali Asal (2010) indicated that yeast has good efficiency on growth characters of wheat plants. Nakayan et al., (2009) reported that combination of yeast strain Pichia sp. CC1 and a half dose of chemical fertilizer (½CF) increased lettuce dry weight to 107%. In addition, yeast content of macro and micronutrients, growth regulators and vitamins stimulate the plant to build up dry matters (Hesham and Mohamed, 2011). The promoting effect of yeasts could be due to the biologically active substance produced by these biofertilizers such as auxins, gibberellins, cytokinins, amino acids and vitamins (Bahr and Gomaa, 2002). Fawzy et al., (2012) found that, foliar sprayed of amino acid significantly influenced dry weight of leaves, neck and bulb of Chinese garlic plants.

***2- Photosynthetic Pigments:***

The contents of chlorophyll a; b; total chlorophyll (a+ b) and carotenoids of wheat plants (Table 3) showed, significant increases in chlorophyll a, b, a+b and carotenoids content in response to various treatments applied yeast extracts, arginine, $B_{12}$ and their interactions. The obtained results agree with those observed by a number of investigators for example, Agamy et al., (2013) showed that application of the yeasts (Kluyveromyces walti, Pachytrichospora transvaalensis and Sacharromycopsis cataegensis) significantly increased the photosynthetic pigments of sugar beet. Also, showed that, the application yeasts induced the formation of photosynthetic pigments (chlorophyll a and b). The positive effect of yeasts on chl. a and b is in consistence with the result obtained by Hayat (2007) and Stino et al. (2009), who stated that the increase in chl. a and b leads to a consequent increase in total carbohydrates, because the yeast application could enhance role in cell division, cell elongation producing more leaf area. Hussain et al. (2002) reported that Saccharomyces sp. is among the microorganisms, which improve crop growth and yield by increasing photosynthesis, producing bioactive substances, such as hormones and enzymes and controlling soil diseases. Castelfranco and Beale (1983) stated that the increase in photosynthetic pigment formation could be attributed to the role of yeast cytokinins delaying the aging of leaves by reducing the degradation of chlorophyll and enhancing the protein and RNA synthesis. The application of arginine significantly promoted the growth and increased chlorophylls a and b and carotenoids in bean (Nassar et al., 2003); in wheat Abd El-Monem, 2007) and El-Bassiouny et al., 2008).

***3- Soluble Carbohydrates and proteins:***

In the present study, it was found (Table 4) that carbohydrates contents in shoots of wheat plants, were significantly increased in response to Arginine, Yeast (2 g/l)+Arg., Yeast (4 g/l) +Arg. and Yeast (6g/l)+Arg. during the two seasons. While protein contents in shoots of wheat plants, were significantly increased in response to Yeast (2 g/l), B12 and yeast (2g/l) + Arg. Data in Table (4) also, noted that the activities of amylases enzymes was positively affected by the foliar spray of all treatments during the second stages.

Amino acids are the fundamental ingredients for the process of protein synthesis. The importance of nitrogen or 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 (Kamar and Omar, 1987).

The obtained results are in harmony with those reported by Agamy et al., (2013) showed that application of the yeasts significantly ($P < 0.05$) increased the soluble sugars, sucrose, and total soluble proteins of sugar beet. Abdel-Halim

molecular weights (MWs) ranged from about 9.97 to 147.47 KDa in the yielded wheat seeds in response to treatment with different concentrations of yeast extract, Arg., B12 and their interactions. Results of the present study revealed that the electrophoregram of the plants treated with different concentrations of yeast extract, arginine, B12 and their interactions exhibited the appearance of different protein bands of others presented in the control samples. The obtained results showed the presence of 7 monomorphic common polypeptide bands, 11 polymorphic common polypeptide bands. The obtained results are in agreement with those reported by Fawzy., (2012) clearly showed that, foliar spraying of amino acid significantly increased protein content in tissue of Chinese garlic bulb. Ekmekçi and Karaman (2012) showed that application of 100 ppm ascorbic acid (vitamin C) increased the intensity of protein bands as well as synthesized additional new proteins of Silybum marianum (L.) plants.

