Agricultural Research & Technology
Open Access Journal
ISSN: 2471-6774

Juniper Publishers
key to the Researchers

Research Article
Volume 18 Issue 4 - November 2018
DOI: 10.19080/ARTOAJ.2018.18.556063

Agri Res & Tech: Open Access J

Durum wheat (*Triticum durum* Desf) Variety "Utuba" Performance in Ethiopia

Mekuria Temtme*, Wasihun Legese, Shitaye Homa and Asenafi Gemechu

Ethiopian Institute of Agricultural Research (EIAR), Ethiopia

Submission: September 22, 2018, **Published:** November 02, 2018

***Corresponding author:** Mekuria Temtme, Ethiopian Institute of Agricultural Research (EIAR), Debre Zeit Research Center, P.O. Box 32, Addis Ababa, Ethiopia.

Abstract

Durum wheat (Triticum durum Desf.) is industrial and a staple food crop of Ethiopians. Produced in most parts of Ethiopia and has existed in Ethiopia for thousand years. Annually, it occupies 500 thousand hectares in the country. However, the national average yield of durum wheat is low 2.2 t ha-1. The use of unimproved local cultivars and biotic and a biotic stresses are partially attributed to the low yield of the crop. Thus, the experiment was designed to develop high yielding, disease resistant and desirable quality improved varieties of durum wheat suitable for diverse agro-ecologies, farming systems and purposes. Eighteen durum wheat genotypes including four standard checks were laid out in randomized complete block design using four replications for two years (2013 and 2014) at eight locations. The combined data analysis across locations and over the years indicated that candidate variety "Utuba" (IDON-MD-2009_off/53/2009) performed better than the four standard checks and other test genotypes. Consequently, Utuba was identified and released for large scale production.

Keywords: Durum wheat; Utuba; Yield; Quality

Abbreviations: DRRW: Durable Rust Resistant Wheat; EAAPP: East Africa Agricultural Productivity Project; CSA: Central Statistical Agency

Introduction

Durum wheat Durum wheat (*Triticum durum* L.) is a member of the Gramineae family which belongs to the Triticeae tribe. It is an allotetraploid (two genomes: AABB) with a total of 28 chromosomes (2n = 4x = 28). *Triticum durum* is believed to be originated thousands of years ago from a hybridization between the wild diploid *T. monococcum* L. subsp. *Boeoticum* (Boiss.) (A genome donor) (Synonym: *Triticum urartu*: AA) and the donor of the B genome which, according to morphological, geographical and cytological evidence, has been recognized as *T. speltoides* (Tauschi) Gren. Or its closely related species [1]. There are six types of *Triticum* species of which *Triticum aestivum* and *Triticum turgidum* are the most dominantly grown species in Ethiopia.

Durum wheat is grown in Ethiopia since antiquity because of its wide adaptation to the different agro-ecologies of the country, and resistance to biotic and a biotic stresses. Annually, it occupies 500 thousand hectares. However, the national average yield of durum wheat is low 2.4 t ha^{-1}. The use of unimproved local cultivars and biotic and a biotic stresses are partially attributed to the low yield of the crop. Thus, the experiment was designed to develop high yielding and desirable quality improved varieties of durum wheat suitable for diverse agro-ecologies and farming systems. Eighteen durum wheat genotypes including two checks were laid out in randomized complete block design using four replications for two years (2013 and 2014) at eight locations. Thousands of different crosses have been made since the initiation of the crossing program in 1974. Between outstanding local selection and adapted exotic varieties has shown more promise than using two exotic varieties [2].

High yielding varieties have been identified some of which are under popularization while others are either under production or out of production. Up to now, the Ethiopian Agricultural Research System [3], has released 36 improved durum wheat varieties. Through the years of durum wheat breeding, genetic gain studies revealed that the average annual genetic gain in yield was 1.5% from 1966 until 2015 [4].

Methodology

IDON-MD-2009_off/53/2009: developed by the ICARDA wheat breeding programme for Africa (Ethiopia), selected for disease, drought and high yield under optimal conditions by Debrezeit agricultural research center until reached to national variety trial. 18 durum wheat genotypes including four standard checks were laid out in randomized complete block design using four replications for two years (2013 and 2014) at eight locations. The combined data analysis across locations and over the years using SAS 9.1 [5], software indicated that candidate variety Utuba (IDON-MD-2009_off/53/2009) performed better than the

two checks and other test genotypes in all tested parameters. Consequently, Utuba was identified and released Ethiopian durum wheat variety for large and small-scale production.

The seed was drilled by hand at seed rate of 125kg/ha which is equivalent of 45gm/3m^2 and planting depth was ~5cm. Planting carried out at appropriate planting time for each location and fertilizer applied according to the specific recommendation (200kg/ha of Urea and 100kg/ha of DAP) of each location. The purpose was to develop stable, high yielding; and farmers and consumers preferred durum wheat varieties for the high rainfall and optimum moisture (high potential) areas of the country. In other words, it was targeted at developing varieties with high yielding potential and better quality than the improved contemporary standard check variety Mangudo was selected for its high yielding ability, farmer- and consumer-preferred high yielding amber seed color, and wide adaptability Following a successful germplasm advancement up to two times per year was made using off-season irrigation facilities. As a result, Utuba was selected as a variety through series of multi-environment yield tests in various major durum wheat-growing regions of the country.

