

## The Performance of Selected Sudanese wheat (*Triticum aestivum* L.) cultivars under Modern Irrigation System (Sprinkler irrigation) in the High Terrace Soils of Sudan

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### ABSTRACT

Afield experiment was conducted in a marginal soil in Sudan ( Nile River State) to evaluate the performance of 8 released ARC (Agricultural Research Corporation) wheat cultivars known of tolerating high temperatures, plus an introduced cultivar adopted in Saudi Arabia by The Rajhi Group. All the recommended packages by ARC in Sudan were applied, except for the fertilization program which followed the recommendation of Al-Rajhi Group ( Saudi Arabia) based on their experience in wheat growing in the Kingdom of Saudi Arabia. Upon crop harvest after 115 days from sowing, differences were encountered with most of the cultivars tested in: days taken to maturity, tillering, grain weight, harvest index and grain yield. The overall mean yield of the growing season was (2947.9kg/ha). However, grain yield of more than 3000 kg/ha was obtained by 4 cultivars; namely Nebta, Elneilein, Wadi Elneil, and Yaco Rajo, but Nebta scored almost 4 tons and exceeded Elnilein by 0.7 tons. The introduced cultivar ( a very short cultivar) performance was comparable to three of the tested released cultivars and ranked 4 among the tested cultivars, seemingly due to its high tillering ability. Recommendations were made for investors interested in wheat growing in Sudan on the cultivars they could use.

**Key words:** Released cultivars , sprinkler irrigation, high terraces, tillering ability

### INTRODUCTION

The success in wheat research has enhanced the expansion of the wheat area in the Sudan; the intensification and diversification of cropping systems has increased the land available for wheat production from 9,000 to 307,000 hectares. The expansion in wheat production has contributed to an increase in farmer income, which has resulted in increased domestic household activities, social activities, and leisure consumption; it has reduced the number of farmers migrating to other professions (Dawelbeit 1997).Also, investors from foreign countries need information regarding the technology to be adopted in wheat growing. Therefore , such technologies need to be stressed in future studies.

However, wheat which is grown in Sudan as a winter crop suffers from a number of abiotic and biotic stresses, yet the short season ( 90-110 days) and the relatively high temperature crop growth at early and late stages contribute greatly to its low productivity. Wheat yields on experiment stations range between 3 and 4.5 t/ha, whereas commercial production yields are only .8 to 1.5 t/ha. The prevailing weather conditions during wheat growing season in Sudan is quite mild as tending towards the north, so emphasis must be focused on the northern region.

Wheat production under fertile soils in this region is limited due to area limitation and due to farmers preference to legume cultivation as cash crops with guaranteed and quick return. Also, water erosion is an essential factor encouraging farmers to seek an alternative to wheat .For these reasons, wheat production should be extended horizontally to cover marginal areas. Such areas are classified as such if they are saline, sodic, has poor fertility , and poor physical properties, and they are known as high terrace soils.

The technical packages of wheat are unsuitable to all soil types and irrigation systems. So efforts should be made by soil and irrigation specialists to conduct extensive research to address the prementioned types of marginal soils in an attempt to figure out a full wheat package i.e. suitable genotypes or varieties, land preparation, amendment, and fertilization.

In this experiment, we concentrated mainly in valuation of some commercial wheat cultivars and promising genotypes in marginal lands of Sudan under fixed fertilizer program .

The objectives of this work therefore is to evaluate the yield performance of released wheat varieties

under sprinkler irrigation system in a marginal land in the Nile Province in Sudan.

## MATERIALS AND METHODS

A trial consisting of 9 wheat varieties ; namely short stature ( Nebta and Bohein), two medium semi-short ( Khalifa and Imam), and 4 tall ( Alnilein, Tagana, Wadi Elneil, and Debiera) plus one introduced genotype( Yaco Rajo) at Rajhi Farm in the Nile Province ( latit.32-35<sup>0</sup> south, altitude 16-22<sup>0</sup> North), Sudan).

