IMPROVEMENT OF GROWTH AND YIELD OF BLACK CUMIN PLANT BY ACTIVE DRY YEAST AND SOME VITAMINS

Sakina I. Ismail[1], Mahmoud A. Khafagy[2] and Mortada R. Khater[1]

1- Department of Medicinal and Aromatic Plants Research, Horticulture Research Institute, Agricultural Research Center, EGYPT

2- Department of Agricultural Botany, Faculty of Agriculture, Mansoura University, EGYPT.

ABSTRACT

Two pot experiments were carried out in the experimental farm of Agricultural Botany Department, Faculty of Agriculture, Mansoura University, Mansoura, Egypt, during the two growing seasons of 2004 and 2005 to investigate the effect of presoaking black cumin seeds in vitamins (ascorbic acid at 25 or 50 ppm, thiamine at 50 or 100 ppm and α tocopherol at 10 or 20 ppm) and active dry yeast at 1000 or 2000 ppm on black cumin plant growth and yield and its components.

The results indicated that presoaking seeds in vitamins and active dry yeast lead to an increase in vegetative growth in terms of plant height, number of leaves, number of lateral branches and fresh and dry weight per plant. Data also showed that α tocopherol at 10 and 20 ppm, thiamine at 50 ppm and yeast at 1000 ppm delayed significantly flowering and fruiting date While, other treatments hastened flowering and fruiting in both seasons.Application of vitamins and active dry yeast caused a marked increase in number of capsules and seed yield per plant as well as volatile oil and fixed oil percentage in addition to oil content per plant. Yeast at 2000 ppm and α tocopherol at 20 ppm were the best treatments.

INTODUCTION

Medicinal and aromatic plants occupy a prominent position in the Egyptian cultivation because of increasing interest demand of local industry and export.

Black cumin (*Nigella sativa* L.) belonging to family Ranunculaceae is an annual spicy herb native to the Mediterranean region and now cultivated in other parts of the world including Middle East, North Africa and Asia. Its seeds used for edible and medicinal purposes in many countries. In Egyptian folk medicine, Nigella seeds are used as carminative, diuretics and delayed menses and lactation, while its oil has protective action against histamine induced bronchospasm, cough and bronchal asthma (Soliman, 1978). Recent studies indicated that the Nigella oil has antibacterial, antifungal and antihelminthic effects **(**Salomi *et al.* 1992).

Organic and biodynamic agriculture considered as one of developmental techniques which produce no or less polluted yields. It has many angles, one of them application of biofertilization which had drown the attention of research workers and had became in the last few decades a positive alternative to chemical fertilizers, biofertilization are reasonably more safer to the environment and human compared to chemical fertilizers. In parallel to biofertilization and equal to its importance as well its sound able impact on the environment using natural and safety substituents, i.e. vitamins (B1 or C or E) and yeast as alternatives to using growth regulators in order to improve plant growth, flowering, fruit setting and yield.

Vitamins are organic compounds that are essential to the metabolism of living organisms. They are known as growth factors inflicting many physiological processes. They act as co-enzymes or constituents of enzymes cofactor. Vitamins have functions as growth regulators or hormone precursors; have antioxidative properties and probably also yet unknown modes of actions (Oertli, 1987). The various positive effects of applying active dry yeast was attributed to it own contents of different nutrients, high percentage of protein, larger amounts of vitamin B and natural plant growth regulators such as cytokinins. (Ahmed *et al.* 1997)

The beneficial effects of applying vitamins and yeast on growth and yield of medicinal and aromatic plants have been frequently reported, In early studies of Reda *et al*. (1977)they found that application of vitamins (thiamine and ascorbic acid) favoured the growth of roots, stems and leaves as well as fruits and rays of umbels of *Ammi visnaga* L. as indicated by increase in their dry weight. The most effective concentration of thiamine was 50 mg/L whether applied as soaking of the seeds or as foliar spray. Ascorbic acid was more effective when applied only as presowing treatment of the seeds especially at 50 and 100 mg/L. Thiamine treatment significantly increased the total yield of chromones and khellin as well as visnagin yield (mg/plant) in the fruits in both soaking and spraying applications, especially at 50 mg/L. The yield of different chromones in the fruits under the effect of ascorbic acid (50 and 100 mg/L soaking method) was about 3 folds that of corresponding control.

Ahmed *et al.* (1998) on roselle plant found that when active dry yeast were applied as foliar spray with three concentrations 0.0, 0.1 and 0.2 g/L at vegetative growth, flowering and fruiting stages improved significantly growth, yield of calyxes and active ingredients. They added that maximum values obtained when plants sprayed with 0.2 g/L. Ahmed and Ali (2001) found that active dry yeast at 0.0, 0.1 and 0.2 g/L significantly increased the vegetative growth of *Amborsia maritima* , while damssin and ambrosin percentage significantly decreased by increasing the yeast concentration. Ali (2001) found that foliar spray with 4.5 g/L active dry yeast gave better results of *Calendulla officinals*.

