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Abstract. ICARDA-ARC Wheat improvement program (ICARC-WIP) is a joint project between ICARDA and Agricultural Research Center (ARC) in Egypt. The project, which commenced in 2009, aimes to breed for high yielding potential and rust resistance in durum wheat. Nineteen durum wheat genotypes were selected from advanced yield trials in addition to five checks from the growing season 2010-2011 and were planted across five environments at north, middle and south of Egypt as elite durum wheat yield trail (EDWYT) in growing season 2011-2012. Four durum wheat genotypes were selected based on multi location testing by ICARC-WIP and are candidates for inclusion in the preliminary yield trail at the national program in Egypt in the growing season 2012-2013. The pedigree of the 4 durum wheat promising lines are ICAMO-R-TA04-61/Mrb3, Quarmal/Gbch-2//Terbol97-4, Bushen-4/2*Green-18//M ki-1/3/Icasyr-1//Saadi 1989/Chan, and Mrf1/Stj2//Gdr2/Mgnl1. Data were collected on yield and yield components. The previous lines had high yielding ability compared to the grand mean (8786.51 kg/ha) and were resistant to rusts and lodging. The grain yield for these lines were 9061.585, 10422.68, 10805.61 and 9980.483 kg/ha respectively.

Keywords. Durum wheat – Breeding – Yield potential – Egypt.

L'amélioration du blé dur pour un rendement potentiel élevé en Egypte

Résumé. *Le programme ICARDA-ARC pour l'amélioration du blé (ICARC-WIP) est un projet conjoint entre l'ICARDA et le Centre de recherche agricole (ARC) en Egypte. Le projet, qui a débuté en 2009, a pour objectif de réaliser une sélection pour un potentiel de rendement élevé et pour la résistance à la rouille du blé dur. Dix-neuf génotypes de blé dur ont été sélectionnés sur la base du test de rendement avancé, en plus de outre cinq témoins, dans la saison de croissance 2010-2011 et ont été plantés dans cinq différents endroits dans le nord, le centre et le sud de l'Egypte pour effectuer des tests de rendement sur le blé dur d'élite (EDWYT) dans la saison de croissance 2011-2012. Quatre génotypes de blé dur ont été sélectionnés sur la base de tests multi-sites par ICARC-WIP et sont candidats pour être inclus dans le test de rendement préliminaire du programme national égyptien pour la saison de croissance 2012-2013. Les pédigrées des 4 lignées de blé dur prometteuses sont ICAMO-R-TA04-61/Mrb3, Quarmal/GBCH-2//Terbol97-4, Bushen-4/2*Green-18//Miki-1/3/Icasyr-1//Saadi 1989/Chan, et Mrf1/Stj2//Gdr2/Mgnl1. Des données ont été collectées sur le rendement et ses composantes. Les lignées précédentes avaient une capacité de rendement élevée par rapport à la moyenne générale (8786,51 kg/ha) et étaient résistantes à la rouille et à la verse. Le rendement en grain de ces lignées était de 9061.585, 10,422,68, 10805,61 et 9980,483 kg/ha, respectivement.*

Mots-clés. *Blé dur – Sélection – Potentiel de rendement – Egypte.*

I – Introduction

Durum wheat represents 8-10% of the wheat grown and produced worldwide (FAOSTAT, 2006). The production is concentrated in relatively small geographical areas where it often plays a major role in the food security and in the livelihood and nutrition of urban communities (Ammar *et al.*, 2008). About 50% of total area is in the developing countries. In these countries, durum wheat occupies approximately 11 million hectares of which 80% is found in the Mediterranean region of West Asia and North Africa (WANA) (Nachit, 1992). The importance of durum wheat is attributed to multiple usage for human consumption in bread-making, macaroni industry, and it is high in protein and gluten contents (Rachon *et al*., 2002). In Egypt durum wheat growing areas are concentrated in Middle and Upper Egypt and used in bread and macaroni industry. Since that time many durum wheat cultivars have been identified (Bani Swif 1, Bani Swif 3, Bani Swif 4, Bani Swif 5, Bani Swif 6 and Sougage 3).