### *Conclusion*

Our results are promising in the field of biofertilizers. Foliar application of yeast (2 , 4 and 6g $l^{-1}$), amino acids (arginine) and vitamin ($B_{12}$) as bio-stimulants can be recommended to enhance total yield and yield quality of wheat, while foliar application of yeast was the best for vegeta-

**Table (1): Effect of yeast extract (g/l), arginine (ppm), B12 (ppm) and their interactions on shoot length, root length and number of leaves of Triticum aestivum L. (var. suds 1) plants. Values given are means of ten replicates.**

| Treatment | Shoot length (cm) | | Root length (cm) | | Number of leaves | |
|---|---|---|---|---|---|---|
| | Stage I | Stage II | Stage I | Stage II | Stage I | Stage II |
| Control | 30.28 | 61.60 | 7.62 | 7.18 | 4.20 | 7.00 |
| Yeast 2g/l | 37.96* | 60.82 | 8.42 | 7.78 | 4.40 | 9.00 |
| Yeast 4g/l | 33.64 | 62.54 | 7.92 | 8.32 | 4.00 | 8.60 |
| Yeast 6g/l | 33.52 | 56.84 | 8.14 | 7.02 | 4.00 | 6.80 |
| Arg 200 | 31.16 | 59.60 | 8.82 | 8.84 | 4.00 | 8.60 |
| $B_{12}$ 200 | 33.94 | 62.04 | 8.84 | 8.62 | 4.00 | 5.40 |
| Yeast 2+ Arg 200 | 33.30 | 56.70 | 8.14 | 10.36 | 4.20 | 8.20 |
| Yeast 2+$B_{12}$ | 36.74* | 52.80* | 7.26 | 8.36 | 4.00 | 7.60 |
| Yeast 4+ Arg 200 | 33.58 | 55.04* | 8.16 | 7.44 | 4.00 | 7.20 |
| Yeast 4+$B_{12}$ | 32.36 | 60.46 | 7.08 | 9.12 | 4.00 | 6.00 |
| Yeast 6+ Arg 200 | 37.28* | 52.96* | 9.1 | 9.82 | 4.00 | 7.60 |
| Yeast 6+$B_{12}$ | 35.34 | 55.60 | 7.7 | 5.82 | 4.00 | 6.20 |
| LSD at 0.05 | 3.48 | 5.58 | 2.26 | 2.07 | 0.31 | 2.07 |

*** Significant at 5% confidence level.**

**Table (2): Effect of yeast extract (g/l), arginine (ppm), B12 (ppm) and their interactions on fresh and dry weight of shoots and roots of Triticum aestivum L. (var. suds 1) plants. Values given are means of ten replicates.**

| Treatment | F. wt. of shoots (g.) | | D. wt. of shoots (g.) | | F. wt. of roots (g.) | | D. wt. of roots (g.) | |
|---|---|---|---|---|---|---|---|---|
| | Stage I | Stage II | Stage I | Stage II | Stage I | Stage II | Stage I | Stage II |
| Control | 0.63 | 3.72 | 0.09 | 0.93 | 0.10 | 0.22 | 0.015 | 0.031 |
| Yeast 2g/l | 1.08* | 4.14 | 0.14 | 1.15 | 0.32* | 0.40* | 0.046* | 0.057* |
| Yeast 4g/l | 0.99* | 5.48* | 0.14 | 1.31* | 0.14 | 0.39 | 0.020* | 0.056* |
| Yeast 6g/l | 0.97* | 3.15 | 0.15* | 0.89 | 0.20 | 0.30 | 0.029* | 0.043* |
| Arg 200 | 0.81 | 3.43 | 0.11 | 0.92 | 0.14 | 0.32 | 0.020* | 0.046* |
| B12 200 | 1.16* | 3.25 | 0.16* | 1.01 | 0.22 | 0.28 | 0.032* | 0.040* |
| Yeast 2+ Arg 200 | 0.92 | 3.25 | 0.13 | 0.81 | 0.16 | 0.41* | 0.023* | 0.059* |
| Yeast 2+B12 | 0.98* | 3.29 | 0.13 | 0.86 | 0.11 | 0.23 | 0.016* | 0.033* |
| Yeast 4+ Arg 200 | 0.89 | 3.03 | 0.12 | 0.91 | 0.11 | 0.18 | 0.016* | 0..026* |
| Yeast 4+B12 | 0.93 | 3.64 | 0.14 | 1.13 | 0.32* | 0.06 | 0.045* | 0.009* |
| Yeast 6+ Arg 200 | 0.99* | 3.17 | 0.14 | 0.79 | 0.17 | 0.21 | 0.025* | 0.030* |
| Yeast 6+B12 | 1.12* | 2.49* | 0.26* | 0.78 | 0.18 | 0.25 | 0.025* | 0..035* |
| LSD at 0.05 | 0.31 | 1.19 | 0.057 | 0.35 | 0.19 | 0.18 | 0.0004 | 0.0003 |

