

1. Progress Report of Research in Agricultural Engineering Related to Prunes - 1969

A. Mechanization and Physical Properties Research:

A computer program for tree shaking has been developed. It is based on a finite element technique and uses consistent mass matrix instead of lumped mass matrix. It also defines the local coordinate such that it is always parallel to the system coordinate. Some calculations from a steel model have shown very good agreement to the experimental results.

Since the present computer on this campus is not big enough to handle the real tree shaking problem, a few mathematical techniques have been used to solve this problem, but none of them has provided significant improvement. Finally, a physical approach has shown some potential to solve this problem. A truncated conical element is used instead of a constant circular element in the finite element technique. The conical shape more nearly represents the true structural element. Preliminary calculation has shown some good results.

Studies of physical properties as they relate to prunes have been initiated. From an engineering standpoint, a few preliminary tests have shown that the side cracking of prunes has close relation to the mechanical and thermal properties of prunes. A simple tension test to measure the elasticity of the skin of prunes has been made on Instron compression tester and the technique for measuring expansion, such as by using strain gage or pycnometer, is in progress. Plans are to study the effect of thermal expansion and the effect of mechanical expansion due to moisture transfer within the fruit.

B. Pesticide Application Involving Horticultural Crops:

No work was done and no funds expended in the period July 1 - December 31, 1969.

2. Agricultural Engineering effort on Prune Research July 1 to December 31, 1969

R. B. Fridley, Professor - five days on research related to physical properties of prunes and tree shaking.

T. H. Burkhardt, Assistant Professor - two days on research related to physical properties of prunes as they effect prune cracking.

C. Yung, Research Assistant - fifty days on physical properties research and tree shaking research.

N. B. Akesson, Professor - four days on research related to chemical application.

3. Expenditures

To June 30, 1969 - None

July 1 to December 31, 1969

A. Mechanization Research and Physical Properties Research

General Assistance	\$2,162
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B. Aerial Application of Pesticides - None

4. Research to be Continued or Initiated

January 1 to June 30, 1970

A. Mechanization Research and Physical Properties Research will be continued.

Studies will be continued to (1) study physical characteristics of prunes as they relate to obtaining optimum quality and (2) study of vibration characteristics of trees to determine best tree structure for mechanization. A Bulletin relating to tree bark strength and bark damage will be written. Part of the effort under (1) above will be directed toward assisting Dr. Uriu in the cracking studies. Funds will be used to partially support a graduate student and cover his direct expenses. Anticipated expenditures are:

General Assistance	\$1,300
Supplies and Expenses	200
Equipment	200

B. Research on Application of Pesticides for the current fiscal year will be conducted during January, February and March. Objective is to study how aircraft can be used in the prune dormant spray program to (1) increase timeliness, (2) not increase cost, and (3) maintain effectiveness of spray program. Project is cooperative with Plant Pathology (Dr. Ogawa).

Our work will start with the dormant spray program after January 1, 1970 continuing thru February and possibly later. The program will be aimed at checking machines (both ground and aerial) and application methods, as well as formulations and chemicals, to try to determine to what extent aircraft (helicopter and fixed wing) can be used for control of prune diseases. Funds will be needed for hiring general assistance as well as aircraft and pilots, also for laboratory work on atomization and spray nozzles. Funds are needed for field travel and support of toxicological and other data analysis on specific chemical deposit studies. The program will be on three disease problems: (a) Russet scab control, aimed at determining operational use of aircraft. (b) Brown rot control, emphasis on aircraft use, but with a basis of comparison relating to air-carrier ground sprayers. (c) Leaf rust control, again aimed at determining limitations and abilities of aircraft, and including evaluation of dust application.

Anticipated expenditures are:

General Assistance	\$1,820
Supplies and Expenses	1,170
Employee Benefits	180

July 1 to December 31 (Cost estimates are for entire fiscal year July 1, 1970 to June 30, 1971)

A. The Research on Mechanization and Physical Properties described above will be continued. Estimated costs are:

General Assistance	\$4,000
Supplies and Expenses (including travel)	500
Equipment	100
Overhead (including employee benefits and secretarial help)	690

B. Pesticide Application Research:

It is anticipated that this program should continue for three or more years because of biological differences in each season and also because the work of the program will require more test runs than one or two seasons can give with limited personnel and equipment available to us.

Thus, we propose at this time to request that funding to Agricultural Engineering in the extent of around \$3,500 be set aside for the 1970-71 season of work on methods of spray application for prune disease control.