Proc. Fla. State Hort. Soc. 96: 338-340. 1983.

MOBILE PROCESSING LINE FOR SOUTHEASTERN GRAPES—STATUS AND PLANS

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Abstract. **The U.S.D.A. Citrus and Subtropical Products laboratory has worked cooperatively with the Florida Grape Growers, Florida A&M University, and other research establishments to provide technical services since 1975. Over this period of time, several devices have been designed, built and tested by this laboratory to improve the potential for products from muscadine grapes (**Vitis rotundifolia **Michx.) in the southeastern states. Several canning/storage tests have been previously described, as well as a density grape separator (for maturity), and a deseeder. These devices have been interconnected with a conveyor system and a trash eliminator. This small processing line includes sizing and canning equipment and is arranged on a small trailer. This trailerable processing line is currently being tested and modified.**

Muscadine grapes grown in the southeastern United States are used for fresh market and wines. A small quantity of these grapes are processed for jellies, jams, pie fillings and candies. Mucilaginous and tough skins and seeds are major problems in preparing processed products. Because of uneven ripening a great majority of muscadine grapes are currently handpicked, adding another disadvantage.

These characteristics of commercially available muscadine grapes and the current depressed economic markets for their fresh produce have led the grape growers in the southeast to seek means of cleaning the grapes, separating them according to maturity, deseeding them and canning the deseeded product. This led to studies for developing a small-scale grape canning system.

The best handpicked commercial berries contain some trash, as well as immature and over-mature berries which are unacceptable on the fresh market. Second and third harvests also tend to have more problems with maturity range in the fruit. Therefore, a trash eliminator and density separation unit are necessary as parts of the system.

Deseeding is necessary for a processed product and two types of deseeders are available, one commercially. The Fresno deseeder utilizing rollers (Elliot Manufacturing Co., Fresno, California) and the core-boring deseeder designed and built by us in cooperation with Florida Agricultural and Mechanical University (FAMU), Tallahassee, Florida, and previously described (2).

Materials and Methods

A brief description of each of the separate units comprising the processing line is included below. A schematic drawing of the system is shown in Fig. 1 and a photograph of the line is shown in Fig. 2. Letters refer to positions on Fig. 1.

"A"—Conveyor system. Eight inches wide x 12 ft long, metal 1/2 inch x 1 inch mesh belt is driven by a 1/4 hp electric motor through a 30 to 1 reduction gear to convey the grapes through the processes described below. Grapes are loaded onto this conveyor at a hopper and passed over a trash eliminator (see "B" below). Finally, the product drops off this conveyor belt into the density separator.

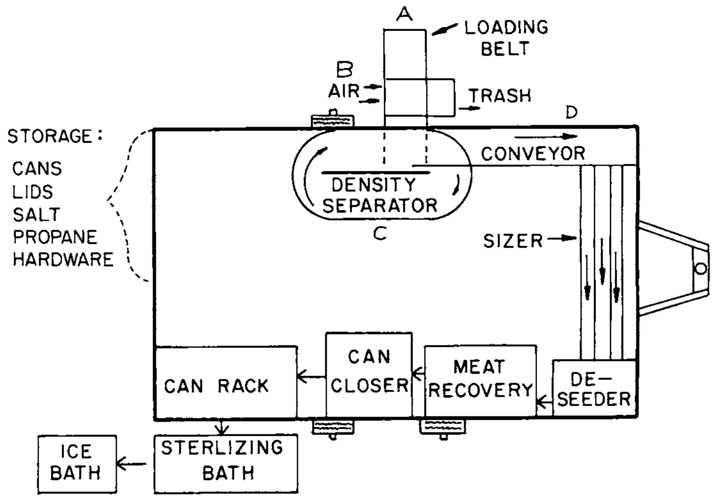

Fig. 1. Schematic of the proposed trailerized system.

