Improvement of tomato productivity by using certain natural materials

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Two field experiments were conducted at the Experimental Farm Station of Hort. Faculty of Agriculture, Benha University, during late summer seasons of 2006 and 2007 on tomato (Lycopersicon esculentum, Mill.) Cv. Super strain B.The aim of this study was to study the possibility of using some natural materials (as antioxidants or oxygen free radicals scavengers) effects on some morphological, physiological and anatomical characteristics as well as flowering, yield and fruit quality of treated tomato plants compared with control. By enhancing the internal metabolical defensive processes of tomato plant against the higher temperature adverse effects towards maximizing its growth and productivity. The plants were sprayed 5 times, 20 days after transplanting and again every 15 days intervals.Treatments were as follow:1.Yeast extract at 15 and 30 ml/L.2.Marjoran extract at 15 and 30 ml/L.3.Amino acids at 1.5 and 3m1/L.4.Vit. E at 100 mg/L. + Sel.at 400 ?g/L.5.Vit. E at 200 mg/L. + Sel. at 800 pg/L.6.Citric acid at 2.5 and 5 g/L.7.Vit. E at 100mg/L. + Sel. at 400 ptg/L. + Citric acid at 2.5 g 'L.8.Vit. E at 200mg/L. + Sel. at 800 ?g/L. + Citric acid at 5 g/L.9.Boron at 25 and 50 mg/L.10.Zinc at 50 and 100mg/L—11. Control (water treated)Seven weeks old tomato seedling (i.e., at the beginning of May for 2006 and 2007 seasons, respectively, were transplanted to the experimental plots.The obtained results could be summarized as follow: 1. Vegetative growth:(a)The obtained results clearly showed that different used treatments were significantly increased the all vegetative characteristics i.e., plant height, stem diameter, shoots 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 50 and 70 days after transplanting during 2006 and 2007 seasons.(b)The used treatments were increased the number of branches and leaf area per plant ,this increase was more than three times of the control plants with yeast extract at 30 ml/L, at 50 and 70 days after transplanting during 2006 and 2007 seasons.(c)Moreover, the used treatments were highly increased concentration of chlorophyll a, b and carotenoids of tomato plant at both 50 and 70 days after transplanting during 2006 and 2007 seasons. 2. Chemical composition:(a) The obtained results clearly showed that different applied treatments were highly increased minerals concentrations (N, P, K, Ca, Mg mg/g d.w and Z, Fe, Mn ppm) also crude protein in tomato leaves at 50 and 70 days after transplanting during the assigned season.Summary and Conclusion—206—(b)Moreover, reducing, non-reducing and total sugars (mg/g d.w.) also total carbohydrates, total phenols and total amino acids (mg/g d.w.) were greatly increased with different used treatments at the two times of determination, i.e., at 50 and 70 days after transplanting during 2007 season.* The most effective treatments, which greatly improved the morphological and metabolical performances of tomato plant were yeast extract at 30 ml / L, Zn at 50 mg /L ,B at 25 mg /L ,amino acids at 3 ml / L and vitamin E at 200 mg / L +Sel. at 800 p.g /L +citric acid at 5g /L.(c)Protein electrophoretic pattern of the treated tomato plants revealed that, different used treatments induced the appearance of new set of protein bands, 16 new protein bands were induced with different treatments at 70 days after transplanting during 2007 season compared with control. These proteins appeared at molecular weights 261.76-235.29, 217.66-183.76, 159.95-140.05, 128.97-118.18, 114.87-109.68, 105.03-98.34, 86.96-78.42, 70.63-64.31, 62.83-61.83, 40.00-35.84, 31.89-28.80, 28.06-27.28, 27.04-26.85, 26.79-26.60, 25.63-22.90 and 17.41-16.11 1(1).(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 antioxidantal 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 protectiveSummary am(Conclusion-207-status by their direct scavenging functions against the toxic free radicals (induced by heat stress) or due to their promotional effect on synthesis of natural protective antioxidants, i.e. total phenols and 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 contentof leaves.(f) Endogenous phytohormones: The obtained results show that different applied treatments increased the levels of endogenous auxins, gibberellins and cytokinins in trated plants shoot, meanwhile, abscisic acid was decreased as compared with the untreated plants. The most effective treatment was yeast extract at 30 ml/L in this respect in tomato plant shoot at 70 days after transplanting during 2007 season. These positive alterations in levels of endogenous phytohormones of treated tomato plant led to vigorous growth and enhancement of flowering and fruit setting under adverse effects of high temperature stress conditions. 3- Anatomical study:The obtained results clearly indicate that vigorous growth of tomato 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 1 thickness, increment of stem thickness was accompanied with increases in most of its anatomicalSumauzy mut Conclusion—208—features, i.e., thickness of epidermis, thickness of cortex and thickness of parenchymatous pith.Moreover, increased thickness of midveim, lamina, upper epidermis, lower epidermis, thickness of spongy tissue and palisade tissue as well in tomato leaf.Furthermore, increasing dimentions (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 fruits 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, yeast extract at30 ml/L was the most effective treatment. (4) Reproductive growth:(a) 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 marjoram extract at 15 ml/L, Zn at 50 ml/L and B at 50 mg/L, their days of earliness reached to 26.95, 19.44 and 17.75 more than control values during 2006 season. On the other hand, yeast extract at 30 ml/L gave the highest values for each of number of flowers, total fruits per plant and percentages of fruit setting as well.and —209—(b)Different applied treatments highly increased the fertility of pollen grains in treated plants compared with control. Also, the yeast extract and Zn at 50 mg/L gave the highest fertility. Since, e.g. yeast extract at 30 ml/L treatment gave increase value of 233.39% relative to the control.(c)Different applied treatments increased early and total yields in term of number of early and total fruits per plant, weight of early and total fruits per plant and relative total yield % at the two seasons compared with those of the control.(d)The highest early and total yield were obtained with yeast extract at 30 ml/L.(e)These values were 383.33 & 461.67 g/plant and 1.824 & 1.891 kg/plant for the early and total yield per plant with yeast extract at 30 ml/L during 2006 and 2007 seasons, respectively. While, control values were 86.53 & 89.60 g/plant and 0.660 & 0.643 kg/plant.(f)The used treatments improved the physical characteristics of tomato fruits and increased the average of fruit fresh and dry weight, length, diameter and shape index per plant compared with control.(g)The quality characteristics of tomato fruits i.e., vitamin C, titratable acidity and total soluble solids as well as minerals content and also, total carbohydrates, crude protein, sugars and total amino acids were increased with different treatments. Also yeast extract at 30 ml/L was the most effective treatment in this respect.Summary andCondusion —210--CONCLUSIONFinally, it could be concluded with spraying tomato plant (under late summer/ heat stress conditions), 5 times with yeast extract at 30 ml/L for maximizing fruit yield. That yeast extract activity enhanced the internal metabolocially

protective status by their direct scavenging functions against the toxic free radicals (induced by heat stress) or 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 yeast extract as antioxidant.Stmunag and-Concha/on —.