

Wheat Mexican Landraces and *Triticum spelta*: Novel Germplasm with High Levels of Zinc and Iron in the Grain

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INTRODUCTION

Wild relatives of wheat and landraces have been identified as some of the best sources of germplasm with high levels of Zn and Fe in the grain (Cakmak et al. 2000, Monasterio and Graham 2000). In a conventional wheat breeding program, one of the main advantages of using hexaploid germplasm such as *Triticum spelta* L. and *T. aestivum* L. is the high compatibility when crossing with modern hexaploid varieties. In addition, using landraces of *T. aestivum* L. that have been domesticated offers generally good agronomic types. Wheat from Mexico, which was originally introduced by the Spanish and was selected for adaptation to a wide range of ecosystems in Mexico, offers an interesting source of germplasm to explore for micronutrient concentrations. The objective of this work was to screen a collection of Mexican landraces (*T. aestivum* L.) and *T. spelta* L. for micronutrient contents and concentrations in the grain.

METHODS

A replicated field experiment with Mexican landraces was conducted during the wheat crop cycle 2004-2005 at the CIMMYT research station in the Yaqui Valley near Ciudad Obregon, Sonora, Mexico. In a set of non-replicated experiments in the greenhouse (2003 and 2004), in the field at the CIMMYT research station in El Batan (2005), and in the field in Yaqui Valley (2004-2005), a group of 28 *T. spelta* races were grown and screened for micronutrient concentrations in their grain. Laboratory analyses were done at the Waite Analytical Services in Adelaide Australia. Whole wheat grains were digested with nitric/perchloric acid and analysed using Inductively Coupled Plasma - Atomic Emission Spectrometry (ICP-AES). Laboratory analyses included the concentrations of Al and Ti, which were used as indicators of soil contamination particularly for Fe.

RESULTS AND DISCUSSION

The Mexican landraces, as a group from Northern states of Coahuila (4), Chihuahua (84), Durango (1) and from the central state of Michoacan (1) had the highest concentrations of Zn and Fe in the grain (Figure 1). When content was measured (ug/grain), these landraces were also ranked among the highest. Individually, a race from Hidalgo had the highest Zn levels, and seven of the top ten Zn-entries were from Chihuahua. The other two entries of the top ten for Zn were from Hidalgo and Coahuila. The top entry had 57.8 mg Zn kg⁻¹ and 2.14 ug Zn per grain, which represents a substantial increase when compared to the control Rayon F89 with 32.6 mg Zn kg⁻¹ and 1 ug Zn per grain.

For Fe concentrations, the top two entries were from Durango and the State of Mexico and were not significantly different from each other. Six of the top ten entries were from Chihuahua. The Fe concentration of the top two entries was 56 mg Fe kg⁻¹ and the content 1.7 ug per grain, which is significantly different from the control Rayon F89 with 31.3 mg kg⁻¹ and 0.96 ug per grain.

The correlation between Fe concentrations and contents was 0.72, while the correlation between Zn concentrations and contents was 0.73. The correlation between Fe and Zn concentrations was 0.88.

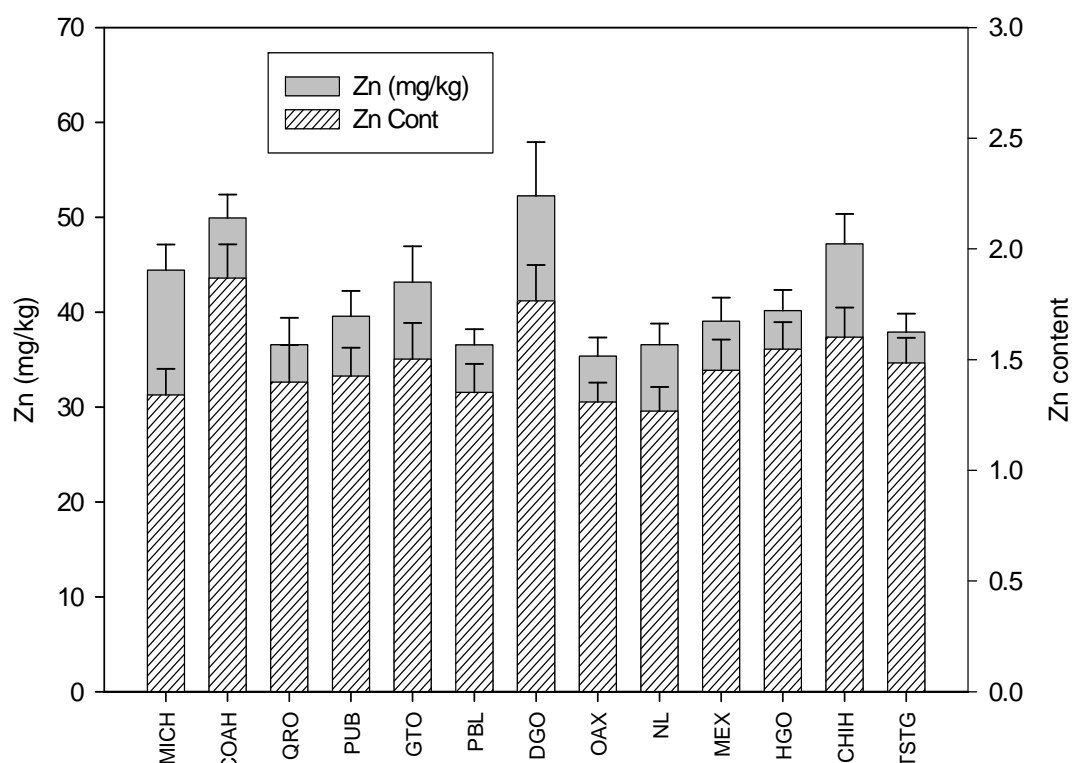


Fig. 1. Zinc concentrations (mg/kg) and contents (ug/grain) of Mexican landraces and controls (Testg).

Among *T. spelta*, there was one entry with an average of 60 mg Fe kg⁻¹ at four locations, while the average of all entries from all locations was 48 mg Fe kg⁻¹. There was one entry with an average of 80 mg Zn kg⁻¹ at three locations, while the average of all entries from the same three locations was 60 mg Zn kg⁻¹.

CONCLUSIONS

Some of the wheat Mexican landraces and *T. spelta* are promising sources of hexaploid wheat for the development of biofortified wheat varieties.

ACKNOWLEDGEMENTS

This research was funded by the Harvest Plus program.

REFERENCES

- Cakmak, I., Ozkan, H., Braun, H.J., Welch, R.M. and Romheld, V. (2000) Zinc and iron concentrations in seeds of wild, primitive, and modern wheats. *Food and Nutrition Bulletin* 21:401-403.
- Monasterio, J.I. and Graham, R.D. (2000) Breeding for trace minerals in wheat. *Food and Nutrition Bulletin* 21:393-396.