Refaat and Balbaa (2001) obtained pronounced increment in lemongrass vegetative growth, yield and essential oil percentage due to applying thiamine. They also found that quantitative and qualitative changes in essential oil constitutes due to thiamine treatment. Naguib and Khalil (2002) reported that using yeast and thiamine on *Nigella sativa* L. plant had promising effects on vegetative growth, seed index and yield as well as fixed and essential oil yield. The treatment with the superiority was yeast at 2 g/L combined with 20 ppm thiamine in increasing *Nigella sativa* seed yield with good quality. Wahba (2005) mentioned that using yeast and riboflavin increased vegetative growth parameters and yield of *Oenothera biennis.*

Recently, Massoud (2006) confirmed that using yeast caused an increase in vegetative growth in terms of plant height, number of branches, herb fresh and dry weight per plant , herb yield and essential oil of sage (*Saliva officinalis* L.) plant.

It could be noticed that there is no enough literature concerning the effect of vitamins and yeast on the growth and yield of medicinal plants generally and particularly on black cumin. Thus this study aimed to give some spot lights on this topic and to investigate the effect of presoaking *Nigella sativa* seeds in different concentrations of active yeast, thiamine, ascorbic acid and α-tocopherol on plant growth and seed yield and its components.

MATERIALS AND METHODS

Two pot experiments were carried out in the farm at the Agricultural Botany Department, Faculty of Agriculture, Mansoura University during the period of 2004-2005, to investigate the effects of vitamins (ascorbic acid, thiamine and α-tocopherol) and yeast (active dry yeast) on black cumin plants growing under normal conditions.

The seeds of black cumin (*Nigella sativa* L.) used in the present study were secured from Medicinal and Aromatic Plants Research Department, Horticulture Research Institute, Agricultural Research Center, Giza, Egypt.

The pots used in this experiment were of plastic type 40 cm in diameter having drainage holes and were filled with 20 kg clean air dry soil. Homogenous lots of black cumin seeds were separately soaked for 12 hours in vitamins and yeast as follows: 1-Control (distilled water), 2- Ascorbic acid at 25 ppm. , 3- Ascorbic acid at 50 ppm, 4- Thiamine at 50 ppm, 5- Thiamine at 100 ppm, 6- α-tocopherol at 10 ppm, 7- α-tocopherol at 20 ppm, 8- Yeast at 1000 ppm and 9- Yeast at 2000 ppm.

After soaking, thirty seeds were planted in each pot on 19 th November in the two growing seasons. After 6 weeks from sowing, the plants were thinned to leave only 5 uniform plants per pot. Phosphorus fertilizer (calcium super phosphate 15.5% P_2O_5) was mixed with soil prior to sowing at the rate of 200 kg / feddan, while both nitrogen (ammonium sulphate 20.6% N) and potassium (potassium sulphate 48% K_2O) were added individually in two equal doses at the rate of 50 Kg/Feddan and 75Kg/Feddan, respectively. The first dose was added after thinning and the second half at the beginning of flowering stage. Irrigation was conducted whenever required throughout the experimental period.

After 90 days from sowing three plants from each treatment were taken randomly to study the following parameters.1- Plant height, number of leaves / plant, number of lateral branches / plant, shoot system fresh weight (g) and shoot system dry weight (g).During growing season the number of days till flowering and fruiting were recorded while at the end of season the following yield parameters were taken , number of capsules / plant, seed yield / plant (g), weight of 1000 seed (g), oil yield per plant and oil percentage% (fixed and volatile).

Fixed oil % was carried out as described by A.O.A.C. (1990) and volatile oil was determined according to Guenther (1961).

The treatments were arranged in complete randomized block design and the obtained data were subjected to statistical analysis of variance according to Gomez and Gomez **(**1984) LSD value for comparison

RESULTS AND DISSCUSSION

1- Vegetative Growth

Data presented in Table (1) reveal that α-tocopherol at (10 or 20 ppm), thiamine at (50 and 100 ppm) and yeast at (1000 and 2000 ppm) increased significantly black cumin plant height in the two growing seasons. There are no significant differences between thiamine and yeast treatments especially at the high level. The highest values were obtained with the high level of them. In addition presowing seeds in active dry yeast at 2000 ppm proved to be more effective in increasing plant height. However, ascorbic acid at 25 ppm decreased plant height in the first season while, increased it in the second season.

With regard to number of leaves per plant, data presented in Table (1) reveal that the presowing seeds in thiamine, α-tocopherol and yeast led to an increase in the number of black cumin leaves per plant, Moreover, both thiamine and yeast at high levels were more effective in this concern. While, ascorbic acid either at 25 or 50 ppm and thiamine at 50 ppm had no significant effect in this concern.