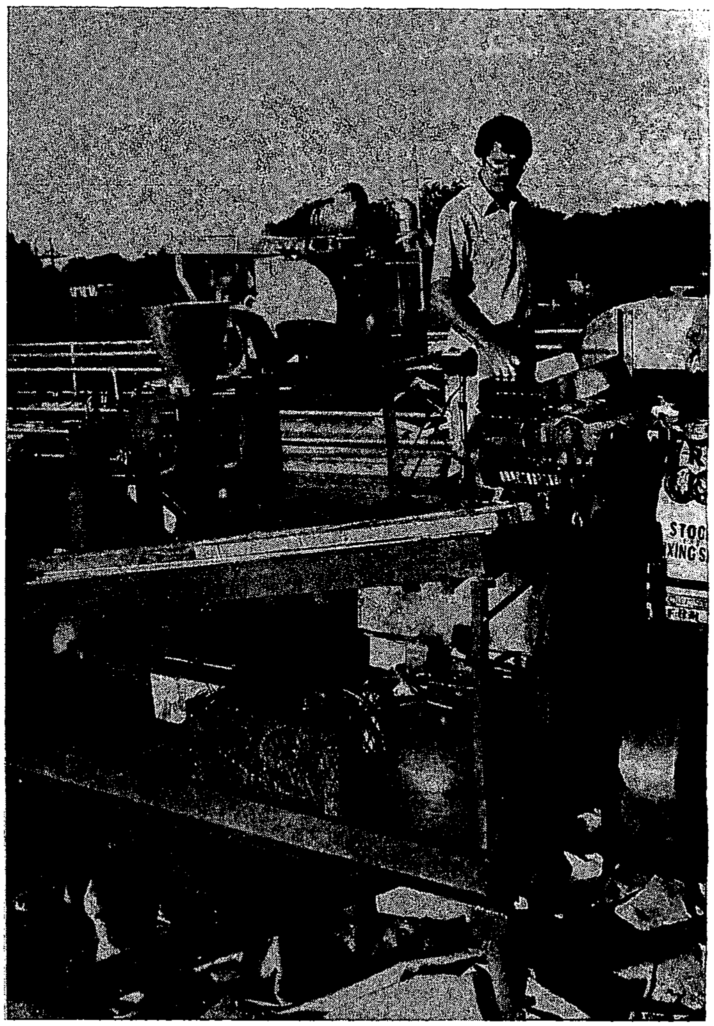

Fig. 2. View of the trailerized system during its preliminary trial run.

[1]Southern Region, Agricultural Research Service, U. S. Department of Agriculture. Mention of a trademark or proprietary product is for identification only and does not imply an endorsement or warranty of the product by the U. S. Department of Agriculture over other products which may also be suitable.

"B"—Blower. Squirrel cage fan driven by 1/2 hp motor moving air at 2000 ft^3/min through the mesh conveyor belt. Blowing through the product, this blows trash over to the side of the trailerized processing line. In preliminary tests a burlap bag was used to catch trash blown aside by this device.

"C"—Density separator. An oval shaped metal tank having the following dimensions: 4 ft long x 2 ft wide x 40 inches deep. This tank contains a salt or sugar solution of a density sufficient to float or sink grapes of some specific °Brix. Fig. 3 shows the ratio of salt to water necessary to make the solution equivalent to 12-18°Brix. By adjusting the equivalent °Brix of this solution, the operator can separate grapes according to their maturity based upon the solids content (°Brix) of the harvested grapes.

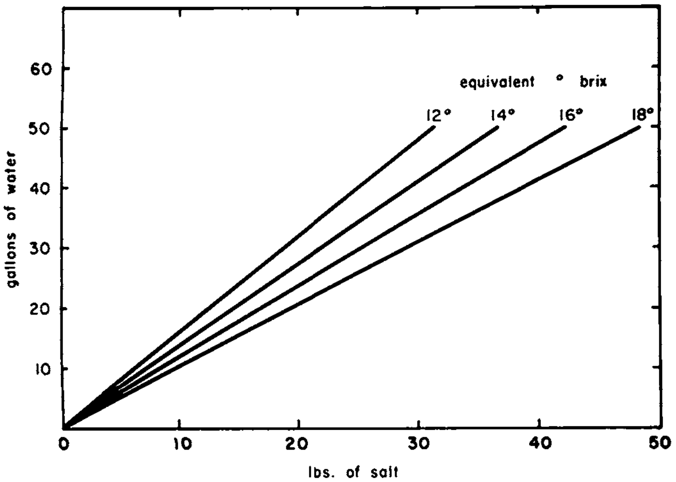

Fig. 3. Graph showing equivalent °Brix solution composed of (X) lb. of salt in (Y) gal of water.

The salt or sugar solution is circulated clock-wise around the tank using a small variable speed submerged motor. Grapes in this moving solution are driven against barriers which direct floating (less mature) grapes to the outside of the tank and sunken (more mature) grapes to the inside of the tank, where a single divided continuously moving conveyor lifts them from the solution. Sources of additional information regarding grape separation are listed in the bibliography (1, 3, 4, 5).

"D"—Lift conveyor belt. Used to lift separated grapes from the density separator tank is a 12 inch PVC food grade belt with 11 inch x 12 inch squares removed. UHMW (ultra high molecular weight) plastic bars (1 inch x 11 inches) were attached to this belt to serve as buckets on the belt (Fig. 4). The conveyor is driven by a 1/4 h.p. electric motor with 30 to 1 reduction gear mounted on the density separator.

