IMPROVEMENT OF SEED PRODUCTION AND QUALITY OF COMMON BEAN UNDER WATER STRESS CONDITIONS

By

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B.Sc. Agric. Sc. (Horticulture), Ain Shams University, 2001

M.Sc. Agric. Sc. (Vegetable Crops), Ain Shams University, 2006

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ABSTRACT

Hany Gamal Metwally, Improvement of Seed Production and Quality of Common Bean under Water Stress Conditions. Unpublished Ph.D Thesis, Department of Horticulture, Faculty of Agriculture, Ain Shams University, 2010.

The field experiment was carried out during the growing seasons of 2007 and 2008, at the farm, Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima, Egypt, in order to in order the investigate the effect of irrigation at different percentage of available soil water depletion, foliar application of glycine betaine and salicylic acid on vegetative growth, yield and quality of common bean (*Phaseolus vulgaris* L.). Irrigation at different percentages of available soil water depletion (30, 45, 60, 75 and 90%) was started after full germination until seed harvesting. There were three levels of glycinebetaine (0, 2, and 4 mM), applied after 30 and 50 day from sowing (foliar application). There were three levels of salicylic acid (0, 0.5, and 1 mM), applied after 40 and 60 day from sowing (foliar application).

Results of this study indicated that irrigation at depletion of 30 % available soil water increased leaf number, leaf area, leaf fresh and dry weight, stem fresh and dry weight in the two seasons as compared with the other studied irrigation treatments.

Respecting the foliar application of glycine betaine, the obtained data showed that the foliar application of glycine betaine reduced leaf number, leaf area, leaf fresh weight, stem fresh weight and percentage of yellow plants, but the reductions were insignificant in the first tested However, the differences detected for the foliar application of glycine betaine was significant in leaf dry weight in the first tested season and not significant in the second tested season. In the two tested seasons, the differences were insignificant for the values of leaf area, leaf fresh weight, stem fresh and dry weight and percentage of yellow leaves. However, the differences detected for the foliar application of salicylic

acid was significant in leaf number in the first tested season and not significant in the second tested season. Moreover, irrigation at depletion of 30% available soil water gave the highest values in two seasons as compared with the other studied irrigation treatments. The foliar application of 0 and 2 mM/L glycine betaine increased pod number and pod fresh weight per plant compared with application of 4 mM/L glycine betaine treatment. However, the foliar application of 0 and 2 mM/L glycine betaine increased pod number and pod fresh weight per plant compared with application of 4 mM/L glycine betaine treatment.

Irrigation at depletion of 30 % available soil water increased seed yield per plant, seed yield per feddan and hundred-seed weight compared with the other studied irrigation treatments. The foliar application of 2 mM/L glycine betaine increased seed yield per plant and per feddan in the two tested seasons compared to other treatments. Further, the foliar application of 0.5 mM/L salicylic acid produced the highest seed yield per plant and per feddan in the two tested seasons.

Chemical analyses of common bean responded positively to irrigation at different percentages of available soil water depletion. Irrigation at depletion of 30% available soil water resulted in the highest values of chlorophyll reading, protein content, total carbohydrate percentage and calcium percentage as compared with the other studied irrigation treatments in the two seasons. However, irrigation at depletion of 90% available soil water gave the highest values of free proline as compared with the other studied irrigation treatments in the two seasons. There were statistically insignificant effects for foliar application of glycine betaine and salicylic acid on chlorophyll reading, free proline, protein content and calcium percentage in the two tested season.

The highest values of stomatal density were noticed by irrigation at depletion of 30 and 45% available soil water, without significant differences between them. Meanwhile, the other irrigation treatments led to lower stomatal frequency without significant differences among them. The decreasing of available soil water gradually decreased the seed coat

thickness; each decrease of available soil water caused a reduction of seed coat thickness. Moreover, application of irrigation after depletion of 90 % available soil water whether foliar applied with glycine betaine and salicylic acid or not showed the highest values of the seed testa thickness with compared with the other studied treatments.

It was, therefore, concluded that reproductive and seed yield characteristics of common bean responded positively to irrigation, foliar application of 2 mM/L glycine betaine and 0.5 mM/L salicylic acid.

Key Words: Common Bean, *Phaseolus vulgaris*, Water stress, Glycine betaine, Salicylic acid, Seed yield, Reproductive characteristics**.**

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LIST OF ABBREVIATIONS

Abbreviation	Meaning of abbreviation
A.O.A.C.	Association of official agricultural chemists
ASA	Acetyl salicylic acid
Cm, Cms	Centimeter, Centimeters
cv., cvs.	Cultivar, Cultivars
D.W.	Dry Weight
Fed	Feddan
g, gm	Gram
G, GB	glycine betaine
ha.	Hectare
I	Irrigation
Kg	Kilogram
m	Meter
m^2	Square meter
mm	Millimeter
mM/L	Millimol / liter
M.S.	Mstatic software
mg	Milligram
ml	Milliliter
S, SA	Salicylic acid