

**INDUCING COLD TOLERABILITY IN FABA BEAN
PLANTS FOR MAXIMIZING ITS PRODUCTIVITY**

BY

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SUMMARY AND CONCLUSION

Two field experiments were conducted at the experimental farm station of the Faculty of Agriculture, Benha University, during two growing successive winter seasons of 2009 and 2010 to study the effect of some treatments of assimilates transport – inducing materials, antioxidants, energy source , and setting - inducing materials i.e potassium citrate at 500 and 1000 ppm, salicylic acid at 200 and 400 ppm, putrescine at 200 and 400 ppm, humic acid at 500 and 1000 ppm, phosphoric acid at 500 and 1000 ppm and naphthalene acetic acid (NAA) at 20 and NAA at 20 ppm speratley or combination with all applied treatments on growth, flower abscissions, chemical characteristics such as enzyme activity and seed yield and yield components of faba bean *Faba vulgaris* cv balday plants. In addition, water was used as control. Treatments were as follows: 1-Potassium citrate at 500 and 1000 ppm. 2-Salicylic acid at 200 and 400 ppm. 3-Putrescine at 200 and 400 ppm. 13- Humic acid at 500 and 1000 ppm. 14- Phosphoric acid at 500 and 1000 ppm 6- NAA at 20 ppm 7- NAA at 20 ppm with Potassium citrate at 500 and 1000 ppm. 8- NAA at 20 ppm with Salicylic acid at 200 and 400 ppm. 9- NAA at 20 ppm with Putrescine at 200 and ppm. 10- NAA at 20 ppm with Humic acid at 500 and 1000 ppm. 11- NAA at 20 ppm with Phosphoric acid at 500 and 1000 ppm 12- Control (distilled water).

The obtained results could be summarized as follow:

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1. Vegetative growth: a) The obtained results clearly showed that different used treatments were significantly increased the all vegetative characteristics i.e., plant height, leaf and stem fresh weight g/plant, number of branches and leaves and leaf area/plant. Also, different treatments were significantly increased dry weight of branches and leaves at 70 days after sowing during 2009 and 2010

seasons. (b) The used treatment were increased all growth characteristics, this increase was control plants with NAA at 20 ppm 70 days after sowing during 2009 and 2010 seasons. 2-Flowering characteristics: The obtained results indicate that most applied treatments were effective and increased their flowers earlier than control plants. The most effective treatments in this respect were NAA at 20 ppm gave the highest values for each of number of flowers, total fruits per plant and percentages of fruit setting as well. 3. Chemical composition: (a) the obtained results clearly showed that different used treatments were highly increased concentration of chlorophyll a, b and carotenoids of faba bean plant at both 70 days after sowing during 2009 and 2010 seasons. (b) The obtained results clearly showed that different applied treatments were highly increased minerals nutrients concentrations as a percentage for (N, P, K, Ca, Mg % d.w and a part per million (ppm) for Z, Fe, Mn ppm) also a percentage age of faba bean crude protein leaves at 70 days after sowing during the assigned season. (c) Moreover total carbohydrates and total free amino acids (mg/g d.w.) were greatly increased but total phenols were decreased with different used treatments at 70 days after sowing during 2010 season.

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* The most effective treatments, which greatly improved the morphological and metabolical performances of faba bean plant were NAA at 20 ppm during 2010 season (d) The obtained results also, showed that application of various treatments induced reduction in enzymatic antioxidants activity (i.e., peroxidase, catalase and superoxide dismutase) as compared with those of activity could be attributed to antioxidant direct effects of used treatments on scavenging toxic radicals. (e) It is clearly from the previously results that used treatments were actively enhanced the internal metabolically protective status by their direct scavenging functions against the toxic free radicals (induced by

cold stress) or due to their promotional effect on synthesis of natural protective antioxidants, i.e. carotenoids as well as they induce an potent biosynthesis case due to the higher photosynthetic pigments content (protection of chlorophyll's and chloroplasts against stress degradable/ senescence effects), thereby, higher protein and carbohydrates accumulation and content as well as higher minerals content of leaves as well as reduction of total phenols content. 4- Anatomical study: The obtained results clearly indicate that vigorous growth of faba bean plant treated with different applied treatments was positively correlated with different anatomical responses of stems and leaves. Since, different applied treatments increased stem anatomical features e.g. stem thickness, increment of stem thickness was accompanied with increases in most of its anatomical features, i.e., thickness of epidermis, thickness of cortex and thickness of parenchymatous pith. Moreover, increased thickness of midvein, lamina, upper epidermis, lower epidermis, thickness of spongy tissue and palisade tissue as well in faba bean leaf.

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Furthermore, increasing dimensions (length and width) of vascular bundles, thickness of both phloem and xylem tissues and number of xylem vessels. Of interest is to note that these positive responses of different anatomical aspects to treatments were completely reversed upon vegetative and reproductive growth of treated plants. So, present study revealed those increases of xylem tissue, i.e., the route of mineral nutrients and water translocation from roots to leaves and the phloem tissue i.e., the pathway of different assimilates from leaves to seeds and other plant sinks. Thereby, improvement of translocation events directly could be considered a direct reason for increment the final fruit yield. In this respect, NAA at 20 ppm was the most effective treatment. (5) yield and yield components: (a) Different applied treatments increased number of pods per plant, pod weight, number of seeds per pod, weight of seeds per pod, 100 seeds

weight, number of seeds in terminal pod, weight of seeds in terminal pod, weight of seeds per plant, per feddan (ardab and kg) and biological yield at the two seasons compared with those of the control. (b) The highest yield were obtained with NAA at 20 ppm during 2009 and 2010 seasons. (c) These values were 115.70 g/plant and 120.58 g/plant and 1539.7 and 1593.0 kg/feddan and 10.26 and 10.62 ardab per feddan yield per plant and per feddan with NAA at 20 ppm during 2009 and 2010 seasons, respectively. While, control values were 49.50 & 55.40 g/plant and 732.0, 819.0 kg/feddan and 4.88 and 5.46 ardab per feddan during 2009 and 2010 seasons. 6- Chemical characteristics in seeds at harvest time:-

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The used treatments improved the seeds characteristics such as N, P, K, Ca, Mg, Fe, Zn, Mn, total carbohydrates and crude protein contents in seeds at harvest time compared with control during 2010 season.

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CONCLUSSION Finally, it could be concluded with soaking and spraying faba bean plant 4 times with 21 days intervals with NAA at 20 ppm maximizing growth, flower number, seeds yield and fully seeds in different part of plant (basal and terminal). That NAA activity enhanced the increase of flower setting and reduction of abscission and due to their promotional effect on synthesis of natural protective antioxidants, i.e., total phenols and carotenoids as well as it induce an potent biosynthesis case due to the higher photosynthetic pigments content (protection of chlorophyll's and chloroplasts against stress degradable), thereby higher protein and carbohydrates accumulation and content as well as higher minerals content. The positive correlations of such constituents growth and fruit yield confirmed and coincided such functions and roles of NAA.

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