Regarding the effect of vitamins and active dry yeast on number of lateral branches per plant, data in the same table point out that yeast, α-tocopherol and thiamine increased significantly number of branches of black cumin plant but ascorbic acid caused a slight increase in this regard. Moreover, yeast application was more effective in this respect.

With respect to fresh and dry weights per plants, data recorded in Table (1) reveal that ascorbic acid, thiamine and α-tocopherol as well as yeast treatments increased significantly both fresh and dry weight of black cumin plant in the two successive seasons. This increment was highly significant in yeast, α-tocopherol and thiamine at the high concentrations.

It could be noticed that soaking black cumin seeds with vitamins (ascorbic acid, thiamine, and α-tocopherol) or yeast showed higher significant increases in all studied growth characters compared with control.

The promotive effects of ascorbic acid on the fresh and dry weights per plant could be attributed in part to its effect on many metabolic and physiological processes and/or increase the organic acids exerted from the roots into the soil and consequently increase the solubility of the most nutrients which slowly release into the rizosphere zone where it may be utilized by the plant (Negm *et al.* 1997)

Thus, it could be concluded that ascorbic acid in lower concentrations might probably acts as growth factor. Another approach for the role of ascorbic in intact plant growth was stated by Aberg, (1961) who attributed its effect to increasing the availability of iron and micronutrients in the plant. Tarraf *et al*. (1999) mentioned that AsA increased plant height and greatly increased the number of tillers/ plant of lemon grass plants. They added that ascorbic acid could be involved in the main metabolic processes especially with energy transfer coenzymes, carbohydrate metabolism and improved photosynthetic activity. Some investigators mentioned that ascorbic acid had a regulation effect upon oxidation reduction potential of cytoplasm (Aberg, 1961, Sana and Ota 1977). Our findings are in line with Reda *et al.* 1977 on *Ammi visnaga* L. and Saraswathamma and Jayachandra, 1981 on *Trigonella foenum* L.

Dealing with thiamine effects on growth, thiamine is connected with the role of thiamine pyrophosphate cocarboxylase, as a co enzyme in various types of decarboxylation involving pyruvic and α-ketoglutamic acid. Kodandaramaiah and Rao (1985) suggested that B. vitamins participate in plant growth and development indirectly by enhancing the endogenous levels of various growth factors such as cytokinins and gibberellins. Naguib and Khalil (2002) mentioned that thiamine has a promotive effect on vegetative growth of *Nigella sativa* L. they suggested that thiamine affect upon the meristem may partly be of an indirect nature and be mediated by the mature tissue through an altered supply of metabolite to the apex. Vitamin B1 has a function in intermediate carbohydrate metabolism (Robinson, 1973).These results are in accordance with those of ZhuKova (1977), Ramaiah *et al*.(1984), Oertli (1987), El-Ghamriny *et al*. (1999) and Youssef *et al*. (2005).

The enhancing influence of α-tocopherol (Vitamin E) on *Nigella sativa* L. growth parameters which was observed in this study may be due to its physiological role in protecting membrane lipids from peroxidation ,the vitamin E used up by this process is regenerated by vitamin C (Kunert and Ederer ,1985) and reducing oxidative stress ,e.g. imposed by gaseous pollutants (SO_2 ,O_3 , O_2 and OH) ,drought , chilling and herbicides (Fryer ,1992). Preliminary studies have shown that α-tocopherol can be absorbed by the plant tissue (Schmitz, 1997). The maximum of α-tocopherol uptake is achieved within 24 to 48 hours. Vitamin E results in higher membrane fluidity (Tanczos *et al.* 1982). These authors suggested that α-tocopherol is built into the plant membranes, the fluidity of which is thus increased. Alpha tocopherol increased the water permeability of liposomes at low temperatures. Similar results were published by Mallet *et al.* (1994) who established a significant linear correlation between antioxidative capacity of lipophilic extracts and α-tocopherol content in leaves of 15 selected plant species. Finally, the improving effects of antioxidants on growth characters might be attributed to their positive action on enhancing cell divisions and protecting plant cells from free radicals that responsible for plant sencences (Raskin, 1992).The positive effect of α-tocopherol on plant growth is in harmony with many findings on earlier results from literature on some plant species i.e. Tanczos *et al*. (1982)on rice, Matakiadis and Kintzios (2005) on cucumber plants.

Regarding the increasing effects with yeast, the positive effect of yeast extract on black cumin growth characters may be due to the fact that yeast extract is a natural source of cytokinins, vitamins, and most of the essential elements (Nagodawithana, 1991). In addition, the increase in the release of carbon dioxide through fermentation process effectively stimulates photosynthesis and accelerates the biosynthesis of carbohydrates. It increases synthesis of plant growth promoters especially GA_3, IAA and cytokinins which lead to improving cell division and cell enlargement (Moor, 1979). Our results coincided with the results obtained by Ahmed *et al.* (1998) on roselle plants, who found that yeast treatments improved growth and yield of plants, Ahmed *et al.* (1998) on marjoram plant who showed that active dry yeast caused more branches, heavier herb and leaves and dry weight, Naguib 2002 on lemongrass, as well as Naguib and Khalil 2002 on black cumin plant.

