

Morocco and the Wheat Initiative

CEREAL SECTOR IN MOROCCO - DR. M. FERRAHI & DR. F. BEKKAOUI, APRIL 2020

The importance of the cereal sector in Morocco is clearly demonstrated by its contribution to agricultural GDP (over 20%), the extent of its land use (over 5 million ha, 75% of arable land), its contribution to meeting the needs of the population and livestock and its socio-economic weight (offers 40% of work labor). On average common wheat is cultivated on approximately 2 million hectares whereas durum wheat, which used to be the traditional crop of the country, is roughly cultivated in 0.9 to 1 million hectares and barely occupies more than 2 million hectares. The irrigated area is around 2% of the total surface (the total irrigated area in Morocco is around 0.85 million hectares). Yields depend on the cropping season and are around 2t/ha in rainfed areas and 4t/ha in irrigated areas.

Despite this importance, Morocco, like other importing countries, is subject to food security risks resulting from its heavy dependence on cereal imports. The volume of imports continues to increase despite important domestic production in recent years. Drought is the most important abiotic stress for rainfed agriculture, affecting agricultural production and limiting the expression of yield potential and stability. In the Mediterranean region, drought is manifested by increasingly long and frequent periods with great intra- and inter-annual variability in rainfall and temperature regimes.

In Morocco, the projected trend of decreasing rainfall and increasing temperatures is likely to jeopardize the country's food security. Yield is generally the main selection criterion for drought tolerance, as it automatically incorporates all known and unknown contributing factors. However, the complexity of the drought phenomenon (timing, intensity and duration), the complexity of plant response mechanisms, the size of the wheat genome and the genotype x environment interaction make it difficult to efficiently select the best genotypes. For biotic stresses, Hessian fly, yellow and leaf rusts and Septoria are common diseases that affect yield each year.

OBJECTIVES OF WHEAT IMPROVEMENT AT INRA MOROCCO (NATIONAL INSTITUTE FOR AGRICULTURAL RESEARCH)

INRA has, for a long time, put emphasis in productivity improvement and grain value enhancement covering the following approaches:

- Plant breeding, biotechnology and genetic resources conservation;
- Improvement of management techniques;
- Phytosanitary protection and methods of controlling diseases and pests;
- Enhancement of production and quality improvement;
- Socio-economics studies;
- Technology transfer.

Image 04: Seed increase of new INRA varieties, ©Dr Ferrahi Moha, 2019



RELEASED VARIETIES BY INRA MOROCCO

Since 1980, INRA has provided the cereal industry with 111 varieties targeting different agro-ecological zones and meeting the requirements of quality, resistance to diseases and insects, and high productivity. This comprises 34 durum wheat varieties including nine new released varieties: five varieties that are Hessian fly resistant and drought tolerant, two varieties combining resistance to Hessian fly and leaf rust and two productive varieties with good end use quality. For common wheat, INRA has released 30 varieties including three new varieties resistant to Hessian fly, yellow rust and Septoria and with good grain quality.

Varieties are classified according to their first choice adaptation: highly adapted, adapted, fairly adapted according to the agro-climatic zone (favourable, intermediate and unfavourable environments). As mentioned before, a great effort has been made by INRA in recent years to release new varieties. The progress made includes yield potential (at least 10% higher than controls), wide adaptation, improved resistance to diseases (Hessian fly, Septoria and rust) and good grain quality.

Unfortunately, a large number of varieties have been developed but are not available yet on the market. As a result, 55% of farmers are using varieties that are more than 20 years old. The most cultivated 10 varieties in the country occupy around 92% of the total area and are at least 16 years old. Yet the transfer of genetic potential to Moroccan farmers is delayed and these varieties can be found at farmer's level only after several years, perhaps once the resistance is broken or the yield potential is no longer important.

The efficiency of the breeding programmes is supported through the use of marker assisted selection (MAS) by developing a large number of molecular markers of interest. Examples include, Septoria, 18 markers associated with the Stb resistance genes and a new marker linked to the Stb2 gene have been identified. For leaf rust, the genes were classified according to resistance in the seedling stage: Lr19/Sr25, Lr21, Sr39, Sr4 and resistance in the adult stage: Lr34/Yr18/Pm38, Lr46/Yr29, Lr67/Yr46, Lr68 and Lr72. Finally, in order to develop genetic material with good quality, the team is working on the identification and validation of molecular markers associated with quality parameters. In addition to the creation of new

varieties, progress has been made in technical management and agronomy including adequate fertilization and the chemical control of weeds and diseases.

INRA MOROCCO FUTURE RESEARCH AGENDA

In Morocco, mitigation of climate change effects can be achieved through several approaches such as selection for good yield potential and stability, followed by strengthening drought resistance/tolerance. Varieties developed in this way should combine resistance to major diseases including Hessian fly, rust (especially yellow rust), and Septoria. In terms of technical management, carbon sequestration must be improved through measures such as conservation agriculture and breeding programs should give more importance to prebreeding activities using interspecific crosses for resistance to biotic and abiotic stresses with the use of relative species. Finally, we recommend that farmers should obtain access to new national varieties as soon as possible (maximum 3-4 years after registration). INRA should propose 2 to 3 adapted varieties for each agroclimatic zone (variety map) and encourage a large-scale multiplication of these varieties per production basin (irrigated, rainfed and mountain) and the identification of production basins to secure an adequate production volume with common wheat varieties for industrial processing, which is currently lacking.

PARTNERSHIPS

INRA Morocco scientists have developed partnerships with several scientists in different CGIAR research centers such as ICARDA and CIMMYT. In addition, INRA has close relations with scientists in national and international universities in countries like France, Italy and USA.

WHEAT HUMAN RESOURCES AT INRA MOROCCO

Approximately 60 researchers are involved in wheat research at INRA.