



Improvement of Omani local Bread Wheat (*Triticum aestivum* L.) Cultivars through Breeding

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Abstract

This project on improvement of Omani local cultivars of bread wheat through breeding was implemented at Agriculture Research Station, Jimah, Oman between 2002 and 2003. Twelve crosses were effected involving three Omani wheat cultivars (Cooley, Missani and Sarriya) as female and four exotic wheat cultivars (WOS 110, WOS 125, WOS 225 and WOS 300) as male. The seeds of F₁ generation were grown in winter season of 2002/2003 to get enough F₂ seeds were obtained from these crosses. The seeds of F₂ generation were grown during winter season 2002/2003. The selection of F₂ plants was based on plant height (short, medium and tall plants), number of tillers per plant (equal or higher than 7 tillers), date of heading and maturity (early, medium and late), disease and insect's resistance and other relevant agronomic characters. Pedigree method of breeding was applied. Higher selection intensity (0.05) was applied and the selection was done on a single plant basis in F₃ populations.

Thirty-two lines were tested along with three standard local check cultivars in a RCB design with three replications in two locations. The results of this trial showed significant differences among the families/lines. Ten promising lines were selected for indicated characters under study.

These ten lines were tested under farm trials in three governorates, from which lines belonging to the crosses Cooley x WOS 300, Cooley x WOS 125, Sarriya x WOS 300 and Sarriya x WOS 125 with popular names respectively as Niwa, Alrean, Najd and Bahla, were selected for high yield with at least 15% superiority, early maturity (at least 110 days) and bread making quality. The percentage superiority of these four hybrid cultivars of bread wheat (Sarriya x WOS 225, Sarriya x WOS 300, Cooley x WOS 125 and Cooley x WOS 300) were 54%, 37%, 34% and 28% respectively over their parents for grain yield.

Wheat cultivation

Bread wheat (*Triticum aestivum* L.) is the world's leading cereal grain crop and is considered as the third largest crop in the world after corn and rice

- More than half the world populations rely on it
- Wheat crop is harvested somewhere in the world during every month of the year
- It's a leading as source of vegetable protein in food.

Currently wheat production of the world in 2012-2013 was 753 million tons and the area is 218 million hectares.

Wheat cultivation in the world



World wheat production in 2012-2013

The Omani farmers take care of wheat crop since the ancient times because of the economic importance and for human consumption.

Omanis use flour produced by local varieties in the manufacture of local bread (Tortilla or Al-Rakal bread) because the quality of taste due to high proportions of gluten.

It is very good for pastries and other baked goods and for preparation of many Omani sweets.

The left over flour and bran can be used as a concentrated feed for animals as well as the stubble.

Most of wheat varieties cultivated in Oman belong to the spring wheat varieties according to the growth habit. These varieties are divided into groups as follows:

Local Wheat Varieties:



Improved Wheat Varieties

During the last four decades fifteen varieties of the bread wheat varieties were introduced from ICARDA and The International Center for wheat and maize (CIMMYT). These varieties were tested for several years under severe selection intensity.



The area of wheat (ha) and production (ton) during the



Strategic Research Project (Long Term Research)- Improving and breeding bread wheat (*Triticum aestivum* L.)

Objectives:

To breed and improve the local Omani varieties of bread wheat for high yielding, and other related characters

Locations:

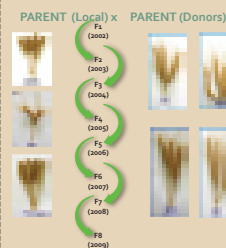
- Jimah Research Station in AlDakhliyah, Oman
- Alkamal Research Station in AlSharqiyah, Oman
- Farmer Fields

Three local varieties as female:

- Cooley, Sarriya and Missani (Female)

Four exotic cultivars as male:

- WOS 110, WOS 125, WOS 225 and WOS 300 (Male)



Selection Criteria

Grain yield (t/ha)

- High (> 4 t/ha)
- Medium (2-3 t/ha)

Plant height (cm)

- Short, Medium, Long

Tillers per plant

< 7

Days to heading and maturity

- Early, Medium, Late

Diseases and Insects

Others like (Protein, Fiber, Ash, etc.)