2 Yield and Its Components

2-1 Flowering and fruiting date:

Data tabulated in Table (2) show that thiamine at 50 ppm and α-tocopherol at 10 and 20 ppm as well as yeast at 1000 ppm delayed significantly flowering and fruiting date. Yeast treatment at 1000 ppm delayed the appearance of the first flower by 6 days while α-tocopherol treatments delayed flowering by 5.4 and 5.7 days respectively followed by thiamine at 50 ppm which delayed flowering by 3.7 days in the first season. In addition, α-tocopherol at 10 ppm delayed the appearance of first flower by 4.6 days followed by thiamine at 50 ppm and yeast at 1000 ppm which delayed it by 4 days as well as α-tocopherol which delayed flowering by 3 days in the second season. On the contrary, ascorbic acid at 25 and 50 ppm and thiamine at 100 ppm as well as yeast at 2000 ppm hastened flowering in the two seasons. The rate of ascorbic acid at 25 ppm was more effective in this respect. On the other hand, yeast application at 1000 ppm delayed the appearance of the first fruit by 5.3 days while α-tocopherol at 10 and 20 ppm delayed fruiting by 4.7 days only but thiamine at 50 ppm delayed it by 4 days in the first season. Thiamine at 50 ppm, α-tocopherol at 10 and 20 ppm and yeast at 1000 and 2000 ppm delayed fruiting in the second season. The rate of thiamine at 50 ppm was more effective in this regard which delayed fruiting by 4.4 days. Meanwhile, ascorbic acid at 25 and 50 ppm and thiamine at 100 ppm promoted fruiting by 2, 1 and 1 days respectively in the second growing season. Both ascorbic acid and thiamine at 100 ppm stimulated flowering and fruiting behavior by decreasing number of days required from sowing till flowering and fruiting. The hastening effect of ascorbic acid, the highest level of thiamine and yeast on flowering and fruiting may be attributed to the influence of them on metabolic processes such as carbohydrates metabolism. It also influences the synthesis of enzymes, nucleic acids and protein; in addition, it acts as co-enzyme in metabolic changes (Patil and Lall, 1973; Reda *et al*.1977 and Fadl *et al*. 1978). Therefore, the obtained results might be attributed to the increment in the amounts of metabolites synthesized by the plant, which in turn accelerated plant growth and dry weight, resulting in favorable effects on flowering and fruiting as well as finally improved the total yield.

Regarding the retardant effect of α-tocopherol on black cumin flowering and fruiting, Michniewicz and Kamienska (1965 and 1967) reported that vitamin E in the form of α-tocopherol acetate induced flowering under the long day condition. Thus, a possible role of the vitamin in controling the level of GA was suggested because vitamin E was less effective than GA. Since the GA level decreases in one species and increases in another after a flower-inducing application of vitamin E, The same authors subsequently decided that actions of vitamin E and GA must be independent of one another. Similarly, Baszynski (1967) recorded an induction of flowering in *Calendula officinalis* upon addition of α-tocopherol under non-inductive short day conditions.

2-2 Seed yield / plant:

Data presented in Table (2) reveal that the applications of vitamins and active dry yeast on black cumin plants lead to a marked increase in the number of capsules and seed yield per plant especially at the high concentration of vitamins and yeast in the two growing seasons. Moreover, data in the same table point out that the weight of 1000 seeds (seed index) increased slightly with all treatments except AsA at 25 ppm in the first season whereas AsA at 25 and 50ppm as well as thiamine at 50 ppm decreased the weight of 1000 seeds while, the remaining treatments increased this parameter in the second season.

The improving effect of antioxidants on the yield was mainly attributed to their positive action on enhancing growth and nutritional status of plant (Faissal and Hassan, 2004).

Concerning the promotive effects of thiamine on black cumin yield and its attributes, the effect of thiamine may be due to the role of thiamine which is combined with 2 molecules of phosphoric acid to form thiamine pyrophosphate (TPP) which is the most effective form that acts as a co-enzyme necessary for oxidative decarboxylation of pyruvic acid from glycolysis to active acetate in Krebs cycle and this in turn affect the growth and yield of plants. In addition, Vit. B1 affect the meristem and plant growth as well as development indirectly by enhancing the endogenous levels of various growth factors such as cytokinins and gibberellins (Kodendaramariah and Gopala Rao, 1985). Moreover, Sahu *et al*. (1993) recorded that improvement in maize yield with thiamine and ascorbic acid at 100 ppm treatments as appeared to have resulted from increased photosynthetic efficiency and canopy photosynthesis and hence larger accumulation of assimilates during grain filling.