Trailer (Fig. 1). The Atwood Trailer Company (4750 Hiawatha Drive, Rockford, Illinois 61101) supplied materials from which Lohiser Inc. (Winter Haven, Florida) assembled a tandum axle 6 ft x 12 ft trailer used in this processing line. The trailer frame is made of 4 inch channel steel and is supported by four stabilizer jacks when processing equipment is in use. The trailer was designed to carry in excess of 3500 lb. of equipment and incorporates hydraulic surge brakes.

Elliot Manufacturing Company (Fresno, California) deseeder (Fig. 1). This deseeder utilizes two merging rollers, one of rubber and one of steel. Grapes are fed into the nip of these rollers, eventually being caught between them. The steel roller has rows and columns of tightly arranged steel fingers which puncture the grapes, pressing seeds onto the rubber roller. Grape meat and skins are combed from the steel fingers and seeds are scraped from the rubber roller.

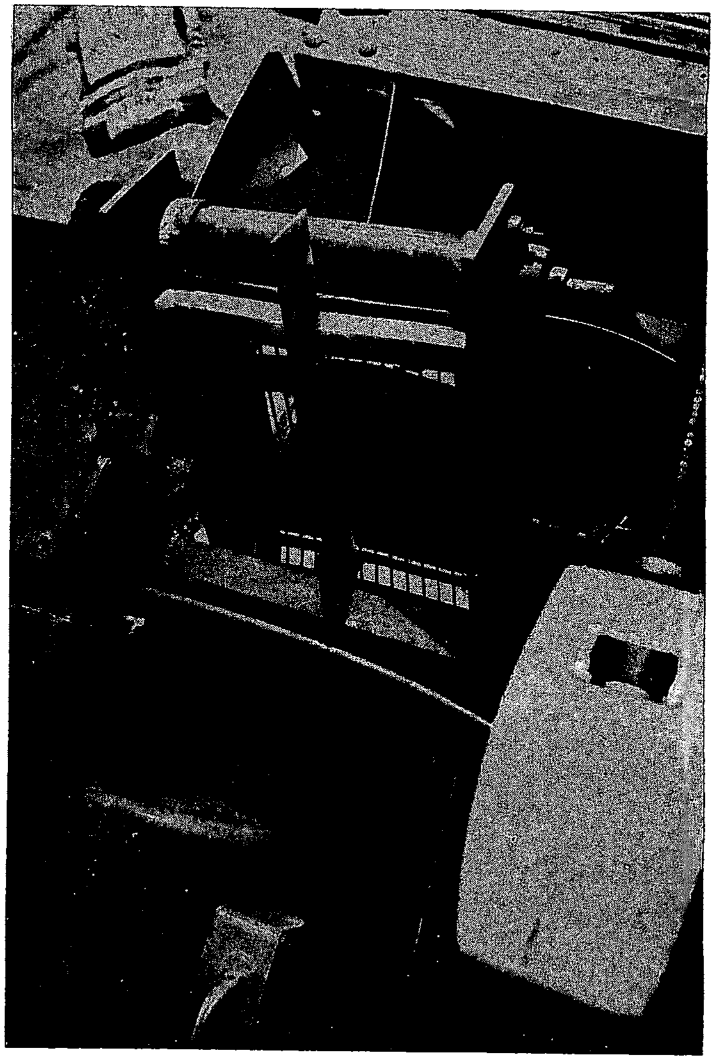

Fig. 4. "D"—Lift conveyor.

Automatic deseeder. A device used to remove seeds without destroying the shape of muscadine grapes. This device uses spinning tubular cutters to core grapes through their centers 4 at a time and was described in detail by Coleman (2).

Results and Discussion

The conveyor-blower equipment worked well even when grapes, leaves, soil and assorted vineyard trash were wet. Several air-leaks were located during testing and will be closed before subsequent tests. One-half inch (1.27 cm) chain belts used on this conveyor tended to eliminate 3/8 inch (0.95 cm) grapes and grapes that had dried on the vine (raisins). Grapes of this size and the raisins are considered disposable trash. Grapes with higher turgor tended to be thrown farther from the end of this conveyor over the density separator solution than the broken, split or rotten (overmature) grapes. Turgor may be applicable as a basis for preseparating these undesirable grapes before conveying them to the density separator. Initial tests on this system were carried out at the FAMU Viticulture and Small Farm Center.

Density separator. The original design and tests of this separator have been described and discussed previously (2). Several changes were made to incorporate an automatic conveyor for removing the separated mature and immature grapes and to prevent turbulence in this system from remixing grapes once they had been separated.