Description of the Variety "Utuba"

"Utuba" (IDON-MD-2009_off/53/2009) is released as Ethiopian durum wheat variety christened "Utuba" in 2015 [3]. Utuba is amber seeded, high protein content and high yielding potential variety resulting from a simple and top cross and released as an alternative variety to Mangudo and Mukuye. The grain yield performance on research station ranged from 3.4-6.5 t ha^{-1} and farmers' fields the grain yield ranged from 2.5-4.5 t ha^{-1}. Utuba takes 62 days to (head) and 108 days to mature. It is 82cm tall.

Table 1: Mean agronomic performance of Durum wheat genotypes evaluated in National Variety Trial across locations and over years.

S. No	Genotype	DTH	DTM	TGW	PLH	YLD
1	IDON-MD-2009_off/12/2009	61.54	109.78	36.95	79.7	4355.82
2	IDON-MD-2009_off/34/2009	58.94	109.55	42.09	82.59	4731.26
3	IDON-MD-2009_off/53/2009	58.92	109.5	42.65	83.89	5113.29
4	DSP2009_off. F3.2H.22_meh.1H.26	58.8	109.04	40.1	78.27	4157.81
5	DSP2009_off. F4.1H.783_meh.4H.259	58.15	108.73	38.6	76.19	4281.5
6	DSP2009_off. F4.1H.785_meh.2H.	57.72	107.97	40.16	77.07	4260.23
7	DSP2009_F6 off/1508/2009	61.42	110.23	37.62	81.28	4355.94
8	IDON-MD-2009_off/25/2009	60.7	109.9	42.53	95.73	4147.48
9	DSP2009_off. F4.1H.378_meh.4H.	59.2	109.19	42.25	73.32	4394.3
10	DSP2009_off. F4.3H.639_meh.1H.	67.71	112.62	38.51	80.29	4395.05
12	DSP2009_off. F4.2H.712_meh.1H.	61.73	110.92	40.39	97.22	4985.18
13	DSP2009_off. F4.2H.735_meh.2H	58.27	108.4	38.84	73.79	4108.89
14	DSP2009_off. F4.3H.976_meh.2H	62.04	109.73	36.73	75.4	4194.25
15	Hitossa	61.47	110.34	34.26	81.27	4570.12
16	Mangudo	58.84	109.65	43.64	83.28	4409.32
17	Ude	61.06	108.94	39.59	81.52	4256.93
18	Yerer	65.37	112.14	40.38	78.71	4235.26
19	Local	61.78	111.09	42.4	95.69	3714.91
20	Heritability	0.93	0.76	0.84	0.91	0.73
21	Grand Mean	60.76	109.87	39.87	81.96	4370.42
22	LSD@ 5%	1.09	1.13	1.49	2.89	283.92
23	CV	4.02	2.04	9.1	8.65	14.71

Note: DTH=days to heading, DTM=days to maturity, TGW=thousands grain weight (gm), PH=plant height (Cm), HLW=hector liter weight.

Table 2: Stem rust, Leaf rust and yellow rust durum wheat disease response.

S. No	Genotypes	Leaf Rust	Stem Rust	Stripe Rust
1	IDON-MD-2009_off/12/2009	10MS	10MS	0
2	IDON-MD-2009_off/34/2009	15MS	15MS	0
3	IDON-MD-2009_off/53/2009	TR	10MS	0
4	DSP2009_off. F3.2H.22_meh.1H.26	5MS	10MS	0

How to cite this article: Mekuria T, Wasihun L, Shitaye H, Asenafi G. Durum wheat (*Triticum durum* Desf) Variety "Utuba" Performance in Ethiopia. Agri Res& Tech: Open Access J. 2018; 18(4): 556063. DOI: 10.19080/ARTOAJ.2018.18.556063.

5	DSP2009_off. F4.1H.783_meh.4H.259	15MS	20MS	0
6	DSP2009_off. F4.1H.785_meh.2H.	10MS	15MSMR	0
7	DSP2009_F6 off/1508/2009	5MS	15MSMR	0
8	IDON-MD-2009_off/25/2009	20MS	20MSMR	20
9	DSP2009_off. F4.1H.378_meh.4H.	10MRMS	15MSMR	0
10	DSP2009_off. F4.3H.639_meh.1H.	5MS	10MS	0
12	DSP2009_off. F4.2H.712_meh.1H.	TRS	TRMS	0
13	DSP2009_off. F4.2H.735_meh.2H	5MS	15MS	0
14	DSP2009_off. F4.3H.976_meh.2H	TMR	10MR	0
15	Hitossa	25MS	25MS	0
16	Mangudo	TR	TR	0
17	Ude	10MS	20MS	0
18	Yerer	5MS	5MSMR	0
19	Local	TR	TR	0

Note: MR=moderately resistant, MS= moderately susceptible, TR= tress resistant, R= resistant