The stimulating effect of α-tocopherol on yield and its components may be due to the role of α-tocopherol in preventing the propagation of lipid peroxidation by scavenging lipid peroxyl radicals in thylakoid membranes. Dealing with the various positive effects of applying active dry yeast to plants, Idso *et al*. (1995) reported that these effects are attributed to their own contents of different nutrients, high protein, larger amount of vitamin B and natural plant growth regulators such as cytokinins which play a role in orientation and translocation of metabolites from leaves into the reproductive organs. Moreover, it might be play a role in the synthesis of protein degradation which might lead to the improvement of yield and its quality (El-Ghamriny *et al.* 1999). In addition, of soluble phosphate combination with cation in soil solution to form low solubility substances called phosphate fixation which improve net photosynthesis. Moreover, Naguib and Khalil (2002) found that the enhancing effect of yeast on the growth and yield of black cumin plants could be attributed to its great content of minerals particularly N,P and K as well as certain natural hormones, beside high amount of vitamins especially B which plays an important role in improving growth (Subba Rao, 1984).

Finally, application of vitamins to plant may be enhance plant yield by direct effects of vitamins on the metabolism in plants (Simkunas *et al.* 1980) or act as growth regulators.(Oertli, 1987)

3-Oil percentage and oil content/plant:

The results of determination fixed and volatile oil percentage as well as oil content/plant in black cumin seeds are shown in Table (2). It is clear that presoaking seeds in ascorbic acid at 25 and 50 ppm, thiamine at 50 and 100 ppm, α-tocopherol at 10 and 20 ppm or yeast at 1000 and 2000 ppm cause a marked increase in the volatile oil percentage, fixed oil percentage and oil content per plant in the two successive seasons. Both yeast and α-tocopherol as well as thiamine at 100 ppm were the best treatments in this respect.

It could be pointed out that exogenous application of ascorbic acid had a regulating effect on the essential and fixed oil of black cumin plants. Similar results were obtained by Tarraf *et al*. (1999) on lemongrass plants. In support, AsA was known to be involved in oxidation-reduction system as electron donor and acceptor in the photosynthetic process (Robinson, 1973).

He mentioned that the superiority of vitamins and yeast on fixed and volatile oil may be due to the role of these vitamins as co-enzymes involved in specific biochemical reactions in the plant such as oxidative and non-oxidative decarboxylation. He stated also that the biochemical active pyrophosphates are the units which condense to form the many varied forms, which constitute of terpenes. In addition, Subba Rao, (1984) and Dewic (2000) mentioned that these results may be due to the stimulatory effect of yeast and vitamins which act as co-enzymes of photosynthesis and metabolism of carbohydrates and other metabolites in seeds.

REFERENCES

A.O.A.C. (1990). Official Methods of Analysis. Association of Official Agriculture Chemists. P.O. Box 540, Benjamin, Franklin Station, Washington, D.C.

Aberg, B. (1961). Vitamins as growth factors in higher plants. Encyclopedia of Plant Physiology. XIV: 418 – 448.

Ahmed, E. T. (1998). Influence of concentration and time of spraying active dry yeast on growth and volatile oil content of marjoram plant. J. Agric. Sci. Mansoura Univ., 23 (11). 5067-5081.

Ahmed, F.F.; Ragab, M.A.; Ahmed, A.A. and Mansour, A.E.M. (1997). Improving the efficiency of spraying different nutrients for Red Roomy grapevines (*Vitis vinifera* L.) by using glycerol and active dry yeast. Egypt. J. Horti. 24 (1): 91 – 108.

Ahmed, S.K. and Ali, A.F. (2001). Effect of salinity treatments and active dry yeast on growth and active ingredients of *Ambrosia maritima* L. . Proc. The Fifth Arabian Horticulture Conference, Ismailia, Egypt, 1:217-224.

Ahmed, S.K.; El-Ghawas, E.O. and Aly, A.F. (1998). Effect of active dry yeast and organic manure on roselle plant. Egyptian J.Agric. Res. 76 (3). 1115 – 1142.

Ali, A.F. (2001). Response of pot marigold plants (*Clanendula officinalis* L.) to some rock phosphate source and yeast. Proc. The Fifth Arabian Horticulture Conference, Ismailia, Egypt, 1:31-42.

Baszynski, T. (1967): Naturwissenschaften 54, 339. Cited from Oertli, J.J. (1987): Exogenous application of vitamins as regulators for growth and development of plants. Z. Pflanzenernahr Bodenk, 150: 375-391.

Dewic, K.P.M. (2000). Medicinal Natural Products, A Biosynthetic Approach. 2nd Ed., pp. 306 – 356. John Wiley & Sons, N.Y.

El-Ghamriny, E.A.; Arisha, E.A.H. and Nour, K.A. (1999). Studies on tomato flowering, fruit set, yield and quality in summer season. I. Spraying with thiamine, ascorbic acid and yeast.

