

PROJECT: 3717 (formerly 4323) - Final Report

TITLE: Photosynthesis, Partitioning, and Yield in Sweet Cherry

YEAR INITIATED 1985 **CURRENT YEAR** 1992 **TERMINATING**
YEAR 1991

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JUSTIFICATION:

The unique, early development of a crop in sweet cherries raises important and critical questions which need to be answered for proper crop management. Management practices effect development of the leaf area in the spring, photosynthetic capacity, utilization and storage of carbohydrates, flower bud formation, winter hardiness, and yield. Specifically, it is necessary to understand how sweet cherry trees accumulate and store carbohydrate reserves, then utilize those reserves together with current photosynthates, for fruit development and maturation. This is important for utilizing orchard management practices, e.g. pruning, deficit irrigation or root restriction, where carbohydrate réserves and current photosynthates must be available for early season fruit growth year after year.

OBJECTIVES:

The major objective has been to develop a full understanding of the carbon economy of sweet cherry trees. Additional objectives have been to determine the extent to which management practices, e.g. pruning and deficit irrigation, effect the partitioning of carbohydrates, photosynthesis, water relations, canopy development and productivity.

PROGRESS:

A summary of the results of this 6-year project involving orchard and greenhouse trees are:

1. Root storage carbohydrates are the major pool of reserves in sweet cherry trees and are utilized primarily for early bud and flower development.
2. Post-harvest management of sweet cherry trees is important for accumulation of root carbohydrate reserves, especially late-season photosynthesis during September and October.

3. Sweet cherry trees in which carbohydrate reserves have not accumulated have reduced winter hardiness and crop productivity the following year.
4. Sweet cherry trees are extremely resistant to water stress. Young leaves are able to continue to photosynthesize during water deficits which would otherwise be inhibitory for many plants. Older leaves may not be able to adjust to deficit conditions and may senesce, placing added demands on the requirement for late-season carbohydrate storage. The carbohydrate sorbitol may be a critical component in the ability of sweet cherry leaves to adjust to water deficits.
5. Sweet cherry fruit may have only limited ability to draw on photosynthates from distant leaves. This may have implications for bringing young trees into bearing and the effects pruning on flower bud and spur development.

Several seasons of deficit irrigation experiments have been performed both at IAREC Prosser and WSU Pullman. Samples from these experiments are still being analyzed. This work should be completed by the end of 1991. At that time a full report on the results and conclusions of those experiments will be prepared.

The following research publications detail the results of research performed under this project by Wayne Loescher, Curt Rom, and their graduate students:

- Roper, Teryl R. and Wayne H. Loescher. 1987. Relationships between leaf area per fruit and fruit quality in 'Bing' sweet cherry. *HortScience* 22(6):1273-1276.
- Roper, Teryl R., Wayne H. Loescher, John Keller and Curt R. Rom. 1987. Sources of photosynthate for fruit growth in 'Bing' sweet cherry. *J. Amer. Soc. Hort. Sci.* 112(5):800-812.
- Roper, Teryl R., John Keller, Wayne H. Loescher and Curt R. Rom. 1988. Photosynthesis and carbohydrate partitioning in sweet cherry: Fruiting effects. *Physiol. Plant.* 72:42-47.
- Keller, John D. and Wayne Loescher. 1989. Nonstructural carbohydrate partitioning in perennial parts of sweet cherry. *J. Amer. Soc. Hort. Sci.* 114(6):969-975.
- Wayne H. Loescher, Thaddeus McCamant and John D. Keller. 1990. Carbohydrate reserves, translocation, and storage in woody plant roots. *HortScience* 25(3):274-281.

PROPOSED RESEARCH:

Future research on the effects of orchard management practices, e.g. deficit irrigation, on sweet cherry productivity should be reserved for a new planting of sweet cherries, especially one which incorporates some of the promising dwarfing rootstocks.