Soil Science for peace, cutting edge challenges to the 1 wheat production in Pakistan

Ijaz Rasool Noorka*, Muhammad Afzal and Saba Tabassum

University College of Agriculture, University of Sargodha, Pakistan.
ijazphd@yahoo.com

Abstract

Soil science and wheat production are the road map for food security and ultimately the peace in region and in the world. The global climatic changes have effected the provision of water and rise in temperature. These changes have reduced the food production. Seven wheat varieties including two exotic varieties were tested under two set of environments. The exotic varieties due to their better adaptability behaved best in contrasting environment. The paper comprehend the modern use of soil science to the production of new varieties of wheat that can with hold the water stress with regard to climatic changes. The soil science future research can combat the poverty, peace global climatic changes and food security cutting edge challenges.

Key words. *Contrasting Environment, Exotic, Food security, Peace, Road map and Temperature*

Introduction

The global village is under the threat of burgeoning population; there is only one hope to safe guard food issues, which is Agriculture. It is said that the twenty-first century is a century of food security. The United Nations has estimated that 65% increase in the world's population between 1995 and 2050, particularly in the developing countries. As observed by Voortman,(1985), an increase in agricultural products may be achieved by intensive land use and soil science planning. By the healthy projections, it is suggested that rise in agricultural production over 3% annually is must. Fresco,(1989). So, growing more crops and cultivating more land is need of hour but it is also a limiting factor in the context of water stress and soil health, Thompson and Dodson, (1958). The changing global climatic conditions have affected not only day length, growing season and water availability but also soil moisture availability, reduction in agricultural crops yields, Gao et al.(1993). Change in temperature and short spell of rain fall played a negative role in field crop production in Pakistan, Qureshi and Iglesias (1992). Water is blood life for agriculture and water crisis has affected sustainability in agriculture in most of the Asian countries, Huaqi et al. (2002). Pakistan is facing unrelenting water stress from last more than six year, Ahmad (2005), Ahmad et al. (2004) Responses to such issues require inter alia, the generation of scenarios constructed with detailed biophysical data coupled to process-simulation methods. Today after witnessing the prevailing situations of demand and supply of agricultural products, land use and water stress, an enormous challenge is for all policy makers, planners and scientists, Voortman, (1985).

The present research was initiated to evaluate the following Objectives.

i. To identify the soil properties of study area and minimizing water requirements of wheat crop.

ii. To identify the constraining factor for land use.

iii. To evaluate the genotypes under normal irrigation and water-stress condition by assessing the physiological basis of water-stress tolerance.
iv. To find the best way of eliciting and structuring expert knowledge, to over come yield barriers

Materials and Methods

The present study was initiated at University of Agriculture, Faisalabad, Pakistan during the 2005-06. In Pakistan water availability and occasional rain fall are neither sufficient nor reliable, so shortage of water may occurs at any stage. In this study two exotic and five local wheat genotypes were selected and sown under normal irrigated and water stress conditions (simulated by totally withholding irrigation after sowing). A 1.5 m buffer zone separated the both experiment. All agronomic practices, i.e. hoeing, weeding and fertilization etc were maintained the same for both experiments, however the save irrigation was applied only to the normal irrigation experimental site.

Soil analysis of experimental site

The experimental site was precisely leveled so that even distribution of water and inputs may be insured. The soil samples were collected from 0-15cm,16-30cm and 31-60cm depths and analysis were made according to the methods described by (Chapman and Pratt, 1961) and Watanabe and Olson, 1962) Field experiment was conducted to evaluate the soil characteristics that was sandy clay loam. The pH of soil was 7.05, EC_e was 0.21S m^{-1} and organic content was 0.80%.
The data of following traits were recorded and statistically analyzed.
1. Plant height 2. Flag leaf area 3. Number of tillers per plant 4. Grain yield

Results

According to the economic survey 2006-07 the year wise area, production and yield of wheat (Anonymous, 2007)

Table .1: Area, Production and Yield of Wheat

Year	Area (000 Hectare)	Production(000 Tons)	Yield (Kgs/Hec.)
2002-03	8034	19183	2388
2003-04	8216	19500	2375
2004-05	8358	21612	2568
2005-06	8448	21277	2519
2006-07(P)	8494	23520	2769

P: Provisional. (July-March) Source: Ministry of Food, Agriculture and Livestock, Federal Bureau of Statistics Islamabad, Pakistan.

According to Table 1, the economic survey results, it is shown that area and production of wheat is increasing every year but due to burgeoning population pressure and global climatic changes, the Pakistani Government has to spend more than US$1.0 billion annually. (Anonymous, 2007) to feed the nation.