Fadl, M.; Reda, F.; Abdel-All, R.S. and El-Moursi, A. (1978). Physiological studies on *Ammi vesnaga* L. Egypt. J. Physiol. Sci. 5: 73 – 83.

Faissal, F.A. and Hassan, A. M. (2004). Influence of some antioxidants on growth, vine nutritional status, yield and quality of berries in Banaty Grapevines. Assiut. J. Agric. Sci. 35 (4): 131 – 140.

Fryer, M.J. (1992). The anti oxidative effects of thylakoid vitamin E (α-tocopherol). Plant Cell and Environment. 15: 381 – 392.

Gomez, K.A. and Gomez, A.A. (1984). Statical Procedure for Agriculture Research. 2nd Ed. Ghon Willy and Sons.

Guenther, E. (1961). The essential oils. Vol. I, II and III. D. Van Naster and Comp. Inc., New York.

Idso, S.B.; Idso, K,E. and Hoober, J.K. (1995). Effect of atmospheric CO2 enrichment and foliar methanol application on net photosynthesis of sour orange trees (*Citrus aurantium*) leaves. Amer. J. Botany. 82 (1): 26 – 30.

Kodandaramaiah, J. and Rao, P.G. (1985). Influence of B-vitamins on stomatal index, frequency and diurnal rhythms in stomatal opening in Cyamopsis tetragonalba (L). Taub. J. Biol. Res.. 5: 68 – 73.

Kunert, K.J. and Ederer, M. (1985). Physiol. Plant. 65: 85 – 88. Cited from Oertli, J.J. (1987): Exogenous application of vitamins as regulators for growth and development of plants. Z. Pflanzenernahr Bodenk, 150: 375-391.

Mallet, J.F.C.; Cerrti, E.; Ucciani, E.; Gamisans, J. and Gruber, M. (1994). Antioxidant activity of plant leaves in relation to theier alpha-tocopherol content. Food Chem. 49: 61 – 65.

Matakiadis, T.and Kintzios,S. (2005): The effect of ATP on cucumber (*Cucumis sativus* L.) regeneration from nodal explants: association with α tocopherol, H_2O_2 and size of culture vessel.Plant Growth Regulation 45:127-137.

Michniewicz, M. and Kamienska, A. (1967). Acta Soc. Botan. Polon. 36, 67 – 72. Cited from Oertli, J.J. (1987): Exogenous application of vitamins as regulators for growth and development of plants. Z. Pflanzenernahr Bodenk, 150: 375-391.

Moor, T.C. (1979). Biochemistry and Physiology of Plant Hormones. Pub. By Springer-Verlag, New York, USA.

Nagodawithana, W.T. (1991). Yeast Technology. Universal Foods Corporation Milwaukee, Wisconsin Published by Van Nostrand Reinhold, New York. P. 273.

Naguib, N.Y. (2002). Yield and quality of lemongrass plants (*Cymbopogon flexuous* Stapf) as influenced by farm yard manure and foliar application of bread yeast. Annals of Agric. Sci. Cairo. 47 (3): 859 – 873.

Naguib, N.Y. and Khalil, M.Y. (2002). Studies on the effect of dry yeast, thiamine and biotin on the growth and chemical constituents of black cumin (*Nigella sativa* L.). Arab Univer, J. Agric. Sci. 10 (3): 919 – 937.

Negm, A.Y.; Zahran, F.A. and Rizk, N S. (1997): Foliar application of ascorbic acid, magnesium and nickel to lentil grown in newly reclaimed sandy soils. Egypt. J. Agric. Res., 75(4):843-853.

Oertli, J.J. (1987): Exogenous application of vitamins as regulators for growth and development of plants. Z. Pflanzenernahr Bodenk, 150: 375-391.

Patil, B. and Lall, S.B. (1973). Effect of presowing treatment with L-ascorbic acid and gibberellic acid on growth and physiological constituents of wheat. Botanique (Naqpur), 4, 5770 (Biol.Abst., 57 – 64).

Ramaiah, J.K.; Venkataramaiah, C.; Rao, P.G. and Rao, K. N. (1984): Proc. Natl. Acad. Sci. India, Sect. B54, 1-5. Cited from Oertli, J.J. (1987): Exogenous application of vitamins as regulators for growth and development of plants. Z. Pflanzenernahr Bodenk, 150: 375-391.

Raskin, I. (1992). Salicylate, a new plant hormone. Plant Physiology. 99: 799 – 803.

Reda, F.; Fadl, W.; Abdel-Aal, R.S. and El-Moursi, A. (1977). Physiological studies on *Ammi visnaga* L. Lam. 5. The effect of Thiamine and ascorbic acid on growth and chromon yield. Egypt. J. Pharm. Sci. 18 (1): 19 – 27.

Refaat, A. M. and Balbaa, L.K. (2001). Yield and quality of lemongrass plants (*Cymbopogom flexuous stapt*) in relation to foliar application of some vitamins and micro-elements. Egypt Journal of Horticulture. 28 (1): 41 – 57.