"Utuba" has several preferred advantages that make it attractive to farmers. The first is its great tillering capacity. On one hand, this provides more spikes and therefore more yield, the trait most appreciated by farmers. However, the extra stems also provide more straw to be used for feeding livestock, another critical trait for smallholder farmers. Another advantage is early heading, which allows it to avoid the negative effect of the terminal drought and desiccating wind that occur with higher frequency toward the end of the season. Farmers near East shewa saw their neighbors' bread fields completely wiped by stems rust, but with Utuba, even the worst rust infections only affected 5% of the stem. This high level of resistance to rust was one of the most visually compelling decision points for farmers to adopt the variety. Protein content in this variety tends to be high, the gluten is strong, and the color of the semolina is excellent amber yellow (Table 1&2).

Diseases notes are to be taken at least three times using standard procedures. For rust diseases the modified Cobb's scale applied; i.e. disease severity (%) with reaction types (R, MR, MS and S for resistant, moderately resistant, moderately susceptible & susceptible reactions, respectively). This variety "Utuba" showed excellent level of resistant for stem rust (10MS) which is 10% of moderately susceptible at the most hot spot area of the country (Debrezeit) and resistant to yellow and leaf rusts. Originally, this variety consists minor (many) resistant genes. Also known as slow rusting, horizontal or partial resistant genes. As defined by Caldwell [6] and Johnson [7], slow rusting is a type of resistance where disease progresses at a retarded rate, resulting in intermediate to low disease levels against all patho types of pathogen. Partial resistance, as defined by Parlevliet [8], referring to leaf rust resistance in barley, is a form of incomplete resistance characterized by a reduced rate of epidemic development despite a high- or susceptible-infection type. The components that cause slow rusting of a cultivar are longer latent period, low receptivity or infection frequency, as well as smaller uredial size and reduced duration and quantity of spore production. All these components could make the variety preferable by the farmers than local and recently released standard check varieties. Existing durum wheat varieties having major resistance genes frequently lacked "durability", that is, the ability of a widely-deployed resistance gene to provide an economic level of protection over an extended period of time [9].

Acknowledgement

We are grateful to the Durable Rust Resistant Wheat (DRRW) and East Africa Agricultural productivity project (EAAPP) for the finance support in the development of this variety. We also greatly acknowledge all collaborators for their assistance in the execution of the multi-environment field experiments that lead to the release of the variety.

References

1. Colomba MS, Gregorini A (2011) Genetic diversity analysis of the Graziella Ra, *Triticumturgidum* L. subsp. durum (Desf.) Husn. (Poales, Poaceae). Biodiversity Journal 2(2): 73-84.
2. Gebre-Maryam H (1991) Wheat production & research in Ethiopia. In: Wheat Research in Ethiopia: A Historical Perspective. Gebre-Mariam H, Tanner DG, et al. (Eds.), IAR/CIMMYT, Addis Ababa, Ethiopia; p. 1-15.
3. MOA (2015) Ministry of Agriculture, Plant Variety Release, Protection and Seed Quality Control Directorate, Crop Variety Register, Issue No. 17, June 2014, Addis Ababa, Ethiopia; pp. 330.
4. Amsal Tarekegne, Turner DG, Getinet Gebeyehu (1995) Improvement in yield of bread wheat cultivars released in Ethiopia from 1949 to 1987. African Crop Science Journal 3(1): 41-49.
5. SAS Institute (2002) SAS/STAT guide for personal computers, version 9.0 edition. SAS Institute Inc., Cary, North Carolina, USA.
6. Caldwell RM (1968) Breeding for general and/or specific plant disease resistance. In Proc. 3rd Int. Wheat Genetics Symposium, Canberra, Australia; pp. 263-272.
7. Johnson R (1981) Durable resistance, definition of, genetic control, and attainment in plant breeding. Phytopathology 71: 567-568.
8. Parlevliet (1975) Evaluation of the concept of horizontal resistance in the barley/puccinia hordei host-pathogen relationship. Resistance, pp. 494-497.

How to cite this article: Mekuria T, Wasihun L, Shitaye H, Asenafi G. Durum wheat (*Triticum durum* Desf) Variety "Utuba" Performance in Ethiopia. Agri Res& Tech: Open Access J. 2018; 18(4): 556063. DOI: 10.19080/ARTOAJ.2018.18.556063

9. Central Statistical Agency (CSA) (2015) The Federal Democratic Republic of Ethiopia, Agricultural Sample Survey 2014/15 (2007 E.C.), Volume I, Report on Area and Production of Major Crops (Private Peasant Holdings, Meher Season), Statistical Bulletin 278, Addis Ababa, Ethiopia.

DOI: 10.19080/ARTOAJ.2018.18.556063

How to cite this article: Mekuria T, Wasihun L, Shitaye H, Asenafi G. Durum wheat (*Triticum durum* Desf) Variety "Utuba" Performance in Ethiopia. Agri Res& Tech: Open Access J. 2018; 18(4): 556063. DOI: 10.19080/ARTOAJ.2018.18.556063.