Grating screen and a positioned metal sheet were used to direct the separated grapes to the appropriate side of the divided lift conveyor as shown in Fig. 4. A horizontal metal sheet divided the flow of water and grapes to prevent remixing as they approached the lift conveyor.

Vertical bars positioned at 1/2 inch intervals are fixed behind the conveyor belt to prevent grapes from flowing past the lift-buckets attached to the conveyor (Fig. 4). Two pinch points were observed during our initial tests where some grapes over-stacked on the lift buckets and were crushed. Steps being taken to eliminate this pinch problem are: 1) These spots will be redesigned and restructured, 2) more buckets/ft^2 of conveyor will reduce the stacking, 3) a higher conveyor speed will be attempted also to reduce the stacking, and 4) the conveyor belt speed of the trash eliminator can be reduced if necessary.

Conclusion

A trailerized processing line for muscadine grapes has been designed and built. Preliminary tests have been run with this line. It was found to function as designed. Some minor modifications are necessary on the individual devices before the line as a whole should be used in field applications. In brief preliminary trials of the trash removal system, the density separator and the lift conveyor, all worked well even under difficult conditions with wet trash and abused fruit.

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Proc. Fla. State Hort. Soc. 96: 340-344. 1983.

EVALUATION OF VAN CONTAINERS FOR COLD TREATMENT OF CITRUS FRUIT FOR QUARANTINE PURPOSES

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Additional index words. refrigerated containers, fruit fly.

Abstract. **Two types of refrigerated van containers were compared in stationary and shipping tests to determine their suitability as cold treatment chambers for quarantine purposes. Both vans maintained fruit with temperature uniformity throughout the load of 2.0 or 2.2°C for 14 days or more in all four tests. The van with a solid-stacked load, an under-the-load air distribution system and the air temperature control sensor located in the discharge air stream cooled fruit quicker than did the van with an air-channel stacked load, over-the-load air distribution and the thermostat located in the return air stream. Both vans cooled warm citrus (17-22°C) to 5°C within 3-4 days. The van with under-the-floor air delivery cooled warm fruit throughout the load more uniformly than the van with over-the-load air delivery.**

Tephritid fruit flies are destructive to fruits and vegetables in many subtropical and tropical areas, but they are not indigenous to California nor have they become permanently established there. The Mediterranean fruit fly (Medfly) (*Ceratitis capitata* Wiedman), considered to be the most destructive of all fruit flies on a world-wide basis (6), has invaded and has been eradicated from Florida, Texas and California on at least 11 occasions (4, 6). These Medfly infestations covered hundreds of square miles; eradication involved the efforts of thousands of people and cost millions of dollars (15).

For many years the Medfly has been permanently established in Hawaii and in parts of Central America. In the 1960s the Caribbean fruit fly (*Anastrepha suspensa* Loew) became established in Florida (18), and the Mexican fruit fly (*A. ludens* Loew) regularly crosses over into the Rio Grande Valley of Texas (12). Tephritid fruit flies are easily spread in infested plant materials by travelers and by shipments of contaminated fruits and vegetables. This is readily evidenced by the over 18 infestations of Medfly, Mexican fruit fly, oriental fruit fly (*Dacus dorsalis* Hendel) or melon fly (*D. cucurbitae* Coquillett) that have been detected and eradicated since 1965 in California alone (4; J. C. Manning, 1977, personal communication; H. Warren, 1977, personal communication).

Where tephritid fruit flies are established, quarantine treatments are required for host fruits and vegetables shipped from the infested areas to markets in noninfested areas where host crops are grown and where the fruit flies have potential to survive. The only quarantine treatments approved for tephritid fruit flies on citrus fruit are 1) fumigation with ethylene dibromide (EDB), 2) cold treatment, and 3) a vapor heat treatment (1). Vapor heat is approved only for the Mexican fruit fly. EDB fumigation has been the treatment of choice in the United States, because fumigation chambers are easily built, or fruit can be fumigated after loading into trucks, van containers, or ships (1, 13). Also, fumigation takes only a few hours and is relatively cheap. However, proposed new restrictions on the use of EDB as a postharvest commodity fumigant now allow its use only until September 1, 1984, unless nullified judicially.

Cold treatment of citrus fruit has not been practical in the U.S., because there are not nearly enough facilities to treat the large portion of the crop marketed in the fly-free areas that require quarantine treatments; and the cost of building the necessary facilities is high. Cold-treatment also is energy intensive and about 11 times more expensive than EDB fumigation (5). Cold-treating fruit requires 2 wk or more, depending upon the species of fruit fly involved and