The genotypes were treated with Gaucho at 0.5 g/1 kg seeds) and were sown at the third week of November in soils the properties of which are tabulated in table 1.The seed rate used was 120kg/ha. The spacing was as recommended by the research center(ARC, Sudan). A randomized complete Block design with three replicates was used. Fertilizers were applied as NPK (36-14-6), 2 mg Sulfur, 200 kg urea, 150 kg urea injection, 1 kg Cu, 5 liters of phosphoric acid/ha. Humic acid was applied at the rate of 5 liters/ha. Two kg of mixture of Mg, Fe, and Zn were also applied. Ammonium sulfate was added at the rate of 100kg/ha. The Irrigation interval was one day.Soiils were analyzed before sowing and after harvest using standard methods described by Ryan, 2001.

The growth period continued for 115 days after which the crop was harvested. The net harvested area was 8mx5 rowsx0.2 m. Data was taken on grain yield (kg/ha), grains/spike, 1000 seed weight, biomass (kg/ha), and harvest index. Statistical analysis was performed using IRRISTAT program.

## RESULTS AND DISCUSSIONS

The data are presented in table (2).

This season was relatively cool in earlier months(November and December) followed by unusual mid heat stress. The data obtained were erratic in consistent with the findings of Villareal & Klatt, 1985. Yields were medium. The overall mean

yield of this season was (2947.9kg/ha). However, grain yield of more than 3000 kg/ha was obtained by 4 cultivars; namely Nebta, Elneilein, Wadi Elneil, and Yaco Rajo, but Nebta scored almost 4 tons and exceeded Elneilein by 0.7 tons. The main factors in determining the mean yield among the nine cultivars is the grain No/spike, the harvest index, and the earliness. The estimated yield was calculated by multiplying tillers by grains/spike by the weight of individual grain/ha. This could be a good indicator to the cultivar potential. Accordingly, Imam, Wadi Elneil, , and Nebta are the promising cultivars. It is worth mentioning, however, that Khalifa and Imam were shattering cultivars. The data obtained were consistent with previous findings by researchers at ARC in other experimental sites in Sudan ( Hussein et.al., 2010 ; Ageeb, 2008).The introduced cultivar Yaco Rajo score was unexpected based on observations recorded during the growing season, but the high tillering capability of the cultivar seemed to have compensated for the very short height of the cultivar.

The soils analyzed before sowing and after crop harvest revealed a trend to increase in organic carbon, nitrogen percentage, phosphorus content. The pH was relatively reduced which was targeted with the addition of ammonium sulfate. The response of the cultivars performance to the noticed decrease in pH needs further investigation.

Also, the season being cooler will not reflect the proper performance of the tested cultivars which necessitates further evaluation in different seasons in the future.

Since investors are concerned with the benefit and the cost of particular technologies, the easiest technology that could be adopted by them is the impressive cultivar that excels their introduced cultivars. Other technologies like fertilizers ( type, amount, application time), and sowing dates should also be considered.

**Table1. Soil chemical & physical properties of the site used in the study before and after wheat sowing**

Soil property	pH (1:5)	ECe(DS/m)	N (%)	P (ppm)	O.C (%)	Texture
Pre-sowing	8.14	0.08	0.01	0.04	2.9	Sandy Loam
Post-sowing	7.67	0.20	0.02	0.07	3.34	Sandy Loam

**Table 2. The grain yield and yield components and some morphological and physiological characteristics of the cultivars used in the study**

Cultivar	Height (cm)	Days to maturity	Tillers/m <sup>2</sup>	Grains/spike	1000 grain wt.(g)	Harvest index(%)	Biomass kg/ha	Grain yield (kg/ha)	Lodging
Yaco Rajo	Very Short <60	85	519	34	36.3	36.6	9500	3134.4	Non
Nebta	Short 60-70	90	510	68	28.9	38.4	10500	3948.1	Rare
Bohine	Short 60-70	88	563	47	33.7	28.6	8667	2516.6	Non
Khalifa	Medium 70-80	95	432	47	37.2	21.2	15167	2945.4	Rare
Imam	Medium 70-80	100	663	59	31.2	23.4	10167	2625.6	Rare
Elneilein	Tall >80	95	452	62	33.3	27.2	11000	3182.1	Freq
Tagana	Tall > 80	110	453	54	29.2	24.6	12500	2636.6	Rare
Wadi Elneil	Tall >80	105	561	64	33	30.2	12500	3150.1	Freq
Debeira	Tall >80	100	490	62	30.7	25.5	11667	2392.0	Rare
						3.8	1714.5	483.6	

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