The seven wheat genotypes comprising both exotic and local under this study showed that all physiological and yield contributing traits tend to decline in response to water stress. The mean values under normal irrigation as well as water stress environment are evident from Table.2

Table 2.Mean values of 7 genotypes in wheat under normal irrigation and water stress conditions

	Normal	Water stress	Normal	Water stress	Normal	Water stress	Normal	Water stress	
Genotypes	Plant height (cm)	Plant height (cm)	Flag leaf area (cm2)	Flag leaf area (cm2)	No. of tillers/plant	No. of tillers/ plant	Economic yield (g)	Economic yield (g)	Percent decrease in yield
Nesser	99.01c	87.02bc	25.71bc	18.14ab	11.67a	10.17a	27.10a	21.85a	19.37
Dharwar Dry	113.33a	100.01a	32.27a	21.21a	12.07a	10.50a	27.30a	21.81a	20.10
GA-2002	108.33ab	85.33bc	23.59bcd	16.74b	9.96b	8.83b	16.98bc	12.40c	26.97
Bakhar-2002	108.01ab	84.67c	24.10bcd	16.62b	12.06a	9.01b	13.24c	10.01bc	20.40
Chakwal-86	106.02b	90.33b	21.29d	18.21ab	11.40a	9.17b	16.83bc	12.30c	26.92
Inqulab-91	108.67ab	75.67a	26.17b	20.68a	11.50a	9.43a	15.97bc	12.06ab	24.48
Kohistan-97	110.01ab	90.01b	22.38cd	19.54ab	11.77a	10.07a	19.03b	14.47bc	23.96
LSD Mean	6.981	5.1123	3.637	3.54	1.1122	NS	5.702	2.667	NS

Percent decrease in economic yield under water stress condition

The climate has played negative effect, by pulling down most of the traits which ultimately depicted downward trend in economic yield of genotypes The genotypic percent decline are shown in (Table 3) was as follow; genotypes Nesser (19.37%), Dharwar-Dry (20.10%), GA-2002 (26.97%), Bakhar-2002 (20.40%), Chakwal-86 (26.92%), Inqulab-91 (24.48%) and Kohistan-97 (23.96%). The minimum effect of water stress was shown by genotypes Nesser (19.37%) and Dharwar Dry (20.10%).

Discussion

It is imperative to know the mechanism of water stress resistance and the interaction of crop plant and how plant try to adopts water stress in growth period. The natural climatic condition effects on plant growth mainly so we have to develop such types of varieties which may not largely depend upon the provision of ample supply of water. According to Fischer and Sanchez (1979) various facets of water stress effects crop grain yield and biomass. In the present study it was noted that water stress has cumulative and an important role to alter the normal growth functioning. The yield contributing characters are affected

badly which ultimately declined economic yield. The similar results were reported by early researchers like Subhani and Chowdhry (2000), Rana *et al.* (1999), Angus and Van Herwaarden (2001), Nabipour *et al*. (2002).

Under both irrigation and water stress environments all seven genotypes showed significant effects in response to water stress. In trait plant height the genotype Dharwar Dry achieved top position under normal irrigation and water stress condition while the genotype Nesser and Inqalab-91 remained dwarf under normal irrigation and water stress conditions respectively. Due to their dwarfism nature they elicited good yield and less yield decline percentage (Table 2). The flag leaf area contribute maximum photosynthetic activities so its measurement has significant effect in plant yield contribution, Muller (1991). In this study the genotype Dharwar Dry achieved top position by attaining maximum flag leaf area under both normal and water stress irrigation condition. As the number of tillers per plant is also has a prime role in yield enhancement of a genotype and reduction in tillers results reduction in economic yield. Sukhorukov(1989). The genotype Bakhar-2002 attained maximum number of tillers per plant under normal irrigation condition. As the treatment of water stress is concerned, the exotic genotype Nesser once again behaved well as compared to local genotypes. The grain yield is a cumulative effect of all yield contributing traits and grain yield has prime role in selection of a genotype. Atale and Zope (1991). Total dry matter production decreases under dry conditions (Kramer, 1983), Mohammad (1998) and Hassaan (2003). With regard to economic yield per plant, the exotic genotype Dharwar Dry once again attained maximum economic yield per plant under normal irrigation condition while another exotic genotype Nesser revealed best position under water stress environment. The similar results were reported by researchers like Rana et al. (1999), Chowdhry et al ,(1999), Nabipour et al. (2002), Hassaan (2003), Noorka et al, 2009 a. To improve economic yield is the moral duty and prime aim of a researcher and by this way the world food security and peace can be ensured by using soil science in utmost best way in the service of humanity, in the context of changing climatic conditions. The crescendo of the alarming bells has in recent years grown much louder, alerting the right thinking people from all walks of life to the urgent need to take the bull by the horns and spare humanity the sufferings from a likely strangle hold of a virtual catastrophe. Unless a well orchestrated action plan is launched on a fast track, it is feared the planet will be hard to rescue from getting caught into a chain reaction that can impose a dangerous fresh water deficit spawning from a structurally disturbed global environment. Thus there is a unfolding a desperate situation unable to sustain a modernizing soil science use and therewith the continuity of human life on the earth insured against all forebodings of doom and gloom. Rasool,I,(2008) and Noorka et al, 2009 b.