*** Significant at 5% confidence level.**

**Table (3): Effect of yeast extract (g/l), arginine (ppm), B12 (ppm) and their interactions on chlorophyll and carotenoids contents (mg/g. F. wt) of Triticum aestivum L. (var. suds 1) plants. Values given are means of three replicates**

| Treatment | Chlorophyll a | | Chlorophyll b | | Chlorophyll a+b | | Carotenoids | |
|---|---|---|---|---|---|---|---|---|
| | Stage I | Stage II | Stage I | Stage II | Stage I | Stage II | Stage I | Stage II |
| Control | 9.66 | 11.83 | 2.605 | 7.05 | 12.26 | 18.88 | 3.405 | 5.35 |
| Yeast 2g/l | 12.43* | 17.76* | 2.933* | 12.48* | 15.36* | 30.24* | 4.303* | 7.99* |
| Yeast 4g/l | 8.51* | 29.53* | 1.805* | 19.05* | 10.31* | 48.59* | 3.317* | 6.13 |
| Yeast 6g/l | 8.66* | 23.18* | 2.122* | 11.80* | 10.78* | 34.99* | 2.72* | 5.86 |
| Arg 200 | 9.25* | 19.94* | 2.082* | 9.80* | 11.33* | 29.74* | 3.43* | 6.17 |
| B12 200 | 10.04* | 19.58* | 2.257* | 10.46* | 12.30* | 30.04* | 3.56* | 5.49 |
| Yeast 2+Arg | 9.99* | 21.62* | 2.134* | 11.40* | 12.12* | 33.03* | 3.59* | 5.32 |
| Yeast 2+B12 | 7.86* | 44.26* | 4.629* | 23.17* | 12.49* | 67.43* | 1.00* | 11.72* |
| Yeast 4+Arg | 8.51* | 36.05* | 1.776* | 19.34* | 10.29* | 55.39* | 3.16* | 10.99* |
| Yeast 4+B12 | 8.23* | 27.92* | 2.195* | 17.84* | 10.42* | 45.75* | 2.99* | 6.99 |
| Yeast 6+Arg | 5.62* | 33.33* | 1.431* | 16.86* | 7.05* | 50.20* | 2.24* | 9.14* |
| Yeast 6+B12 | 7.46* | 19.62* | 1.403* | 10.64* | 8.86* | 30.26* | 2.72* | 5.41 |
| LSD at 0.05 | 0.053 | 0.604 | 0.092 | 0.910 | 0.092 | 0.481 | 0.053 | 1.03 |

*** Significant at 5% confidence level.**

**Table (4): Effect of yeast extract (g/l), arginine (ppm), B12 (ppm) and their interactions on total soluble carbohydrates, proteins contents and activities of amylases enzymes (mg/g. dry weight) of Triticum aestivum L. (var. suds 1) plants. Values given are means of three replicates.**

