RESPONSE OF AJWAIN PLANT TO SOME TREATMENTS OF WATER STRESS

By

SHAIMAA AHMED HUSSEIN HANAFY AHMED
B.Sc. Agric. Sci. (Environmental Agric.,), Fac. Agric., Cairo Univ., 2009

THESIS

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APPROVAL SHEET

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SUPERVISION SHEET

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ABSTRACT

This study investigated the effect of putrescine and salicylic acid on growth, physiology and secondary metabolites production in Desi Ajwain plant grown under different irrigation treatments. The experiment was designed as a split plot design that included 27 treatments with three replications. The main treatments were three irrigation treatments;7 times (non-stress), 5 times (Moderate stress), 3 times (Severe stress) which were applied at 20, 30, 40 days intervals, respectively. Equal amount of water in each irrigation treatment interval was applied. The nine sub-treatments were the combinations resulted from the interactions between three putrescine treatments; control (P0), putrescine (1 ppm) applied as once (P1) and twice (P2)with three salicylic acid treatments: control (S0), 100 ppm, (S1) and 150 ppm, (S2) which were applied at 45 and 60 days from planting (DFP). Results indicated that drought stress significantly reduced all roots and shoot morphological growth characters, as well as shoots: root ratio, at vegetative stage, however they increased at flowering stage. Total sugars, total soluble phenols, and free amino acids in shoots and roots were significantly increased at veg. and flowering stages. However, chlorophyll b was significantly decreased at flowering only. The essential oil % was increased in plants irrigated every 40 days intrevals, whereas, oil content per plant increased by irrigation at 30 days intervals. Meanwhile, P2 treatment increased the root characters and free amino acids as well as chlorophyll a and total chlorophyll in plants irrigated at 40 days interval . In addition, P1S2 increased shoot growth characters and total soluble phenols. At the flowering stage, P1S2 was the highest significant shoot fresh and dry weights, free amino acids and herb dry yield. Salicylic acid at 100 ppm treatment increased sugars and phenols, and 150 ppm application increased fresh herb yield per Feddan. In addition, P1S1 increased oil content and P2S1 increased oil %. At the maturity stage, the application of S2 increased oil %, and P2 increased seed yield per plant and Feddan. Furthermore, P1S2 increased the oil content and P2S1 increased oil yield per Feddan. In addition, oil % and oil content per plant as well as oil yield per Feddan significantly increased by S1 and S2 in those irrigated every 40 days. Application of 100 ppm salicylic acid increased oil % and oil content as well as oil yield. It was found α –terpiene was the main constituent and followed by α – cymeme were increased under water stress, whereas P2 increased thymol by 109% than control, at the vegetative stage. Whereas, thymol was the third component at the flowering stage. Thymol and α-terpinolene were the highest components at the maturity stage. In addition, P2S1, P1S2 and P1S1 were recorded the highest oxygenated compounds in plants irrigated every 40 days, at the vegetative stage, flowering and maturity stages , respectively. This study recommended the following; firstly, the maximum essential oil yield in Ajwain herb (289.43 L/fed) at the flowering stage observed with plants irrigated with 5 times and treated with P1 putrescine. Secondly, The maximum essential oil yield in Ajwain seeds (151.68 L/fed) was observed with plants irrigated 7 times and treated with P2S1. Thirdly, The maximum seed yield (600 Kg/fed) observed with plants irrigated 7 times and treated with P2S1.

Key words: Ajwain plant *(Trachyspermum ammi*), drought stress, Putrescine, salicylic acid, Organic compounds, Seed yield, Essential oil, Essential oil yield.

DEDICATION

I dedicate this work to whom my heartfelt thanks; to my husband Mohamed Mohamed Saad and my daughter Roqaya for their patience and help, as well as to my parents and my sister as well as my husband's family for all the support that they lovely offered along the period of my past graduation.

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LIST OF ABBREVIATIONS AND INITIALS

Abbreviation	Meaning of abbreviation
Chl.	Chlorophyll
Cm	Centimetre
cv.	Cultivar
DAP	Days After Planting
EC	Electrical Conductivity
ET	Evapotranspiration
FAO	Food Agriculture Organization
Fed	Feddan
g	Gram
GC-MS	Gas Chromatography-Mass spectrometry
LSD	Least Significant Difference
mg	Milligram
MPa	Megapascals
OP	Osmotic pressure
PA	Polyamines
Pn	Net photosynthetic rate
Put	Putrescine
RNA	Riboside Nucleic Acid
ROS	Reactive Oxygen Species
RuBisco	Ribulose 1,5 diphosphate carboxylase
RWC	Relatively water content
SA	Salcylic acid
SPM	Spermidine
TSS	Total soluble solid
UDPG	Uridine diphosphate glucose
WHC	Water holding capacity

CONTENT