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Wheat commercial cultivars deployment strategy as a tool to efficiently manage prevalent diseases notably rusts in Morocco

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ABSTRACT

Wheat, a major Moroccan staple food crop is largely prone to foliar diseases notably Yellow rust, Leaf rust and Septoria Leaf Blotch (SLB). Moreover, Stem rust is becoming an imminent threat to wheat production, unlikely because of the emergence of new virulent races.

The objective of this study was to assess the level of resistance to major diseases of bread and durum wheats across different agro-ecological areas of Morocco during 2020-2021 season, in order to wisely deploy the available commercial cultivars and hence to avoid a rapid breakdown of resistance to prevalent diseases.

A total of 28 and 21 commercial cultivars of bread wheat and durum wheat respectively have been tested at INRA experimental stations (AllalTazi, Annoceur, Douyet and CRRA Meknès) during 2020-2021 season.

The most prevalent diseases on bread wheat were SLB, Yellow rust and Stem rust. Allal tazi, CRRA Meknès and, Annoceur and Douyet were ideal environments or hot spots for SLB, Stem rust and Yellow rust screening, respectively.

Bread Wheat cultivars that might be recommended for SLB disease prone areas are Blini, Bandera, Guadalete, Kharouba, Radia, Granota, Zenzibar and Wafia.

Those that exhibited a very good level of resistance to yellow rust across the three locations (Douyet, Annoceur, and CRRA Meknès) and that might be recommended for yellow rust disease prone areas are Mahdia, Fadila, Faiza, Najia, Kharouba, Bandera and Wafia.

The most promising bread wheat cultivars with regards to the resistance to stem rust are Fadila (CI = 5), Mahdia (CI = 10), and Wafia, Tilila, Amal and Aguilal (CI = 30). These six cultivars might be recommended for stem rust prone areas.

It is to remind that Fadila and Mahdia are the best cultivars with regard to their resistance to both stem and yellow rusts, but are not recommended for SLB prone areas, whilst Wafia was the only cultivar that exhibited at the same time a very good level of resistance to SLB and to both yellow and Stem rusts. That is, no single cultivar could be recommended for all environments except Wafia.

Durum wheat exhibited a good level of resistance to SLB and Leaf rust at Allal Tazi and to Yellow rust at Douyet. In contrast Irden and Marouan were highly susceptible to Yellow rust at Annoceur.

The fact that almost all commercial bread wheat cultivars are susceptible to highly so to stem rust paves the way for an urgent implementation of a breeding strategy to breed for resistance to stem rust using for instance Wafia, Fadila and Mahdia as donors of resistance.

Moreover and in order to ensure a long lasting wheat diseases management strategy, cultivars deployment should be implemented at country level but also at regional and global levels. It is then wise to Target Population of Environments (TPE) with regards to the occurrence and severity of diseases notably rusts that are wind born, to wisely deploy wheat mega varieties according to global wind direction.

Keywords : Morocco, Wheat, Septoria Leaf Blotch, Rusts, Cultivars deployment

INTRODUCTION & OBJECTIVE

Wheat undergoes many biotic constraints. In Morocco for instance, Yellow rust, Septoria leaf blotch, Stem rust, Leaf rust, and Root rot are the most damaging diseases. The same trend was reported by Ramdani and Ibriz (2000) and Ramdani et al. (2004) except for Stem rust and Yellow rust. The latter became more and more prevalent and severe across almost all cereal growing areas according to Ramdani (2009, 2012) and Ramdani et al. (2011a, 2011b, 2011c, 2014a, 2014b). So, Yellow rust that occurred endemically in some areas neighboring mountains such as SAIS, TADLA and TASSAOUT, becomes a real threat for wheat production in Morocco. Stem rust that used to be of no importance is becoming more and more prevalent across Morocco. Such shift in prevalence and severity of yellow rust and Stem rust is presumably because of changes in virulence patterns and hence lost effectiveness of *Yr* and *Sr* genes and/or because of climate changes that become more suitable for yellow and Stem rusts epidemic. The shift in Yellow rust status was confirmed by Ramdani et al. (2018).

