SOLAR USE EFFICIENCY OF METHANOL-TREATED WHEAT PLANTS UNDER DIFFERENT CLIMATIC CONDITIONS

BY

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Approval Sheet

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ABSTRACT

Hassan Mohamed Elhrari: Solar Use Efficiency of Methanol–Treated Wheat Plants Under Different Climatic Conditions. Unpublished Ph.D. thesis, Department of Agronomy, Faculty of Agriculture, Ain Shams University, 2009.

To investigate the effect of foliar methanol application on wheat plants, two field experiments were conducted in winter seasons of 2006/2007 and 2007/2008 in El-Bouseily Research Station, Agricultural Research Center (ARC) at El-Behira Governorate, and at the Research and Experimental Station Farm of Faculty of Agriculture, Ain Shams University at Shalakan, Kalubiya Governorate. Each experiment was designed in complete randomized blocks and contained 10 treatments which were the combinations of three methanol concentrations (10, 20 and 30% v/v), and three spraying intervals being 15, 30 and 45 days (7, 4 and 3 spraying times, respectively) as well as the control treatment, i.e. tap water every 15 day. Methanol spraying schedule was started at 40 days after planting and continued up to the end of March (at grain milky stage).

Results showed that no phytotoxicity effects at any treatment and location. Methanol treatments increased number of total tillers, number of fertile tillers, number of leaves, leaf area index (LAI), total chlorophyll concentration, number of spikes per m^2, number of spikelets per spike, number of grains per spike, weight of grains per spike, 1000-grain weight, grain yield per plant and straw yield per plant, grain yield per feddan, harvest index, biological yield, migration coefficient and radiation use efficiency (RUE) of wheat than the control. The beneficial impact of foliar application of methanol on growth, yield and yield attributes of wheat was mostly concomitant to the reduction in spraying intervals and increase in methanol concentrations up to 30%. Therefore, methanol 30% applied 7 times with 15-day intervals treatment gave the highest values and increased number of tillers per plant, number of fertile tillers, number of leaves, leaf area index (LAI) and total chlorophyll concentration by

15.0, 16.3, 8.9, 13.2 and 17.8% respectively than the control and increased grain yield per feddan, harvest index, biological yield, migration coefficient and radiation use efficiency (RUE) than those of control by 19.8, 6.8, 10.5, 9.6 and 8.9%, respectively.

Enhancing impacts of methanol foliar application on all growth and productivity assessments of wheat plant in this investigation were more pronounced under Shalakan environment conditions than under El-Bouseily ones. Such difference verify that the fruitful response of C3 plants to methanol application is mostly climatically dependent.

Key Words:

Wheat(*Triticum aestivum* L.); Methanol foliar application; Climatic locations; Growth; Yield components; Radiation use efficiency (RUE).

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INTRODUCTION

Limited water and arable land resources, and slow and expensive desert reclamation have directed the policies and strategies of the Egyptian Government towards raising agricultural productivity.

In Egypt, wheat has special importance because the local production is not sufficient to supply the annual demands at the local requirement. Increasing wheat production to decrease the gap between production and consumption is a national goal. Accordingly intensive efforts are being paid to increase the local wheat production vertically and horizontally. Use of exogenous growth regulators to modify crop growth and enhance productivity has long interested channel.

All crop production practices hinge around the fact that the yield of agricultural crops ultimately depends on the ability of plants to carry photosynthesis. Meanwhile, photosynthesis is dependent on carbon dioxide in the atmosphere. Under certain environmental conditions especially in warm, high solar radiation and quiet air conditions, CO_2 levels in the air may limit photosynthesis and yield **(Moursi and Fayed 1979)**. "Carbon fertilization" term is a recent advanced technique, which used to supply crop plants with sufficient levels of carbon to enhance carboxylation and photosynthesis rate in treated plants.

Much interest was generated when **Nonomura and Benson (1992)** reported that foliar applications of methanol increased growth and yield of many different crops by the role of methanol as an additional carbon source to increase carboxylation reactions and enhanced photosynthetic rate.

Methanol is effective only in bright sunlight, which seems to drive its rapid conversion to sugars. Meanwhile, **Faver and Gerik (1993)** pointed out that the positive response of plants to foliar methanol as source for carbon is mostly climaticaly dependent. Therefore, in the shade and when winter crops were treated with methanol, plants showed no improvement of growth **(Nonomura and Benson 1992-a).** Accordingly the efficiency

of methanol foliar application may varied between winter and summer crops and at different climatical locations.

Department of Agronomy of Faculty of Agriculture, Ain Shams University researches **(Al-Mohamed-Kenda *et al,* 2005 and Al-Mohamed-Kenda *et al,* 2009)** studied the influence of foliar spray of methanol on growth and productivity of Egyptian cotton and confirmed the fruitful impact of methanol on productivity of cotton as a summer C_3 crop under our warm and high solar radiation (Arabic climate). Hereof, investigations on the response of C_3 winter crops to methanol foliar application are exactly needed. Therefore, this work was assigned to evaluate the influence of foliar application of aqueous solution of methanol applied at different concentrations and at different spraying times on Giza 168 cv. bread wheat (*Triticum aestivum* L.) plants grown under two different climatic locations in Egypt. And to verify the impact of methanol on growth, yield components, yield and radiation use efficiency (RUE) of wheat.