| Treatment | Shoot carbohydrates | | Shoot proteins | | Amylases | |
|---|---|---|---|---|---|---|
| | Stage I | Stage II | Stage I | Stage II | Stage II | Stage I |
| Control | 1.36 | 0.85 | 30.44 | 19.44 | 1.37 | 1.56 |
| Yeast 2g/l | 0.95 | 1.14* | 34.09* | 24.40* | 1.06* | 1.81* |
| Yeast 4g/l | 1.50 | 0.96* | 38.24* | 14.79* | 0.67* | 1.85* |
| Yeast 6g/l | 1.84 | 1.08* | 33.98* | 20.11 | 0.58* | 1.82* |
| Arg 200 | 2.02* | 1.46* | 33.84* | 19.41 | 0.97* | 1.65* |
| B12 200 | 1.42 | 2.07* | 33.45* | 22.56* | 0.75* | 1.82* |
| Yeast 2+Arg | 2.50* | 0.94* | 34.48* | 21.97* | 0.41* | 1.90* |
| Yeast 2+B12 | 2.07 | 0.99* | 39.22* | 9.24* | 0.17* | 1.72* |
| Yeast 4+Arg | 3.42* | 1.09* | 38.44* | 16.60* | 0.86* | 1.80* |
| Yeast 4+B12 | 1.85 | 1.33* | 11.05* | 16.01* | 0.98* | 1.96* |
| Yeast 6+Arg | 3.94* | 1.09* | 11.61* | 19.91 | 1.41 | 1.83* |
| Yeast 6+B12 | 1.69 | 0.59* | 11.11* | 16.12* | 1.38 | 1.73* |
| LSD at 0.05 | 0.608 | 0.053 | 1.26 | 1.005 | 0.12 | 0.053 |

*** Significant at 5% confidence level.**

**Table (5): Effect of yeast extract (g/l), arginine (ppm), B12 (ppm) and their interactions of yield components of Triticum aestivum L. (var. suds 1). Values given are means of ten replicates.**

| Treatment | Length of spike | Weight of spike | wt. seeds \ spike | No. of seeds/ plant | Wt. of 100 seeds(g) |
|---|---|---|---|---|---|
| Control | 11.22 | 1.04 | 0.59 | 20.60 | 2.90 |
| Yeast 2g/l | 11.80 | 1.13 | 0.82* | 19.00 | 4.01 |
| Yeast 4g/l | 11.50 | 1.00 | 0.66 | 21.10 | 3.28* |
| Yeast 6g/l | 11.00 | 1.05 | 0.64 | 22.20 | 3.65* |
| Arg 200 | 10.25* | 0.58* | 0.42* | 13.80* | 4.03* |
| B12 200 | 10.73 | 1.00 | 0.67 | 17.00 | 3.67* |
| Yeast 2+ Arg | 11.13 | 0.98 | 0.60 | 15.40* | 3.15* |
| Yeast 2+B12 | 10.04* | 0.82 | 0.53 | 17.00 | 3.45* |
| Yeast 4+ Arg | 9.35* | 0.84 | 0.44 | 17.20 | 3.70* |
| Yeast 4+B12 | 10.59 | 1.02 | 0.69 | 18.30 | 3.30* |
| Yeast 6+ Arg | 9.69* | 0.69* | 0.41* | 10.00* | 4.11* |
| Yeast 6+B12 | 8.30* | 1.00 | 0.63 | 17.40 | 4.16* |
| LSD at 0.05 | 0.88 | 0.23 | 0.16 | 4.97 | 0.092 |

*** Significant at 5% confidence level.**

(1995) who observed that ascorbic acid increased protein content of wheat grains. Hussain et al. (2002) reported that Saccharomyces sp. is among the microorganisms, which improve crop growth and yield by increasing photosynthesis, producing bioactive substances, such as hormones and enzymes. The increase in the total soluble proteins content could be attributed to the growth hormones produced by yeast (Khalil and Ismael, 2010), direct stimulation of the synthesis of protein (Stino et al., 2009), providing plants with essential nutrient elements required for protein formation (Hayat, 2007).

***4- Yield Responses:***

Results recorded in table (5) indicated that foliar application of yeast extract, arginine and B12 increased significantly the weight of 100 seeds (g) of wheat plants. The highest value was obtained with plants treated with yeast extract at 6 g /l + B12. Yeast extract at 2g/l leads to increase in the weight seeds /plant about 39% compared with untreated plants. Many studies have been proved that amino acids can directly or indirectly influence the physiological activities in plant growth and development. In addition, reported that the foliar application of amino acids caused an enhancement in fruit yield and its components (Kamar and Omar 1987) on cucumber (El-Shabasi et al., 2005) on garlic (Awad et al., 2007) on potato, (Al-Said and Kamal 2008) on sweet pepper. The positive effect of yeast is supported by the findings of Mekki and Ahmed (2005). They stated that the increase in yield components because of yeast treatment is mainly attributed to the effect of yeast, which can play a very significant role in making available nutrient elements for plants. Hussain et al. (2002) reported that Saccharomyces sp. is among the microorganisms, which improve crop growth and yield by increasing photosynthesis.

