

DEPARTMENT OF AGRICULTURAL ENGINEERING

UNIVERSITY OF CALIFORNIA, DAVIS

ANNUAL REPORT TO THE ALMOND BOARD OF CALIFORNIA

Project Title: Research and Development of an Almond Brush Module Cutter

Project Leader and Principal U.C. Investigators:

Bryan M. Jenkins, Project Leader
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Objectives of Research:

1. Phase I

- A. Establish physical properties of almond brush pertinent to cutting or shearing brush.
- B. Perform experiments on how to separate a module at the cut.
- C. Develop conceptual designs for a prototype almond module cutter.

2. Phase II

- A. Construct and field test a prototype almond brush module cutter.
- B. Compare the overall feasibility of handling almond brush by moduling, cutting and tubgrinding to other possible systems.

Interpretive Summary:

Conceptual designs for a prototype almond brush module cutter were developed. These designs included standard chain saws, large bow type chain saws, band saws, circular saws, oversized cutter bars, reciprocating saws, and shearing devices.

A shear testing apparatus was designed and fabricated in order to obtain cross grain shear force and power requirements for almond orchard prunings. Tests were conducted on groupings of almond prunings of various sizes and moisture contents. The data acquired from these tests can then be extrapolated and used in determining design parameters for the development of a full scale almond module shear. More accurate methods for these data conversions are still being studied.

A large bow type chain saw was developed and fabricated. The saw consists of a large open sided frame which is attached directly to the mast of a 3500 lb.

capacity forklift. A standard .404 inch pitch saw chain travels around the perimeter of the frame and is totally unsupported and exposed across the bottom, open side of the frame. The chain is powered by a high speed hydraulic motor. A separate lifting device including two 10 foot long module lifting forks was added to the existing forklift mast. These forks, after being thrust under the module, lift the module so that as the saw frame descends, the cut is separated. Upon completion of the cut, the saw frame is lifted clear of the prunings, the module is lowered to the ground, and the forks are withdrawn. Figure 1 shows this cutting device. This machine was tested on October 26, 1982, in Fresno, California. Its operation was very favorable as it was capable of completing a cut of a 7 ft. by 7 ft. module within 4 minutes with a cutting power requirement under 15 horsepower. Therefore, it is strongly believed that this system may be a feasible solution to the module cutting problem. At this point in time, alterations are being made before further experimentation and testing can be done to determine the endurance and reliability of the machine components.



Figure 1. Almond Module Cutter

Experimental Procedure:

Accomplishments

1. After first hand observation of the construction of typical almond modules, several conceptual designs for a prototype cutting device were developed and compared. These designs included modifications of standard chain saws, large bow type chain saws, band saws, circular saws, oversized mower cutter bars, reciprocating saws, and shearing devices.
2. Based on preliminary information, the chain saw concept was chosen and its design refined. A large bow type barless chain saw and module lifting device were fabricated as shown in Figure 1.

3. This cutting machine was tested on October 26, 1982, in Fresno, California. Two 7 ft. by 7 ft. by 16 ft. modules of green prunings were cut with minimal difficulty. The fastest cut required less than 4 minutes total time and the power required by the saw chain was approximately 15 horsepower.
4. The shearing concept is also under investigations. A shear test apparatus was developed and fabricated to obtain force and power requirements involved in shearing groups of various almond prunings. The results of these tests are discussed in "Energy and Power Requirements for Shearing Moduled Almond Prunings," ASAE Paper Number 82-3556.

Future Plans

1. Alterations will be made in the construction of the forklift mounted chain saw. These modifications will hopefully enhance the machine's performance and increase safety of operation. The saw will then be tested in a full scale operation in Fresno, California, in order to determine the durability and reliability of its components.
2. New methods will be developed for analyzing the shear testing data in hopes of arriving at more accurate values of force and power requirements involved in shearing full size 7 ft. by 7 ft. modules of almond prunings. These new values will aid in the feasibility study of the shearing concept.
3. A detailed economic analysis will be performed to determine the cutter cost contribution to the moduling/tubgrinding approach to brush handling. The approach will be compared to other approaches that may have future potential, such as size reducing whole modules with special machines, making small modules to fit tubgrinders, or changing cultural practices to allow tubgrinding without moduling by cutting branches to some maximum specified length.

Discussion:

The work done to date shows that the large barless bow type chain saw is a prime candidate for the solution of the module cutting problem. Demonstrations have shown the capability and potential of this machine. After the completion of a few modifications, this saw should be tested in a full scale operation in order to evaluate its endurance and reliability.

The shearing concept also seems to show some merit. The results that have been obtained thus far seem to indicate that the power required to shear the module is not tremendously greater than the power required to saw the module. However, new methods of interpreting this data need to and will be developed to obtain more accurate power requirements involved in the shearing of a full size module.

Publications:

Zohns, M. A. and B. M. Jenkins. 1982. Energy and Power Requirements for Shearing Moduled Almond Prunings, ASAE Paper No. 82-3556, Presented at the Winter Meeting of the American Society of Agricultural Engineers, Chicago, IL. December.

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January 14, 1983

Robert K. Curtis
Associate Director of Research
Almond Board of California
P.O. Box 15920
Sacramento, CA 95852

Dear Bob:

Enclosed is a copy of our Annual Report concerning the research and development of an Almond Brush Module Cutter.

If there are any questions regarding this research project, please don't hesitate to contact either Bryan Jenkins at 752-1422 or myself at 752-1883.

Sincerely,

Mark A. Zohns

Mark A. Zohns
Project Co-investigator

MAZ:Janeen
Encls.

cc: Dale Morrison
Director of Research