By 2020, wheat production must increase 40% to meet the global demand - mainly through elevating yield. "Increasing the intensity of production in those ecosystems that lend themselves to sustainable intensification, while decreasing intensity of production in the more fragile ecosystems" may be the only way for agricultural to keep pace with population (Borlaug and Dowswell, 1997). Hence, future crop improvement has to emphasize grain yield potential (GYP), yield stability, and user preference in concerted interdisciplinary approaches. Issues of environmental sustainability must be an integral part of the research agenda (Pfeiffer *et al*., 2000).

The need to accelerate genetic progress in the yield potential of crops is widely acknowledged (Royal Society, 2009; Philips, 2010), Breeding for high yield potential is very important for many reasons, among them are: 1) increased demand for food; 2) the multiple challenges associated with climate change; 3) declining crop productivity due to attrition of natural resources (Matthew *et al*., 2011). Cox *et al.* (1988) found that 0.6% annual gain in hard red wheat yield in highly productive environments as compared with only 0.4% in stress environments between 1919 and 1987. To achieve environmental sustainability, durum wheat breeding at ICARDA aims to protect high genetic yield potential. ICARDA, Agricultural Research Center (ARC), Wheat Improvement Program (ICARC-WIP) is a joint project between ICARDA and ARC in Egypt conducted at Sids station. Sids station is specific for high yield potential, and the project aimed to 1) breeding for high yield potential, 2) breeding for rust resistant, and 3) capacity building. The ICARC-WIP project supplies CWANA region with different materials..

II – Material and methods

Eight durum wheat experiments including 192 genotypes derived from ICARDA material and acquired by ICARC-WIP were planted in the advanced durum yield trial (ADYT) as augmented design in growing season 2010-2011 at Sids Station 23m asl South of Cairo. Nineteen durum wheat lines were selected from ADYT based on grain yield, rusts reaction (yellow, leaf and steam rust) and resistant to lodging. The selected lines in addition to five checks were planted as elite durum yield trail (EDWT) designed by alpha lattice with three replication in growing season 2011-2012 across six environments representing North, Middle and Upper Egypt. Four promising durum wheat lines were selected from EDYT based on multi locations testing, rust resistant and lodging resistant. These lines are now under evaluation at the national wheat program in the growing season 2012-2013. Table (1) shows the name and pedigree of the EDYT genotypes. Regarding the planting method, it was on flat terrain and all recommendation package were applied for each location.

III Results

Fig. 1. shows variation between durum wheat genotypes under study for grain yield affected by multi location testing across five environments representing North, Middle and Upper Egypt. The highest values observed by genotypes 5, 6, 7 (local check), 14, 19, 21 and 24 which gave 10439.69, 10422.68, 10969.27, 10805.61, 10706.1, 10433.26, 10666.92 kg/ha yield respectively, but some of them were susceptible to rusts.

Regarding yield components Fig. 2, 3 and 4 show the mean values of number of spikes/m^2, number of kernels/spike, and 1000-kernel weight respectively.

Table 1. Name and pedigree for 24 durum wheat genotypes under study.

