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ARABIC SUMMARY	--

LIST OF ABBREVIATIONS

Symbol	Meaning (Indicator)
α -Toco	α -Tocopherol
AsA	Ascorbic acid
Co.	Cortex
Col.T.	Collenchyma tissue
Emb	Embryo
End	Endosperm
Ep	Epidermis
L.E.	Lower epidermis
$^1\text{O}_2$	Singlet oxygen
OH^\cdot	Hydroxyl radical
Pa	Palisade tissue
Par.T.	Parenchyma tissue
Ph.	Phloem
Pi	Pith
S.C.	Seed coat
S.v.b.	Secondary vascular bundle
Sp	Spongy tissue
SP	Secondary phloem
SX	Secondary xylem

Thi.	Thiamine
U.E.	Upper epidermis
V.b.	Vascular bundle
V.c	Vascular cambium
Xy	Xylem
Y.	Yeast

SUMMARY AND CONCLUSION

This study was carried out in the experimental farm of Agricultural Botany Department, Faculty of Agriculture, Mansoura University, Mansoura, Egypt, during the two growing seasons of 2003/4 and 2004/5 to investigate the effect of 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 seed germination, plant growth, physiological characteristics, yield and its component as well as anatomical changes in (root, stem, leaf, peduncle and seed). In this investigation, it has been found that, the morphological and anatomical changes as well as yield vary with vitamins and yeast treatments.

The most important results achieved are summarized as follows :

- 1- All vitamins and yeast concentrations used increased germination percentage of black cumin seeds. The highest values were recorded by thiamine (50 ppm) and yeast (1000 and 2000 ppm).
- 2- Presoaking seeds with vitamins and yeast increased significantly seedling shoot and root length as well as seedling length, especially at low concentrations. All vitamins application and yeast increased black cumin seedling fresh weight. In addition, ascorbic acid at 25 ppm, thiamine at 50 ppm, α tocopherol at 20 ppm as well as yeast at 2000 ppm increased significantly seedling dry weight but the remaining treatments decreased this parameter.
- 3- Thiamine, α tocopherol and yeast treatments increased significantly black cumin plant height. In addition, active dry yeast at 2000 ppm proved to be

more effective in this regard. While, ascorbic acid decreased plant height in the two growing seasons.

4- Presoaking seeds in thiamine, α tocopherol and yeast led to an increase in number of leaves per plant. Both thiamine and yeast at the high levels were more effective in this concern. Meanwhile, ascorbic acid had no significant effect in this concern.

5- Yeast, α tocopherol and thiamine increased significantly number of branches per plant but ascorbic acid caused a slight increase in this respect.

6- All treatments increased significantly both fresh and dry weights of black cumin plant in both seasons. In addition, yeast at 2000 ppm was more effective in this regard.

7- α tocopherol at 10 and 20 ppm, thiamine at 50 ppm and yeast at 1000 ppm delayed significantly the beginning of flowering and fruiting. While, both ascorbic acid levels and thiamine at 100 ppm as well as yeast at 2000 ppm promoted flowering and fruiting in black cumin by decreasing number of days from sowing till beginning flowering and fruiting. The rate of ascorbic acid at 25 ppm was more effective in this respect.

8- Application of vitamins and active dry yeast to black cumin caused a marked increase in number of capsules and seed yield per plant especially at the high concentrations. While, the weight of 1000 seeds increased slightly with all treatments except ascorbic acid at 25 ppm in the first season. While, ascorbic acid at 25 & 50 ppm and thiamine at 50 ppm decreased this parameter in the second season.

9- Vitamins and yeast concentrations used caused a marked increase in the volatile and fixed oil percentage as well its content per plant. In addition, α

- tocopherol at 20 ppm and yeast at 2000 ppm were the best treatments in this concern.
- 10- Either vitamins or yeast increased significantly chlorophyll a, b and its total as well as carotenoids in black cumin leaves except yeast at 2000 ppm, which decreased chlorophyll b and total chlorophylls in the two growing seasons. Moreover, ascorbic acid at 50 ppm and α tocopherol at 20 ppm gave the highest values in this respect. While, chlorophylls/carotenoids ratio was decreased in all treatments compared to the control treatment.
- 11- All treatments used increased N, P and K concentrations and total protein as well as total carbohydrates percentage in black cumin shoots in both seasons. In addition, Yeast treatments proved to be more effective in increasing N and P concentrations. While, thiamine at 100 ppm was the most effective in increasing K concentration in the shoots.
- 12- All applied treatments increased root diameter except α tocopherol at 10 ppm, which decreased it as a result of decreasing cortex and pith thickness. While, the increase in root diameter may be attributed to increase in cortex thickness, diameter of vascular cylinder, secondary xylem and phloem tissue thickness.
- 13- All vitamins treatments led to a markedly increase in black cumin stem diameter. Ascorbic acid at 50 ppm was more effective in this regard. In addition, the increase in the stem diameter was mainly due to the increase in pith, cortex, xylem and phloem tissue thickness, number of vascular bundles as well as vascular bundle dimensions. While, yeast at both levels led to thinner stems because of decreasing cortex, pith as well as phloem tissue thickness.

- 14- Ascorbic acid at 50 ppm, thiamine at both levels, α tocopherol at 20 and yeast at 2000 ppm led to an increase in the thickness of leaf. This increase was due to a corresponding increase in the thickness of spongy and palisade parenchyma as well as lower epidermis. High concentrations of vitamins and yeast were more effective in this concern. Meanwhile, the remaining treatments had no significant effect on the thickness of the leaf.
- 15- Ascorbic acid at 25 ppm, thiamine at at both levels and yeast at 2000 ppm resulted in an increase in the thickness of black cumin peduncle. Moreover, Yeast at 2000 ppm was more effective in this respect. This increment is a result of increasing length and width of vascular bundle as well as number of small vascular bundles. While, Ascorbic acid at 50 ppm, α tocopherol at 10 & 20 ppm as well as yeast at 1000 ppm decreased the thickness of black cumin peduncle.
- 16- Presoaking seeds of black cumin in vitamins and active dry yeast promoted anatomical structure of the seed. Since, all treatments were effective in increasing thickness of seed except thiamine at 50 ppm which decreased this parameter. In addition, all treatments increased markedly thickness of testa and endosperm dimensions (length and width) except thiamine at 50 ppm which decreased endosperm dimensions (length and width).

Conclusion

Under the conditions of these experiments, it may be concluded that for enhancing seed yield, volatile and fixed oil as well as its content, it is recommended to soak the seeds for 12 hours before sowing in α -tocopherol at (10-20 ppm) or yeast at (1000-2000 ppm).