

Controlled Atmosphere Apple Storage Fills Need

Present methods double storage life, but Michigan State College group seeks further gains

CHICAGO.—Increased storage life for nearly all fruits, vegetables, and even flowers is a pressing need today. For apples, controlled atmosphere storage is at least partially filling this need. Present commercial units roughly double apple storage life obtainable in ordinary refrigerated storage. The practice has caught on well in England, where controlled atmosphere storage for about 4 million bushels of apples is now in place. The U. S. has about 500,000 bushels capacity, chiefly in the Northeast. And a search for more basic data in the field is now under way at Michigan State College according to I. J. Pflug. Results to date apply only to McIntosh apples, Pflug told the winter meeting of the American Society of Agricultural Engineers here recently.

Controlled atmospheres now used for apples contain about 3% oxygen, 5% carbon dioxide, and 92% nitrogen. Apples are put into nearly gas-tight storage spaces which at first contain normal air. The fruit consumes oxygen and gives off carbon dioxide, and the atmosphere is sent periodically through an exterior sodium hydroxide scrubber which removes the carbon dioxide. The atmosphere reaches optimum composition in 10 to 21 days, and the more quickly the better. Pflug's group finds that by replacing carbon dioxide removed with nitrogen instead of air, they can reduce by about 20% the time needed to reach optimum gas composition.

Effects of the ratio of free volume to solids volume is also getting attention says Pflug. This ratio varies with the quantity of apples in a given storage container, of course, and also with the stacking method. In normal, completely utilized storage the ratio is 2.5 to 3 for palletized stacking and 1.5 to 2 for the nonpalletized. In ideal storage, Pflug reports, time to reach optimum gas composition is nine days at the 1.5 ratio, 15 days at a 2.5 ratio, and 25 days at a ratio of four.

Carbon dioxide removal in the sodium hydroxide scrubber is done batchwise in current practice. Pflug's group is using a smaller stripping tower than normal, and is moving toward continuous stripping. This aspect of the study has yielded no conclusive results yet, Pflug states, but there is some indication that over-all stripping efficiency will improve.

Pasture Fertilization. Fertilizer effec-

tiveness is one aspect of a six-year study of supplemental pasture irrigation in southern Illinois. Test plots of ladino clover and grass pasture originally received three tons of limestone and 1000 pounds of superphosphate per acre according to B. A. Jones, Jr., and H. L. Wakeland, University of Illinois. Plots were sprinkler irrigated so as to keep the lower level of usable soil moisture at 35%. Irrigation for the six-year period averaged 13 inches annually.

Varying combinations of limestone, phosphate rock, superphosphate, nitrogen (NO_3), and potash were applied to the plots at intervals during the six-year period. Average yield of dry matter per acre was highest on plots getting all fertilizers except nitrogen. Dollar return was \$20 per acre higher than for the next best plots, which got only limestone and phosphate rock. Nitrogen application showed least net return per acre on both test and control plots, partially because of its higher cost. Superphosphate produced more forage than rock phosphate. During the sixth season, 10-10-10 was tried; it yielded a profit on irrigated plots but not on control plots. Considering all factors, including fertilization, Jones and Wakeland conclude that supplemental irrigation in this instance is borderline. Pasture manage-

ment practice must improve if such irrigation is to be worthwhile.

Pre-emergence weed control with 2,4-D played an important role in ridge farming studies at the Iowa Agricultural Experiment Station, say E. V. Collins, Iowa State, and W. F. Buchele and W. L. Lovely, USDA. Ridge farming is aimed at effective control of soil and water losses, and attainment of maximum crop yields.

Conventionally sprayed 2,4-D retards weed growth until corn (used in this study) reaches a height of 12-15 inches. First mechanical cultivation can thus be delayed; the result is a bigger ridge. Cultivation provides further control, when it is finally used, by covering weeds with soil.

Measurements at the ridge root bed, lister furrow, and the travelled furrow between ridges showed the highest available nitrogen content to be in the ridge seed bed. Also, the specific heat of the ridge soil is lowered by drainage; the ridge, therefore, reaches a higher temperature than the furrow.

Daphnids Help to Screen Systemics

The time required to rear, or collect and cage, test insects is rather great in screening one systemic, according to E. H. Wollerman, Central States Forest Experiment Station, USDA. When a large number of chemicals are to be tested, the insect test time becomes great enough to be the limiting factor.

In a report before the Entomological Society of America in Houston Dec. 6 to 9, Wollerman indicated they have found another arthropod, *Daphnia pulex*

I. J. Pflug (left) and B. F. Cargill of Michigan State discuss work on controlled atmosphere storage of apples



(De Geer), a microcrustacean, that can be used as a test animal to guide the rapid selection of systemics.

The small size of daphnids (maximum length 5 mm.) permits a great many to be reared in a small space, he stated. They are easy to culture, requiring only water containing bacteria or their equivalent for food. Reproductive rate is high; in her life span of 2 months a female may produce 400 or more offspring. The handling of daphnids when conducting tests is a simple matter, he said, of taking several hundred from the stock tank with a dipper and distributing them into test dishes with a pipet.

The use of systemic chemicals to protect plants from insect attack has not been developed so extensively for forest trees as it has been on vegetable crops, indicated Wollerman. "No practical control of a forest insect has been attempted by this method," he stated,

"and very little experimental work has been done."

