Project No. 80-Y2
(Continuation of Project No. 79-ZC)

Cooperator:
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Project: Brush Utilization
Densifying & Transporting Brush

Objectives: The overall objective of this study is to determine the optimum almond brush preparation process and develop the associated costs to the grower for this brush preparation.

Progress: This proposal will describe the approach, specific tasks and results of a study to consider the various methods of densifying almond brush and preparing it for centralized markets. It appears that at least two alternatives should be considered in this study:

1. A system utilizing portable equipment that collects and grinds the brush during the pruning process. This equipment would be portable and move through the orchard with the pruning operation. Prunings would be received directly, ground into a size suitable for marketing, and conveyed to an attached bin. This bin would be unloaded into a stationary trailer or bin at the edge of the orchard. The stationary storage unit would be suitable for direct highway transport.

2. A system that collects the brush after it falls and delivers it to semiportable grinding equipment located at the edge of the orchard. The ground material will be conveyed directly into a bin or trailer for highway transport.

This project will be closely coordinated with other brush utilization projects.

Plans:

1. Determine the quantities of brush available by counties, and prepare a map showing the amount of material available and its approximate location.

2. Review the available markets for the brush and establish criteria so that the prepared material is satisfactory for these identified markets. At present it appears that there are two such markets: stationary steam boilers designed for wood or coal firing, and mushroom composting. Concurrent studies will develop the specific characteristics of the material to be used for composting. Included under this study will be development of the criteria for material to be prepared as boiler fuel. Combustion characteristics have been determined by California Polytechnical Institute.

3. Determine the pruning rates in the orchard, to establish a range of preparation equipment sizes.

4. Identify commercially available equipment that will be satisfactory for the intended use, including the characteristics of the finished product and the pruning size ranges established in Item 3. This equipment will be selected to handle a maximum diameter and length of brush, which will be established later.

5. Become familiar with the equipment that is presently in use in the almond orchards, to determine the compatibility of present farming and pruning equipment with the brush processing equipment identified in Item 4.

6. Prepare capital cost estimates and operating and maintenance costs, including fuel and labor for the various types of equipment.

7. Develop a range of costs per ton for prepared brush, based on economic conditions normally used in the almond industry. This will include establishment of the economic time frame, depreciation rates, labor rates, interest and taxes.

8. Discuss the overall brush processing concepts and constraints with various equipment manufacturers to formulate equipment tests and demonstration programs that will be needed.

9. Meet with representatives of trucking firms operating in the area to establish criteria and costs for brush transportation equipment. The principal objective will be to use existing equipment that is compatible with the present transportation system. Portable bins and parked trailers will be among the storage systems considered. Ownership of rolling stock or contract hauling vehicles will also be considered.

10. Develop a projected value of the material as fuel over the next five years, based on anticipated energy economics.

11. Develop criteria for the practicality of brush preparation considering the economy of scale, distance from markets, and market value. Provide a schedule of probable preparation and transportation costs per ton of material for three representative size growers, at varying distances from potential markets.

12. Witness and evaluate the Tub Crinder Test (Project No. 79-ZB) occurring within the time frame of this study.

Almond Industry Participation $22,500

80-Y2

ALMOND BOARD OF CALIFORNIA
1980-81 ALMOND RESEARCH
PROGRESS REPORT

PROJECT NO.: 80-Y2 (Continuation of Project No. 79-ZC)

TITLE: Brush Utilization
Densifying and Transporting Brush

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OBJECTIVE: The overall objective of this project is to find a feasible and economical method for removing brush (prunings) from the almond orchards.

SUMMARY OF PROGRESS

1. Prunings Distribution and Description

Approximately 350,000 tons of dry prunings are generated each year in California after removal of large limbs for firewood. The rate of prunings averages about a ton per bearing acre, with the greatest amount of prunings being generated in the northern and central sections of the San Joaquin Valley. Pruning quantities are expected to increase by about 6-percent per year, with the largest increase occuring in the Southern San Joaquin Valley. Almond prunings are very difficult to densify because of its high resiliency and small diameter. Average prunings are 6 to 10 feet long and 1 to 3 inches in diameter. Heat value varies according to moisture content or about 8,000 BTU/lb at 30-percent moisture and 5,700 BTU/lb at 45-percent moisture. Densified prunings (about 2-inch size) will have a bulk density between 15-20 lbs/cubic foot.

2. Densification and Transportation

Two methods of brush densification have been identified: in-row and orchard-side densification. In-row densification involves use of a continuously-moving chipper or hammermill. Custom in-row units are available for use today. In-row densification eliminates need for buck-raking but can cause damage to orchards and will interfere with orchard activities. Orchard-side densification

may involve the use of a semi-stationary hammermill, tubgrinder, chipper, baler, or packer truck. The hammermill, tubgrinder, chipper, and packer truck have been field tested. Rates as high as 8 tons/hour have been temporarily achieved, but sustained rates above 5-tons/hour appear to be impossible until the methods of feeding the machinery can be improved. The hammermill with forced, horizontal feeding, appears to show the greatest promise for brush densification on the basis of durability, high processing rate, and year-round utilization. However, semi-stationary units are not readily available on the market. Use of live bed trailers appears to be the best method for transporting densified prunings. Machinery tests will continue in 1981.

3. Cost Estimates

The large hammermills will have the highest capital costs of all densification machines while the baler will be least costly. The baler, however, has not been proven for almond brush densification. Densification rates of 10 TPH or more must be maintained to be cost effective. Densification and handling costs will range from a low of $16/ton of prunings for a baler to a high of $25/ton for a large hammermill. Truck transportation costs will average another $4.20/ton using a 40-foot trailer and based on 50 miles distance. Rail transportation unit costs will be slightly higher than truck costs unless longer distances are considered.

Multiple densification machines, buckrakes, and transportation vehicles will have to be used for large orchards in order to maintain the desired cost effective densification rates. At very high densification rates, multiple small hammermills become the least cost alternative.

Leasing rather than owning equipment does not appear to have any significant advantage in costs given leasing costs used in the analysis.

4. Markets

Densified almond brush can be sold at a delivered price of between $15/ton to $50/ton depending on use, size, and moisture. The greatest demand for densified almond brush appears to be as a fuel. About 20-30 biomass fueled plants in California are in operation, under construction, or in the planning/design stages. Other promising uses for densified brush include raw material for soils additive, mushroom compost, alcohol production, and charcoal production. Densified brush may someday serve the following markets: animal feed, paper manufacturing, particle board manufacturing, fire logs, animal bedding, and landfill bio-gasification.