

## Diversification of germplasm and genetic enhancement of barley for biotic and abiotic stress and malting quality for different agro-ecologies

Section B: Segregating populations developed and shared for evaluation at ICARDA India Platform.

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16 February 2021



### ***Introduction***

Barley is a main staple crop and large areas in the world are devoted to the crop. In India, barley is an important crop cultivated since ancient times. The major barley growing states in India are Rajasthan, Uttar Pradesh, Haryana, Punjab, Madhya Pradesh, Uttarakhand, Himachal Pradesh, Bihar, Jammu and Kashmir, West Bengal, Chhatisgarh and Sikkim. However, its area decreased in the country throughout the 20<sup>th</sup> century, mainly due to competition against wheat. As a result, barley is generally confined to marginal, problematic soils as a rainfed crop. The main usages of barley in the country are feed for livestock (ca. 65%), malt (20-30%) and food (less than 10%). An increased interest in barley is apparent in the country since the 90s. The use of malt barley as a cash crop coupled with the increased number of breweries in the country, the high frequency of drought events that can make barley more suitable as feed than other crops (i.e. sugar cane or oats) in drought prone environments and its nutritional quality as food have increased the interest over barley. However, to fulfil the needs, new germplasm with superior productivity, yield stability, disease resistant and fit for purpose needs to be developed.

ICARDA has a long-lasting collaboration with the ICAR, IIWBR and other Indian research institutions that has resulted in a number of varieties released coming from ICARDA nurseries or having ICARDA germplasm as parental material. The interest of the NARS in ICARDA germplasm relies in its high productivity, diversity and resistance to biotic and abiotic stresses. In order to deliver fit-for-purpose varieties to the NARS that will ultimately reach the farmers, the Global Barley Breeding Program of ICARDA uses a multi-location approach to identify the best varieties combining the desired traits. Thus, combining the information from stress hot-spots in Morocco, Tunisia, Lebanon, India and Turkey among others, ICARDA is capable of selecting elite germplasm combining several traits of interest and with yield stability and specific adaptation. In the present report we show results of the efforts made in 2020 in India to provide the NARS with disease resistant high grain and straw yield genotypes as well as new diversity for Indian barley germplasm.

### ***Diversify germplasm by using ICARDA lines for hybridization***

As part of the research collaboration between ICARDA and India, crosses between ICARDA and Indian barley genotypes have been made to increase the diversity and performance of Indian cultivars. In 2020, 26 new advanced lines issued from crosses with Indian varieties were tested across locations in India and Morocco. As a result, 2 of these new genotypes were identified as high yielding in Amlaha, suggesting that the increase diversity can provide highly performant and adapted genotypes for the benefit of Indian farmers (Figure 7).

However, in addition to the benefit for Indian farmers, the introduction of Indian genetic background in the new ICARDA elite genotypes showed also good level of adaptation to the Moroccan conditions. Thus, two elite lines issued from crosses between ICARDA and Indian germplasm were among the best yielding lines in the low input environment of Marchouch (Morocco; Figure 8) This common benefit for Indian and worldwide farmers is a great success of the present project.

In addition, more than 83 new genotypes issued from crosses with Indian varieties were selected into Advanced yield trial and will be tested in India and across locations in Morocco and Lebanon 2021. To continue with the important **70 new crosses** with Indian varieties were done in 2020 and will enter the ICARDA breeding pipeline.

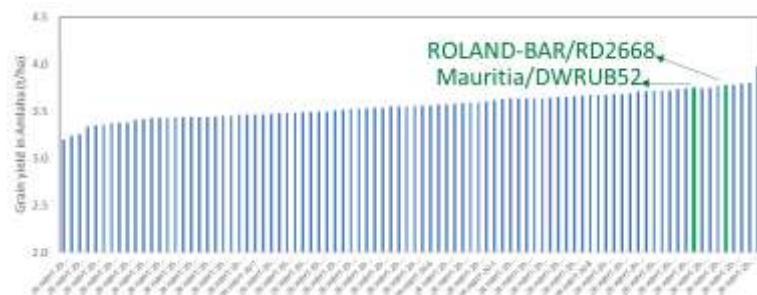


Figure 1 Performance of ICARDA elite barley genotypes in Amlaha (India) in the 2019/20 season). In green are highlighted the genotypes with Indian background.

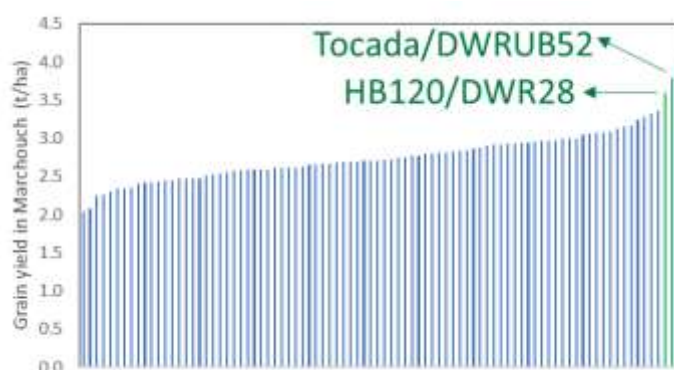


Figure 2 Performance of ICARDA elite barley genotypes in Marchouch (Morocco) in the 2019/20 season. In green are highlighted the genotypes with Indian background.

### **Acknowledgements**

Sincere acknowledgements are expressed to ICAR for supporting this research on barley at ICARDA. The activities reported were designed under the supervision of former ICARDA barley breeder Dr. R.P.S. Verma. The continuous support of Dr A. Sarker (ICARDA country coordinator in India) and Dr Swain (head of the ICARDA Amlaha Research Platform) is highly appreciated. The collaboration and support from researchers and colleagues at IIWBR Karnal, RARI Durgapura, NDUA&T Faizabad and BHU Varanasi is greatly appreciated. Finally, the barley team at ICARDA (especially Dr. A Visioni, Mr. Sunil Kumar, Mr. Rachid Bouamar, Mr Raafat Azzo and Mr. Boukri Mohamad) is acknowledged.