Sn.	Name/pedigree
1	MORL-F38//Bcrch1/Kund1149/3/Bicrederaa1/Miki
2	Omrabi-5 (check)
3	Azeghar-2/4/Stj3/3/Gdfl/T.dicds-SY20013//Bcr
4	ICAMOR-TA04-61/Mrb3
5	Magh72/Rufo//Alg86/Ru/3/Altar 84/Ald/4/../5/Msbl-1/Quarmal
6	Quarmal/Gbch-2//Terbol97-4
7	Bani Swif-5 (check)
8	Marsyr-3//Mrf-2/T.Dids SY 20123
9	Ouasloukos-1/5/Azn1/4/BEZAIZ-SHF//SD-19539/Waha/3/Gdr
10	CM829/Cando cross-H25
11	Korifla (check)
12	CM829/Cando cross-H25
13	Ouasloukos-1/5/Azn1/4/BEZAIZ-SHF//SD-19539/Waha/3/Gdr
14	Mrf1/Stj2//Gdr2/Mgnl1
15	Marsyr-3//Lgt3/Bcrch1
16	Waha (check)
17	Geromtel-1/Icasyr-1
18	Mrf1/Stj2/3/1718/BT24//Karim
19	ICAMOR-TA04-68/6/21563/AA//Fg/3/D68-10-2A-2A-1A/4/Vitron/5/Bcr
20	Miki-2 (check)
21	ICAMOR-TA04-73/Ammar-8
22	Bushen-4/2*Green-18//Miki-1/3/Icasyr-1//Saadi 1989/Chan
23	Geromtel-1/Icasyr-1
24	Atlast1/961081//Icasyr-1

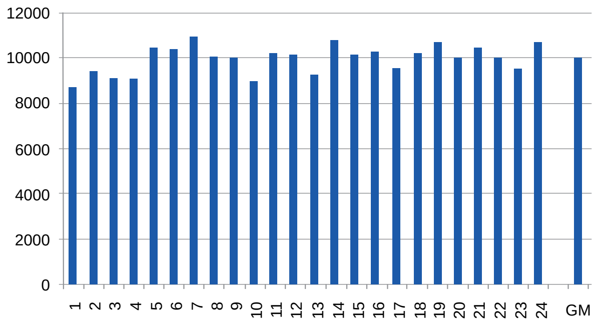

Figure 1. Grain yield performance (kg/ha) over all Egypt compared to checks and grand mean.

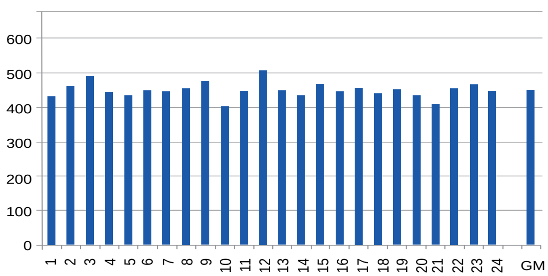

Figure 2. No. of spikes /m^2 for each genotype at Sids station.

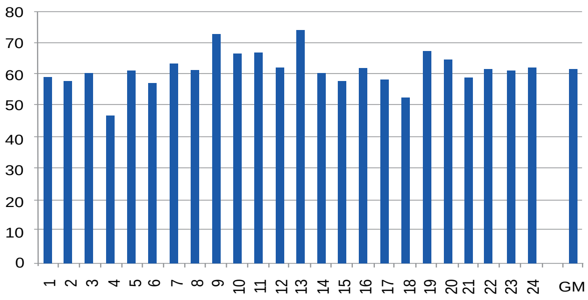

Figure 3. No. of kernels/spike for each genotype at Sids station.

The genotypes 3, 9 and 12 had the highest values for number of spikes/m² (488, 477 and 510 respectively); the highest values of kernels /spike were 58, 61, 67, 67, 74, 67 and 65 observed in genotypes 7, 9, 10, 11, 13, 19 and 20 respectively; genotypes 2, 3, 5, 12, 17, 18, 22 and 24 had the highest values for 1000-kernel weight with 53.4, 56.9, 52.2, 52.5, 52.7, 58, 52.5 and 56.9 gms respectively.

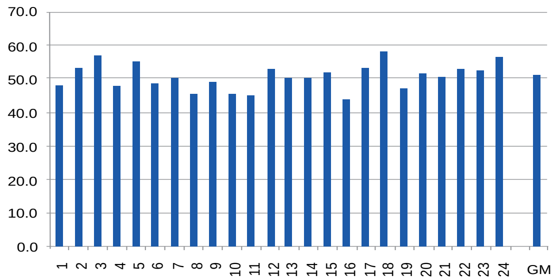

Figure 4. 1000-kernel weight for each genotype at Sids Station.

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