Wollerman cited successful reports of others with the control of a mealybug on coffee trees through trunk application of hanane, isolan and pyrazoxan similarly applied to apple trees for aphid control, and demeton applied to citrus trees for control of several mite species.

Entomologists at the Central States Forest Experiment Station have also investigated systemics and their usefulness against forest insects in laboratory and nursery tests, he indicated. The most effective materials tried on insects feeding on black locust trees were demeton, schradan, and the benzene hexachloride group of isomers. But tests involving a larger number of trees are necessary before recommendations can be made for practical application, he cautioned.

Rough Rice Preserved for Six Months by Gas Storage

FORT WORTH.—Rough rice can be stored in the laboratory for as long as six months in the presence of ethylene oxide and carbon dioxide, says Socrates A. Kaloyereas, LSU Agricultural Experiment Station. But large scale experiments under field conditions are needed, and the effect on nutritive value must be thoroughly evaluated, he cautioned.

The process is not one of fumigation, he explained, before the 10th ACS Southwest Regional Meeting here during Dec. 2-4. Rough rice is a physiologically active seed in dynamic equilibrium with its environment. "If we want to preserve such seeds we cannot use methods critically damaging the physiological processes and destroying the established equilibrium," he declared. "All we can do is move this equilibrium to a lower level of activity."

Spoilage of rough rice is caused by a

combination of factors, explained Kaloyereas. High respiration and transpiration of the seeds, the resulting high temperature and humidity in the air of the bin, all contribute to the growth of microorganisms. Success of the process, he claims, is that carbon dioxide depresses respiration and ethylene oxide helps control the growth of microorganisms.

It is possible, says Kaloyereas, that the process may also help preserve vitamins in rice, and LSU has applied for a patent, using 0 to 0.1% ethylene oxide and 30 to 50% carbon dioxide in the atmosphere of storage bins.

At the end of six months storage, the rough rice was in very good condition. It hadn't developed mold, and after cooking it tasted as good as rice preserved in cold storage.

Rough rice (with a normal moisture content of 20 to 28%) cannot be stored unless it is dried to about 12% moisture, explained Kaloyereas. And all of the year's harvest must be dried in a period of several months. A good process for storing rough rice only a few months would reduce drying costs considerably, he says, and would give the farmer a greater bargaining power than he now has. Kaloyereas pointed to the fact that rice buyers in most cases own drying installations and are naturally interested in keeping the price of rice low during the harvesting period.

Moisture in Ammonium Nitrate. After extensive investigation, we have found a rapid, accurate method to deter-

mine moisture in ammonium nitrate, indicated R. M. Englebrecht, Lion Oil. Ammonium nitrate moisture must be carefully monitored, he explained, to prevent caking when it is used as a fertilizer.

"We are particularly interested in the moisture content between 0 and 1%, with an accuracy of 0.05%," he stated.

Using the Guichard method as a standard for absolute water content, Englebrecht, Sam Drexler, and F. A. McCoy compared vacuum oven drying, Moisture Teller method, and thermister bridge-calcium hydride techniques against Karl Fischer procedures.

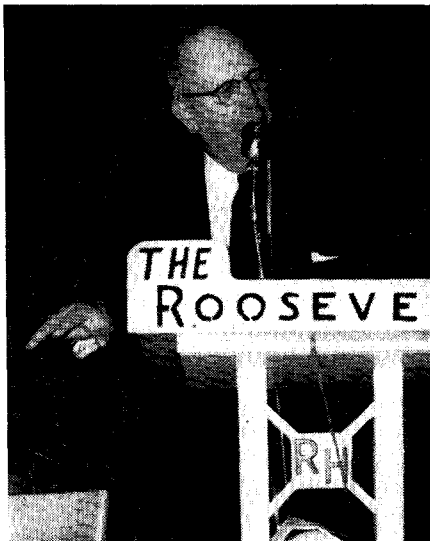
In the Guichard method, says Englebrecht, the sample is placed in an oven for an extended period of time, the weight loss is determined periodically, and the moisture loss curve is extrapolated to zero time for theoretical water content.

Vacuum oven drying is impractical for monitoring process samples, he stated, because the method requires about 3 hours. Moisture Teller takes 30 minutes, and this is still too long.

A thermistor bridge requires only 5 to 6 minutes, and is fine from a time standpoint, he explained, but it is not as accurate as Karl Fischer procedures, even though the accuracy is within

World Hunger Called Foremost Problem Facing U. S.

The foremost problem facing our country today is to see that the rest of the world has enough to eat according to R. G. LeTourneau of R. G. LeTourneau, Inc. Speaking at the eighth annual Men of Science and Industry dinner in New Orleans recently, he said that "instead of feeding people we have to provide them with the means of feeding themselves, in order not to kill their ambition"



CALENDAR

Northeastern Weed Control Conference. Hotel New Yorker, New York, N. Y. Jan. 5-7, 1955.

Southern Weed Control Conference. Soreno Hotel, St. Petersburg, Fla. Jan. 17-19, 1955.

American Association of Cereal Chemists. Chase Hotel, St. Louis, Mo. May 15-19, 1955.

International Seaweed Symposium. Trondheim, Norway. July 1-16, 1955.