Reference

Ahmad, S. 2005. Water resources of Pakistan and strategy for climate change adaptionsin Pakistan. APN and Capable stakeholders workshop on "*Climate change impact on water in South Asia"*. January 13Th 2005, Islamabad.

Ahmad. S. Z. Hussain, A. S. Qureshi, R. Majeed and M. saleem. 2004. Drought Mitigation in Pakistan: current status option for future strategies. IWMI working paper 85. Drought series paper

number 3. *International water management institute,*Colombo

Angus, J.F. and A.F. Van Herwaarden. 2001. Increasing water use and water use efficiency in dry land wheat. *Agron. J.* 93: 290-298.

Anonymous, 2007. *An over view of economy 2007.* Ministry of Food, Agriculture & Livestock, Federal Bureau of Statistics.Islamabad, Pakistan.

Atale, S.B. and W.N. Zope. 1991. Discrimination function analysis and selection indices in bread wheat (Triticum aestivum L.). PKV. Res. J. 15-17.

Chapman, H.D. and P.F. Pratt. 1961. *Methods of analysis for soils, plants and waters*. Univ. California, USA.

Chowdhry, M.A. I. Rasool, I. Khaliq, T, Mehmood and M. M. Gilliani. 1999.Genetics of some metric traits in spring wheat under normal and drought environments. *RACHIS* 18 (1): 34-39.

Fischer, R.A. and A. Sanchez. 1979. Drought resistance in spring wheat cultivars. II. Effects on plant water relations. *Aust. J. Agric. Res*. 30:801-814.

Fresco,L. 1989. Land evaluation and farming systems analysis for land use planning. Wageningen. FAO.

Gao, S.H., J.P. Guo and Y. R. Pan. 1993. Impact of climate change on wheat development production the Nothern China. *Journal of Environmental Sciences*, 5(2):176-185.

Hassaan, R.K. 2003. Effect of drought stress and yield components of some wheat and Triticale genotypes. *Ann. Agri. Sci.* (Cairo). 48(1):117-129 [Pl. Br. Absts. 73(12): 12240; 2003].

Huaqi, W., B.A.M. Bouman, D. Zhao, W. Changgui and P.F. Moya. 2002. *Aerobic rice in northern China: Opportunities and challenges.* Workshop on water wise rice production, 8-11 April IRRI, Los Banos, Philippines.

Kramer, P.J. 1983. *Water relations of plants*. Academic Press. London.

Mohammed, A.I.S. 1998. Evaluation of wheat genotypes under water stress conditions in northern Sudan. *Rachis*: 16(1/2): 86-87.

Muller, J. 1991. Determining leaf surface area by means of linear measurements on wheat and Triticale (Brief report). *Archir fuchtungsforschung*. 21(2):121-123. [Pl. Br. Absts. 63(5): 121-123].

Nabipour, A.R., B. Yazdi-Samadi, A.A. Zali and K. Poustini. 2002. Effects of morphological traits and their relations to stress susceptibility index in several wheat genotypes. *BIBAN 7(*1):31-47 [Pl. Br. Absts. 3(6):5957, 2003].

Noorka, I. R, I. Khaliq, Z.Akram and S. Iqbal. 2009 a. Inheritance studies of physio- genetic traits in spring wheat under normal and moisture stress environments. *Int.J.Agric.Appl.Sci*.,1(1) 29-34.

Noorka, I. R and M. Afzal. 2009 b. Global Climatic and Environmental Change Impact on Agricultural Research Challenges and wheat productivity in Pakistan. *Earth Science Frontier* 16(special issue) 100.

Qureshi, a. and A. Iglesias.1992. Implication of global change for Pakistan agriculture: Impact on simulated wheat production. Climate Institute, Washington, D. C., USA.

Rana, V., S.C. Sharma and G.S. Sethi. 1999. Comparative estimates of genetic variation in wheat under normal and drought stress conditions. *J. Hill Res.* 12(2): 92-94 [Pl. Br. Absts. 70(5): 4624; 2000].

Rasool, I. 2008. Physio genetic basis of water stress tolerance in spring wheat(Triticum aestivum L.) Ph.D Thesis, University of Agriculture, Faisalabad, Pakistan.

Subhani, G.M. and M.A. Chowdhry. 2000. Genetic studies in bread wheat under irrigated and drought stress conditions. *Pak. J. Bio. Sci*., 3(11): 1793-1798.

Sukhorukov, A.F. 1989. Variation in yield components in winter wheat varieties under drought conditions. *Selektsiya i Semonovadstvo*, Moscow (3): 10-13.

Thompson,A.O. and R.G. Dodson.,1958. Geology of the Navasha area.,67

Voortman,R.L., 1985. Guidelines on land evaluation for rainfed agriculture in Mozambique. Maputo. *Instituto Nacional de investigacao Agronomica*.

Watnabe, F.S., and S.R. Olsen. 1962. Colorimetric determination of phosphorus in water extracts of soils. *Soil Sci*. 93:183-188.