F₁ Seeds of first generation obtained for 12 twelve crosses in 2001

The seeds of F₁ generation were grown under wide spacing (25 cm x 25cm) in winter season of 2001-2002 to get enough F₂ seeds from each cross. 4500 to 2800 F₂ seeds were obtained from these crosses. The seeds of F₂ segregating generation were grown also under wide spacing (25 cm x 25 cm) in winter season of 2002-2003 to select desirable plants and harvested separately for planting in rows as families in further generation. The target F₄ families. The program was continued until the identification of 36 outstanding high yielding lines over 12 crosses. In winter season 2007-2008 these lines were grown a long with 3 standard local check varieties in RCB design with 3 replications at a agro climatic zone stations. The results of the trials at both the locations showed significant difference among the families/lines.

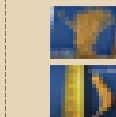
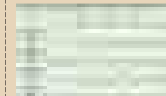
10 promising lines were selected for high yielding, early maturity, lodging, disease resistance and baking quality based on multilocation performance.



Modified Bulk Method used for this program



Bread Wheat Hybrids selected and named



Parents:

Cooley x WOS 125 F

Vegetative Period:

Days to heading: 90-95 (medium)

Days to Maturity: 100-100 days

Phenotypic traits:

Plant height: 100-100 cm

Lodging: Resist

Color of spike at maturity: Straw

Shape of spike: Erect

Axils: without

Shattering: Resist

Diseases Resistance: Resist

Characters of Kernel:

Kernel volume: Medium

Color of kernel: Amber

Shape of kernel: long

Weight of 1000 kernel: 30-30gm

Grain yield: 3.0-4.0 (first according to governorate)

Protein Content: 10-10%

Ability to make bread: 70-75

Adaptation: Adapted to Al-Sharqiyah Interior and Dharia governorate

Parents:

Cooley x WOS 300 F

Vegetative Period:

Days to heading: 90-95 (medium)

Days to Maturity: 100-100 days

Phenotypic traits:

Plant height: 100-100 cm

Lodging: Resist

Color of spike at maturity: Straw

Shape of spike: Erect

Axils: without

Shattering: Resist

Diseases Resistance: Resist

Characters of Kernel:

Kernel volume: Medium

Color of kernel: Amber

Shape of kernel: long

Weight of 1000 kernel: 30-30gm

Grain yield: 3.0-4.0 (first according to governorate)

Protein Content: 10-10%

Ability to make bread: 70-75

Adaptation: Adapted to Al-Sharqiyah Interior and Dharia governorate

Parents:

Cooley x WOS 225 F

Vegetative Period:

Days to heading: 90-95 (medium)

Days to Maturity: 100-100 days

Phenotypic traits:

Plant height: 100-100 cm

Lodging: Resist

Color of spike at maturity: Straw

Shape of spike: Erect

Axils: without

Shattering: Resist

Diseases Resistance: Resist

Characters of Kernel:

Kernel volume: Medium

Color of kernel: Amber

Shape of kernel: long

Weight of 1000 kernel: 30-30gm

Grain yield: 3.0-4.0 (first according to governorate)

Protein Content: 10-10%

Ability to make bread: 70-75

Adaptation: Adapted to Al-Sharqiyah Interior and Dharia governorate

Concluding remarks

This research project focused on developing the Omani local varieties of bread wheat with high yield potential and early maturity (less than 100 days) as compared to parents and good bread quality. This research project showed a great example of collaboration between the research departments and the key role was the teamwork effort. From this program four hybrid wheat varieties have been developed. These varieties are: Sarriya x WOS 125 (Bahla), Sarriya x WOS 300 (Najd), Cooley x WOS 125 (abrean), Cooley x WOS 300 (Niwa). These varieties are now under advanced and intensive seed multiplication. This research project will continue to use finger printing (PCR) or DNA marker for characterization of four hybrid varieties of bread wheat and documentation which is in line with intellectual properties.