EVALUATION OF WHEAT GENOTYPES FOR SUSTAINING YIELD UNDER WATER DEFICIT CONDITION

A Dissertation

By

Mst. Masuma Akhter
Student No. 1405164

DOCTOR OF PHILOSOPHY
IN
CROP PHYSIOLOGY AND ECOLOGY

DEPARTMENT OF CROP PHYSIOLOGY AND ECOLOGY

HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY

DINAJPUR, BANGLADESH

FEBRUARY 2019

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Approved as the style and content by

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Professor Dr. Md. Abu Hasan
(Supervisor)

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Professor Dr. Md. Maniruzzaman Bahadur
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DEDICATED
TO
BELOVED PARENTS

DECLARATION

I, Mst. Masuma Akhter, hereby declared that the dissertation titled "**EVALUATION OF WHEAT GENOTYPES FOR SUSTAINING YIELD UNDER WATER DEFICIT CONDITION"** submitted to Department of Crop Physiology and Ecology, Hajee Mohammad Danesh Science and Technology University, Dinajpur in the fulfillment of the requirements for the degree of **DOCTOR OF PHILOSOPHY** in Crop Physiology and Ecology is a record of bona-fide research designed and carried out by me. No part of this dissertation was produced elsewhere for any degree. It does not contain results of any collaborative study.

(Mst. Masuma Akhter)

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CERTIFICATE

This is to certify that the work embodied in this dissertation is an original research work done by Mst. Masuma Akhter under my supervision for the degree of Doctor of Philosophy in Crop Physiology and Ecology. The references cited in it have duly been acknowledged. The style and contents of the dissertation have been approved and recommended for submission.

(**Professor Dr. Md. Abu Hasan)**
Supervisor

BIOGRAPHICAL SKETCH

The author is the daughter of M. Khalilur Rahman and Halida Banu. She was born on December 1973 at Thakurgaon district of Bangladesh. The author received primary education at Mathurapur-2 Govt. Primary School, Thakurgaon. She completed her secondary school education from Mathurapur Public High School, Thakurgaon Road, Thakurgaon in 1988 and higher secondary education from Thakurgaon Govt. College, Thakurgaon in 1990 and obtained first division both the examinations. She completed B. Sc. Ag. degree in 1994 (held in 1998) with first class from Hajee Mohammad Danesh Agricultural College, Dinajpur an affiliated institution of Bangladesh Agricultural University, Mymensingh. She obtained MS degree in Agronomy in 2001 from Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur with CGPA 3.62 out of 4.0. The author started professional career in 2004 as a Scientific Officer at Bangladesh Agricultural Research Institute, Gazipur. She is the member of Krishibid Institution and Bangladesh Society of Agronomy. She is happily married and blessed with only one daughter (Sohana Mashtura Islam).

The author

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FEBRUARY 2019 The Author

ABSTRACT

Drought is a worldwide problem, constraining wheat production seriously and recent global climate change has made this situation more staid. Selection of drought tolerant wheat genotypes as well as to development of proper crop management techniques is useful tools to enhance the drought tolerance. Regarding these issues, four experiments were conducted during 2014 to 2017 at Hajee Mohammad Danesh Science and Technology University and Bangladesh Wheat and Maize Research Institute (BWMRI), Dinajpur. Effect of PEG 6000 induced water stress (0, -2, -4 bars) on the germination and seedling growth of 30 wheat genotypes was evaluated in petri-dishes on September 2014. Wheat genotypes (BARI Gom 25, E 38, BAW 1118, E 18, Shatabdi, BAW 1138, E 34, E30, BAW 1135 and E 3) showing less affected speed of germination (rate of germination (%), co-efficient of germination and germination vigour index) and seedling growth (length and dry weights of shoot and root) along with higher STI (Stress tolerant index) based on seedling dry weight were considered as comparatively water deficit stress tolerant genotypes. The wheat genotypes (BAW 1151, E 42, BAW 1170, E 29, BAW 1161, E 2, BAW 1157, E 23, BAW 1130 and BARI Gom 26) showed reverse value of the aforesaid traits due to severe stress designating comparatively water deficit stress susceptible genotypes. To screen out more authentically based on yield traits and yield, all genotypes were grown in the field in 2014-15 under three water regimes viz. well watered (three irrigations), one irrigation and no irrigation condition. In no irrigated plots, wheat genotypes- BARI Gom 25, E 18, E 38, BAW 1118, BAW 1170, E 24, E 28, E 3, BAW 1171 and E 34 showed higher relative yield attributes and yield indicating tolerant, while BARI Gom 26, BAW 1130, BAW 1140, BARI Gom 27, BAW 1143, BARI Gom 28, BAW 1138, BAW 1157, E 23 and Sourav showed lower relative value signifying susceptible genotypes. Considering experiments I and II, four water deficit stress tolerant (BARI Gom 25, E 18, E 38 and BAW 1118) and two susceptible genotypes (BARI Gom 26 and BAW 1130) were evaluated physiologically in the third experiment. In view of chlorophyll content, SPAD value, water status (Relative water content, water retention capacity), canopy temperature depression, cell membrane stability (CMS), production of osmolytes (proline and soluble sugar), yield traits and yield, the genotype E 38 showed the highest stress tolerance and the genotype BAW 1130 showed the lowest stress tolerance. To ameliorate the adverse effect of drought stress, these two genotypes (E 38 and BAW 1130) were evaluated with five potassium fertilizer treatments in combination with water regimes during 2016-17. Additional soil and foliar application of potassium enhanced water stress tolerance in relation to LAI, LDW, TDW, water relation, nutrients (N, P, K) uptake, yield traits and yiled. However, considering the results of seed germination, seedling growth, physiology, yield traits and yield, the E 38 can be declared as a drought tolerant genotype, and addition of 75 kg K ha^{-1} may advised to apply for cultivation of wheat under rainfed condition in the drought prone area of Bangladesh.

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