UNIVERSITY OF CALIFORNIA, DAVIS

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO

SANTA BARBARA • SANTA CRUZ

DEPARTMENT OF AGRONOMY AND RANGE SCIENCE
COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES
AGRICULTURAL EXPERIMENT STATION
(916) 752-1703
FAX: 752-4361

DAVIS, CALIFORNIA 95616-8515

DEPARTMENT OF ENERGY
Final Technical Report

DOE/ER/114037--T3

RECEIVED

JUL 27 1998

OSTI

~~DE-18~~
Grant No. FG03-89ER14037
Amount: \$542,639
Expiration Date: 6-30-95

Grant Title: Genetic Characterization of *Lophopyrum Elongatum* Salt Tolerance and
Associated Ion Regulation as Expressed in Bread Wheat

Lophopyrum elongatum is a highly salt-tolerant relative of wheat. Its salt tolerance is partially expressed in the amphiploid from a cross between wheat cv. Chinese Spring and *L. elongatum*. Genetic studies showed that the tolerance of gradually imposed salt stress is controlled by *L. elongatum* chromosomes 3E, 4E, 5E, and 7E and the tolerance of suddenly imposed salt stress by chromosomes 3E, 5E, 6E, and 7E. In wheat, rye, barley, and *Dasyphyrum*, chromosomes of the same homoeologous groups, 3, 5, 6, and 7, were found to control the tolerance of these stress regimes. To gain insight into the physiological mechanisms of salt tolerance by wheat and *L. elongatum*, accumulation of Na and K, 20 protein amino acids, glycinebetaine, aminobutyrate, all TCA cycle intermediates, oxalate, glycerol-3-P, glyceraldehyde-3-P, pyruvate, lactate, ornithine, taurine, glucose, sucrose and other sugars was examined in the amphiploid and Chinese Spring by gas chromatography and H-NMR. The greater Na exclusion from the most recently expanded leaf blades of the amphiploid than Chinese Spring was found to be paralleled by greater accumulation of glycinebetaine in the young leave blades of the amphiploid. The amphiploid accumulated more asparagine in all leaves than Chinese Spring. Old leaves accumulated proline instead of glycinebetaine. There were no differences between the young leaves of the two genotypes in the proline concentrations. The proline concentrations in the old leaves were greater in Chinese Spring than in the amphiploid. This strongly suggests that the accumulation of proline is not a primary mechanism of salt stress tolerance in either *L. elongatum* or in wheat while glycinebetaine and asparagine are strong candidates.

Publications:

Epstein, E. 1994. The anomaly of silicon in plant biology. Proc. Natl. Acad. Sci. 91:11-17.

Fan, T. W.-M, T. D. Colmer, A. N. Lane, and R. M. Higashi. 1993. Determination of metabolites by ¹H NMR and GC: Analysis of organic osmolytes in crude extracts. Anal. Biochem. 214:260-271.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

MASTER

pg. final

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

**Portions of this document may be illegible
electronic image products. Images are
produced from the best available original
document.**

Colmer, T.D., E. Epstein, and J. Dvorak. 1995. Differential solute regulation in leaf blades of various ages in salt-sensitive wheat and a salt-tolerant wheat x *Lophopyrum elongatum* (Host) A. Love amphiploid. *Plant Physiol.* 108:1715-1724.

Zhong, G.Y. and J. Dvorak. 1995. Chromosomal control of the tolerance of gradually and suddenly imposed salt stress in the *Lophopyrum elongatum* and wheat, *Triticum aestivum* L. genomes. *Theor. Appl. Genet.*, 90:229-236.

Zhong, G.Y. and J. Dvorak. 1995. Evidence for common genetic mechanisms controlling the tolerance of sudden salt stress in the tribe Triticeae. *Plant Breeding*, 114:297-302.

October 7, 1997