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Research to develop a rapid, convenient method
of screening potato breeding materials for drought tolerance.
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Background. Over the last several years, CSU personnel have established a strong research and development program using potato tissue culture propagation for seed stock certification and increase. The success of this effort indicates that there may be other useful applications of tissue culture technology. One possibility is the use of cultured microplant systems to screen potato clones for desirable characteristics. Field evaluation and comparison of the many materials (including wild species) available for variety improvement is difficult and expensive, especially for a trait like drought tolerance. The time and space savings of using microplants are very substantial. The problem is that techniques for treating microplants in vitro and evaluating their response in ways that relate to field performance need to be developed.

General Purpose. The purpose of the proposed work is to develop a tissue culture drought stress test that can be used to identify drought-tolerant breeding material. At present, information to guide selection for further testing is limited. Potato germplasm available for variety improvement is diverse and known to vary significantly in drought tolerance, but field screening has limitations.

Specific Objectives are to:

- (1) identify meaningful drought stress treatments for tissue culture media which can be precisely controlled and measured. We will try various osmotic agents, especially polyethylene glycols, in culture media to mimic field drought. Experiments will be conducted to determine the importance of osmoticum concentration (severity of stress), as well as stress timing and duration in evaluation of drought tolerance.
- (2) identify the microplant responses which best indicate differences in drought tolerance. Experiments will be conducted to compare growth and development (leaf area, dry weight, plant height, senescence, tuberization, etc.) as they are affected by drought stress in vitro. The measurement(s) which most consistently relate to performance under drought will be used in further tests.
- (3) begin screening potato breeding materials for drought tolerance. This phase of the work can probably not be conducted with the requested funds, but is the next logical step. It is essential that tissue culture-selected materials be evaluated under field drought conditions. The critical test will be whether the rapid, convenient screening method can accurately select drought tolerance for incorporation into the conventional breeding program.

Budget. We request \$3,000 to pay the hourly wage of a student research assistant. Supplies and the time of S.J. Wallner will be provided under AES Project No. 46.

Comments. The proposed work should be viewed as part of a long term effort. However, it would be very useful to know which of the many genotypes available should be evaluated under the specific and demanding conditions of the San Luis Valley. Also, we foresee the possibility of tissue culture screening for other traits (such as disease resistance, N efficiency, etc.) perhaps as part of an expanded overall program in potato biotechnology at CSU.