Pyramiding multiple diseases and multiple genes resistance in wheat cultivars is the best strategy. However, pyramiding is a tedious, time consuming and a long run and/or an ongoing process. Moreover, each pathogen may have different races in different regions. Besides and despite the fact that there is genetic variation in response to most diseases (McIntosh, 1998), resources available to national programs limit the number of diseases that can be included as breeding objectives. So, patho-breeders should focus on the most damaging pathogens, and extension agents should wisely deploy the available cultivars.

The objective of this study was to assess the level of resistance to the main prevalent diseases of both bread and durum wheat cultivars across many INRA experimental stations representing different agro-ecological areas during 2020-2021 season, in order to wisely deploy the available commercial cultivars and hence avoid a rapid breakdown of resistance to prevalent diseases in Morocco.

MATERIALS & METHODS

Plant material: 28 and 21 of commercial cultivars of bread wheat and durum wheat respectively

Locations: Meknès, Douyet, Annoceur, Allal Tazi, Afourar and Marchouch (see map)

Planting date: On appropriate time (towards the end of November) except at CRRA Meknes where three sowing dates (appropriate (November 17th, 2020), a bit late (February 2nd, 2021) and a very late one (April, 5th, 2021)) were done. At the latter site, frequent mist irrigation was performed to boost the development of diseases. The infection was natural

Plot: Elementary plot was 4 x 1.2 m with six rows spaced by 20 cm ; Scoring periode : At Grain Fill

Scale : For rusts : modified Cobb scale coupled with reaction types to determine the coefficients of infection (CI) (Roelfs et al. (1992).

For Septoria: The SAARI and PRESCOTT double digit scale was used to score the severity of this disease. Moreover, pycnidial density was scored on a basis of 1 to 5 scale where 5 means a high density of pycnidia of *Zymoseptoria tritici*.



RESULTS and DISCUSSIONS

The most prevalent diseases on bread wheat were Septoria Leaf Blotch (SLB), Yellow rust and Stem rust. Allal tazi, CRRA Meknès and, Annoceur and Douyet were ideal environments or hot spots for SLB, Stem rust and Yellow rust screening, respectively (Figure 1)

Bread Wheat cultivars that might be recommended for SLB disease prone areas are Blini, Bandera, Guadalete, Kharouba, Radia, Granota, Zenzibar and Wafia. Those that exhibited a very good level of resistance to yellow rust across the three locations (Douyet, Annoceur, and CRRA Meknès) and that might be recommended for yellow rust disease prone areas are Mahdia, Fadila, Faiza, Najia, Kharouba, Bandera and Wafia.

The most promising cultivars with regards to the resistance to stem rust are Fadila (CI = 5), Mahdia (CI = 10), and Wafia, Tilila, Amal and Aguilal (CI = 30). These six cultivars might be recommended for stem rust prone areas. Fadila and Mahdia are resistant to both stem and yellow rusts, but are not recommended for SLB prone areas, whilst Wafia was the only cultivar that exhibited at the same time a very good level of resistance to SLB and to both yellow and Stem rusts (Table 1). That is, no single cultivar could be recommended for all environments except Wafia.