Robinson, F.A. (1973). Vitamins. In: Phytochemistry Vol. III: 195 – 220. Lawrence P. Miller (Ed.) Van-Nostrand, Reinhold Co., New York.
Sahu, M.P.; Solanki, N.S. and Dashora, L.N. (1993). Effects of Thiourea, Thiamine and Ascorbic Acid on Growth and Yield of Maize (*Zea mays* L.). Journal of Agronomy and Crop Science. 171: 65 – 69.
Salomi, N.; Nair, S.C.; Jayawarahanan, K.K. and Varghese, C.D. (1992): Antitumor principles from *Nigella sativa* seeds. Jhons Hopkins, Al Mag., 63:33-36.
Sana, J.S. and Ota, Y. (1977). Plant growth regulation activities of nicotinamide II. Effect of nicotinamide on growth of several crops. Japan. J. Crop Sci. 46: 8 – 12.
Saraswathamma, D.N. and Jayachandra, N. (1981). Effect of presowing soaking with growth regulators on seedling growth in fenugreek (*Trigonella foenum-grecum* L.). Comparative Physiology and Ecology. 6, (2): 108 – 110.
Schmitz, M.(1997). Bedeutung von vitaminen für die Abwehr von oxidativem Stre B bei Bohne und Apfel Dissertation, Rheinische Friedrich-wilhelms-Univer-sität Bonn.
Simkunas, R.; Mateikiende, I. and Bluzmanas, P. (1980): Mathm. Naturw. Reihe, 29, 85-86. Cited from Oertli, J.J. (1987): Exogenous application of vitamins as regulators for growth and development of plants. Z. Pflanzenernahr Bodenk, 150: 375-391.
Soliman, M. A. (1981). A Pharmacognostical study of certain Nigella species growing in Egypt .M.Sc. Thesis, Cairo Univ., Egypt.
Subba Rao, N.S. (1984). Biofertilizers in Agriculture. P. 189. Oxford. IBH Company, New Delhi.
Tanczos, O.; Erdie, L.; Vigh, L.; Kuipers, B. and Keuper, J.C.(1982). Physiol. Plant. 55: 289 – 295. Cited from Oertli, J.J. (1987): Exogenous application of vitamins as regulators for growth and development of plants. Z. Pflanzenernahr Bodenk, 150: 375-391.
Tarraf, S.A.; El-Din, K.M.G. and Balbaa, L.K. (1999). The response of regulative growth, essential oil of lemongrass (*Cybopogon citrates* Hort.) to foliar application of ascorbic acid, nicotiamine and some micronutrients. Arab-Univer. J. Agric. Sci., 7 (1): 247 – 259.
Wahba, H.E. (2002). Growth, yield and chemical composition of *Oenothera biennis* as affected by yeast, biotin and riboflavin foliar application. Arab Univ. J. Agric. Sci. 10 (3): 997 – 1017.
Youssef, A.A.; Aziz, A.A. and Talaat, I.M. (2005). Influence of some antioxidants on growth, flower-heads and essential oil content of *Matricaria chamomilla* L. plants. Annals Agric. Sci., Moshtohor. 43 (2): 823 – 832.
Zhukova, P. S. (1977). Effect of combined use of growth regulators, vitamins and fertilizers on growth and certain physiological and biochemical processes in vegetable crops. Plant growth Regul. Proc. Int. Symp. 2 nd, 736-743. Kudrev, T., Ivanova, I. and Karanov, E. (Eds), Banasofia, Bulgaria.

تحسين النمو و المحصول فى نبات حبة البركة بالخميرة و بعض الفيتامينات

سكينة إبراهيم إسماعيل[1] , محمودعبد المنعم خفاجى [2] , مرتضى رضا خاطر[1]

1- قسم بحوث النباتات الطبية و العطرية – معهد بحوث البساتين – مركز البحوث الزراعية- مصر

2- قسم النبات الزراعى - كلية الزراعة - جامعة المنصورة- مصر

اجريت تجربتى أصص فى المزرعة التجريبية الخاصة بقسم النبات الزراعى ؛ كلية الزراعة ؛جامعة المنصوره خلال الموسم الشتوى 2004و 2005 لدراسة تأثير نقع بذور نبات حبة البركة فى بعض الفيتامينات مثل حمض الاسكوربيك بتركيزات25؛50جزء فى المليون ؛الثيامين بتركيزات 50؛100 جزء فى المليون؛الالفاتوكوفيرول بتركيزات 10؛20 جزء فى المليون والخميره الجافة النشطة بتركيزات 1000؛2000جزء فى المليون على النموالخضرى و المحصول ومكوناته.