***5- Metabolic responses and Protein electrophoretic patterns of yield.***

Result presented in table (6) showed that the foliar spray of all doses of this treatments increased significantly total seed protein contents, while seed carbohydrate contents only improve in response to yeast (2g/l) +B12 and yeast (4g/l) + B12. Seed phenols contents increased significantly at yeast (6g/l), yeast (4g/l) + arg., yeast (6g/l) +B12 and yeast (6g/l) + B12. Generally, it could be found that, the highest amount of protein in seeds of wheat was found by foliar application of yeast (2g/l) +B12. On the contrary, the lowest amount of protein was recorded by control treatment. With regard of phenolic and carbohydrates contents, the highest amount recorded by foliar sprayed of yeast (4g/l) +B12.

SDS-PAGE in Figure (1) and results in Table (7) revealed the changes in protein patterns with total number of 18 bands with different

**Table (6): Effect of yeast extract (g/l), arginine (ppm), B12 (ppm) and their interactions on total soluble carbohydrates, proteins and phenols of the seed yield of Triticum aestivum L. (var. suds 1). Values given are means of three replicates.**

| Treatment | Carbohydrates (mg/g) | Proteins (mg/g) | Total phenols (mg/100g) |
|---|---|---|---|
| Control | 11.31 | 30.61 | 10.28 |
| Yeast 2g/l | 8.43* | 45.49* | 15.78 |
| Yeast 4g/l | 7.44* | 36.18* | 15.81 |
| Yeast 6g/l | 9.25* | 34.40* | 21.53* |
| Arg 200 | 11.77 | 39.94* | 14.60 |
| B12 200 | 8.43* | 40.81* | 12.97 |
| Yeast 2+ Arg | 10.52 | 38.88* | 10.09 |
| Yeast 2+B12 | 13.71* | 48.08* | 14.78 |
| Yeast 4+ Arg | 11.19 | 32.34* | 26.47* |
| Yeast 4+B12 | 15.63* | 42.76 | 35.83* |
| Yeast 6+ Arg | 11.18 | 38.02* | 15.92 |
| Yeast 6+B12 | 8.03* | 41.25* | 23.45* |
| LSD at 0.05 | 0.99 | 1.45 | 7.33 |

*** Significant at 5% confidence level.**

**Table (7): Effect of yeast extract (g/l), arginine(ppm), B12(ppm) and their interactions on protein profile in the yielded seeds of Triticum aestivum L. (var. suds 1).**

| Band No. | M.W KDa | Treatments | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S 1 | S 2 | S 3 | S 4 | S 5 | S 6 | S 7 | S 8 | S 9 | S 10 | S 11 | S 12 | Polymorphism |
| 1 | 147.471 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | Polymorphic |
| 2 | 139.984 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | Polymorphic |
| 3 | 132.877 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | Polymorphic |
| 4 | 125.745 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | Polymorphic |
| 5 | 97.503 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Polymorphic |
| 6 | 87.854 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Polymorphic |
| 7 | 65.863 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | Polymorphic |
| 8 | 60.262 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Polymorphic |
| 9 | 56.853 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Polymorphic |
| 10 | 47.887 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Polymorphic |
| 11 | 33.354 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Monomorphic |
| 12 | 31.18 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Monomorphic |
| 13 | 28.88 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Monomorphic |
| 14 | 25.705 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Polymorphic |
| 15 | 20.869 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Monomorphic |
| 16 | 17.258 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Monomorphic |
| 17 | 13.341 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Monomorphic |
| 18 | 9.971 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Monomorphic |
| Total | | 7 | 13 | 13 | 13 | 14 | 17 | 13 | 14 | 14 | 18 | 14 | 14 | |

**S1= control, S2= Yeast (2g/l), S3= Yeast (4g/l), S4= Yeast (6g/l), S5= Arg , S6= $B_{12}$, S7= Yeast (2g/l)+Arg., S8= Yeast (2g/l) +$B_{12}$, S9= Yeast (4g/l)+Arg., S10= Yeast (4g/l)+ $B_{12}$, S11= Yeast (6g/l) )+Arg., S12= Yeast (6g/l)+ $B_{12}$.**