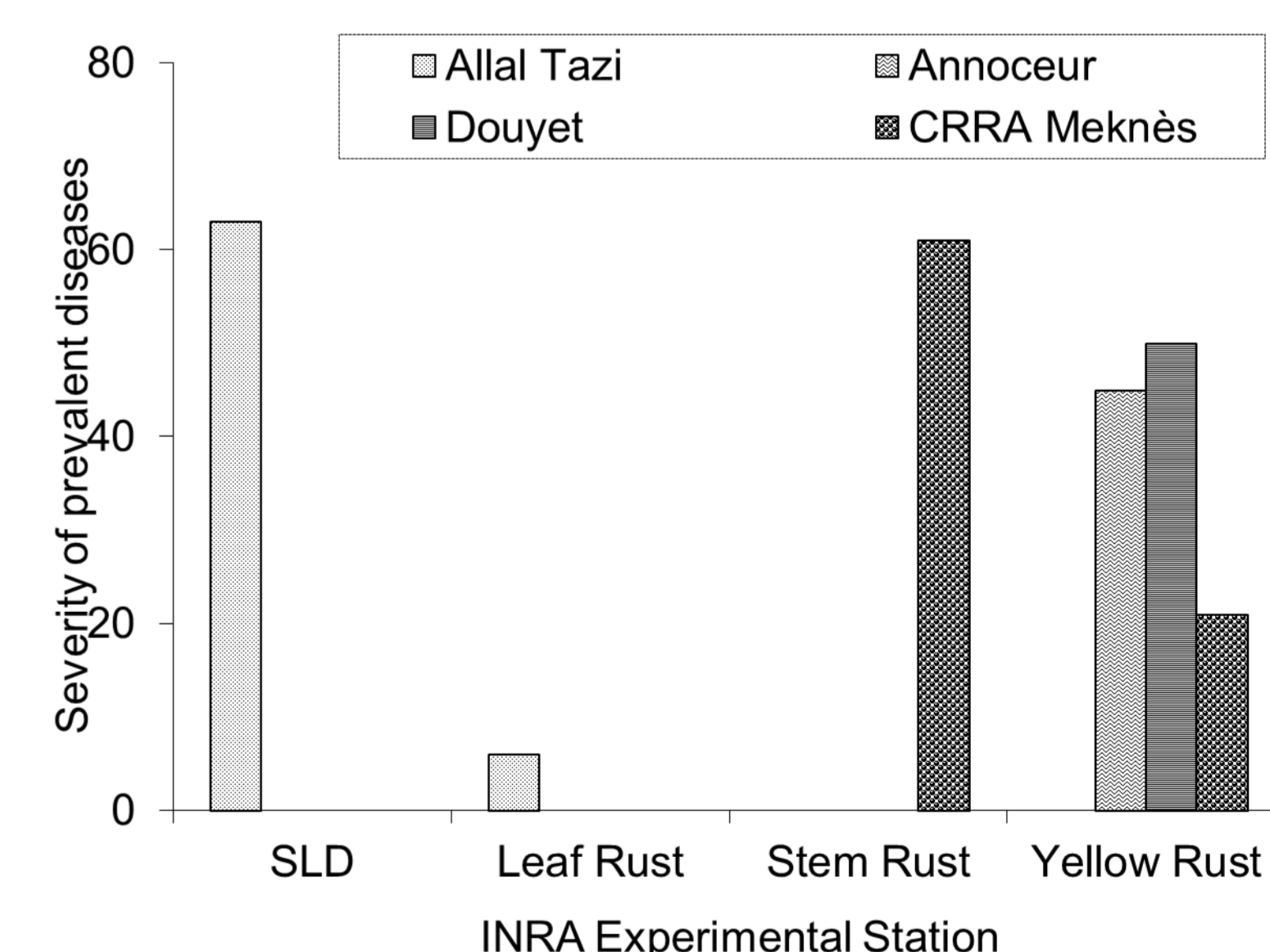


Figure 1: Average severity of prevalent diseases on Bread wheat at different INRA Experimental stations during 2020-2021 season

CONCLUSION

In order to ensure a long lasting wheat diseases management strategy, cultivars deployment should be implemented at country level but also at regional and global levels. It is then wise to Target Population of Environments (TPE) with regards to the occurrence and severity of diseases notably rusts that are wind born, to wisely deploy wheat mega varieties according to global wind direction.

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Table 1: Bread wheat cultivars that exhibited simultaneously a good level of resistance to at least two diseases

Disease	Bread wheat cultivar				
	Mahdia	Fadila	Kharouba	Bandera	Wafia
Yellow Rust	Ok	Ok	Ok	Ok	Ok
Stem Rust	Ok	Ok	---	---	Ok
Septoria LB	---	---	Ok	Ok	Ok