وقد أثبتت الدراسة أن معاملات النقع فى الفيتامينات والخميرة كانت فعالة فى زيادة صفات النموالخضرى المتمثلة فى طول النبات و عدد الأوراق وعدد الفروع الجانبية للنبات و الوزن الطازج و الجاف للمجموع الخضرى و قد تفوقت معاملات الثيامين(100جزء فى المليون) والالفاتوكوفيرول(20 جزء فى المليون) والخميرة(2000جزء فى المليون) على باقى المعاملات. كما أوضحت نتائج التجربة أن حمض الأسكوربيك (25؛50جزء فى المليون) والثيامين(100جزء فى المليون) والخميرة(2000جزء فى المليون)أدوا الى تشجيع الازهار والاثمار بتقليل عدد الأيام اللازمة لتفتح أول زهرة وتكوين أول ثمرة بينما أدت باقى المعاملات الى تأخير كلا من الازهار والاثمار.

أدى النقع فى أى من الفيتامينات و الخميرة الزيادة ملحوظة فى عدد الكبسولات على النبات ومن ثم زيادة المحصول البذرى للنبات و كذلك زيادة النسبة المئوية للزيت الثابت والطيار والمحتوى الكلى للزيت و كانت المعاملة بالألفاتوكوفيرول (20جزء فى المليون)والخميرة (2000جزء فى المليون)هما الأكفأ.

Table (1): Effect of vitamins (Ascorbic acid, Thiamine and α –Tocopherol) and active dry yeast on black cumin plant vegetative growth characters during 2004 and 2005.

Treatments	Plant height cm		Number of leaves/plant		Number of lateral branches/plant		Plant fresh weight g		Plant dry weight g	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Control	23.2	24.9	14.7	15.7	6.0	7.3	3.49	4.89	0.699	0.877
AsA 25 ppm	22.1	25.0	15.0	16.3	6.0	8.7	4.62	5.59	0.924	1.017
AsA 50 ppm	26.7	28.7	14.7	16.0	6.3	8.3	4.65	5.13	0.930	0.927
Thi. 50 ppm	27.1	29.5	15.3	16.7	7.3	9.3	4.39	5.76	0.877	1.053
Thi. 100 ppm	32.3	35.4	18.3	19.7	9.7	11.0	5.58	7.36	1.115	1.373
α -Toco. 10ppm	28.7	30.4	16.7	17.3	8.3	9.3	5.35	6.76	1.070	1.253

α -Toco. 20ppm	30.9	31.3	17.0	18.0	9.0	10.7	5.76	7.91	1.152	1.482
Y. 1000 ppm	27.6	30.4	16.0	17.0	9.0	10.3	4.50	6.26	0.899	1.153
Y. 2000 ppm	34.2	36.3	18.3	19.7	11.0	12.3	6.08	7.41	1.215	1.381
L.S.D. 5%	1.01	1.17	1.14	1.62	1.43	1.36	0.47	0.45	0.100	0.091

Table (2): Effect of vitamins (Ascorbic acid, Thiamine and α –Tocopherol) and active dry yeast on black cumin yield and its components during 2004 and 2005.

Treatments	Days till flowering		Days till fruiting		Number of capsules/plant		Seed yield/plant () ()		Weight of 1000 seeds		Volatile oil %		Fixed oil %		Oil content per plant	
	2004	**2005**	**2004**	**2005**	**2004**	**2005**	**2004**	**2005**	**2004**	**2005**	**2004**	**2005**	**2004**	**2005**	**2004**	**2005**
Control	110	115	114	118	4	5	1.68	1.96	6.27	6.44	1.30	1.32	30.1	30.3	0.528	0.620
AsA 25 ppm	109	113	112	116	5	5	1.96	2.24	6.09	6.27	1.31	1.34	31.9	31.5	0.651	0.736
AsA 50 ppm	109	114	114	117	5	6	2.10	2.38	6.31	6.43	1.35	1.38	31.6	31.8	0.692	0.790
Thi. 50 ppm	114	119	118	123	5	6	2.24	2.38	6.16	6.28	1.36	1.37	31.9	31.4	0.745	0.780
Thi. 100 ppm	109	113	113	117	7	7	2.80	3.08	6.39	6.54	1.37	1.37	32.4	32.3	0.946	1.037
α-Toco. 10ppm	116	119	119	122	6	6	2.66	2.66	6.31	6.45	1.32	1.42	32.6	31.8	0.902	0.884

α Toco. 20ppm	116	118	119	121	7	8	3.08	3.22	6.37	6.70	1.35	1.44	33.9	33.2	1.086	1.115
Y. 1000 ppm	116	119	120	122	5	7	1.96	3.08	6.31	6.63	1.40	1.52	32.8	34.2	0.670	1.100
Y. 2000 ppm	109	114	114	119	7	8	2.94	3.36	6.71	6.84	1.43	1.53	34.6	35.1	1.059	1.231
L.S.D. 5%	1.58	1.81	1.44	2.31	1.81	1.95	0.759	0.820	0.178	0.120	0.047	0.043	0.343	0.515	0.035	0.032