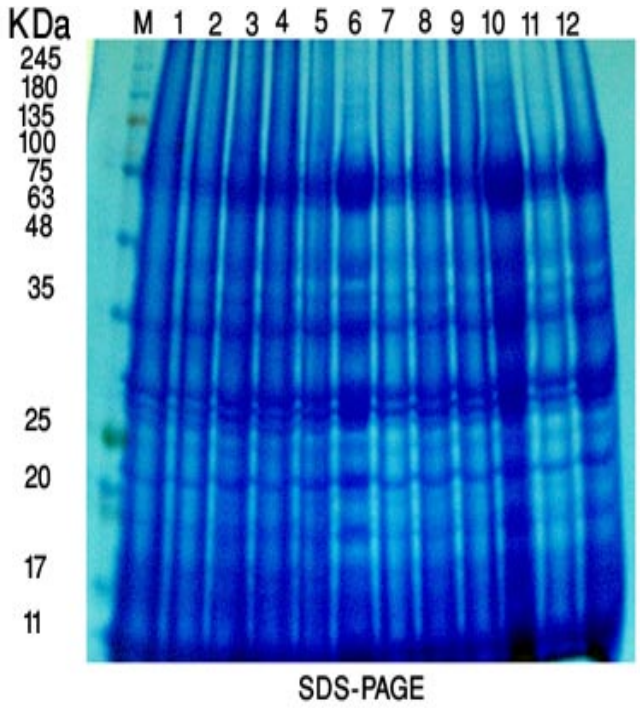


**Figure (1): 1= control, 2= Yeast (2g/l), 3= Yeast (4g/l), 4= Yeast (6g/l), 5= Arg , 6= $B_{12}$, 7= Yeast (2g/l)+Arg., 8= Yeast (2g/l) +$B_{12}$, 9= Yeast (4g/l)+Arg., 10= Yeast (4g/l)+ $B_{12}$, 11= Yeast (6g/l) )+Arg., 12= Yeast (6g/l)+ $B_{12}$.**

tive growth and weight seeds /spike. Application of yeasts2g/l increased the protein content of wheat by about 50 %. It significantly enhanced the overall growth of the treated plants. The mechanisms which could be involved include the bioavailability of macro and micronutrients, production of growth hormones.

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الملخص العربي

أجريت تجربة حقلية في الحديقة النباتية بقسم النبات والميكروبيولوجي بكلية العلوم جامعة الأزهر أثناء الموسم الشتوي 2013/ 2014 لدراسة تأثير الرش الورقي من مستخلص الخميرة (6,4,2 جرام لكل لتر ماء مقطر)، الارجنين (200 جزء في المليون) وفيتامين ب 12 (200 جزء في المليون) بالمعاملة المنفردة لكل منهما اوالمزدوجة بين التركيزات المختلفة من مستخلص الخميرة والأرجنين أو فيتامين ب 12 على النمو والمحصول وبعض النشاطات الأيضية لنبات القمح. أظهرت النتائج التي تم الحصول عليها أن استخدام مستخلص الخميرة(2جرام/ لتر) ادي الي حدوث زيادة معنوية في كلا من طول المجموع الخضري خلال المرحلة الاولي من النمو ووزن البذور لكل سنبلة. جميع التركيزات المختلفة من مستخلص الخميرة ادت ايضا الي زيادات معنوية في الوزن الرطب للمجموع الخضري. جميع التركيزات المستخدمة فعالة في زيادة محتوي الكلوروفيل والكاروتين. اعلي نسبة كربوهيدرات وبروتين تم الحصول عليها في بذور نباتات القمح المعاملة ب (مستخلص الخميرة 4 جرام/لتر + $B_{12}$ , مستخلص الخميرة 2جرام /لتر + $B_{12}$ علي الترتيب). كل المعاملات المستخدمة ادت الي زيادة معنوية في وزن 100 بذرة بالمقارنة بالنباتات غير المعاملة . جميع التركيزات المستخدمة فعالة في تنشيط الانزيمات المحلله للنشويات خلال المرحلة الثانية من النمو.