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THE OUTLOOK FOR WAXY SORGHUM IN NEBRASKA¹

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Experiment Station Circular 73

May, 1943, 5M

The Experiment Station
of the
University of Nebraska
College of Agriculture

W. W. Burr, Director
Lincoln, Nebr.

THIS circular reports on the present situation regarding the use of waxy sorghum grain for the manufacture of special starches. In the spring of 1942, a publication from this Station (Experiment Station Circular 69) suggested the possibility of a market for the waxy grain of Nebraska-grown Leoti sorgho. Since then there have been many developments which may interest those who have grown or who may contemplate growing Leoti in Nebraska.

As stated in the earlier publication, tapioca starch made from the roots of the cassava plant is used for the manufacture of adhesives for postage stamps, envelopes, boxes and packages; sizings for the textile and paper industries; and for food, in the form of tapioca. As much as 375,000 tons of this product have been imported into the United States in one year, the chief source of supply being the Dutch East Indies. Naturally, the war in the Pacific has resulted in the loss of this source of tapioca starch and users of it have been searching for a domestically-produced substitute.

For a long time it has been known that the starch from waxy cereals was different from that of the non-waxy ones. As a matter of fact, for many centuries the Chinese have used the grain of waxy rice and sorghum in the preparation of foods for special occasions. The waxy endosperm is so named because the cut surface of kernels which have this character have a uniform waxy, opaque appearance, while the cut surface of kernels with the usual type of endosperm either is more lustrous and hard or else white and starchy in appearance. The iodine test quickly identifies the two types of starch. Cereals in which there are known to be strains having the waxy endosperm include rice, corn or maize, sorghum, barley, and proso millet.

Comparatively recent studies have shown that the starch of the waxy cereals has many properties similar to those of tapioca starch. It was thus brought to the attention of some of the users of this product that domestically-produced grain of the waxy cereals might serve as a substitute for the no-longer-available

¹ Cooperative investigations of the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, and the Nebraska Agricultural Experiment Station.

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tapioca starch. Research at various experiment stations, in U. S. D. A. research laboratories, and in the laboratories of several starch processors and users has indicated that this can be done. Cereals that have been most intensively studied are maize, both hybrid and open-pollinated, and several varieties of sorghum.

The Leoti Situation in 1942

IN the spring of 1942 it was known that the waxy cereal then most widely grown in the United States was Leoti sorgo. This crop therefore offered the only possibility of producing waxy grain in appreciable quantities in 1942. Accordingly, one of the principal manufacturers of tapioca for food investigated methods for producing starch from Leoti grain on a commercial basis. These studies were not completed in time to influence the 1942 production. The advice given, therefore, in the spring of 1942 was: *At the present time, no expansion of the Leoti acreage is encouraged solely for the production of grain.* It was suggested, however, that farmers who planned to grow Leoti for forage should take steps to produce it in such a manner that, if the market developed, their grain would be acceptable to the trade.

In August it was estimated, by means of a survey, that there were approximately 100,000 acres of Leoti in Nebraska and it was roughly estimated that there were 50,000 acres in Kansas and a smaller area in western Texas. Not all of this Leoti would have been suitable for use in making starch. Much of it was planted with impure seed, and other fields were not sufficiently isolated to prevent cross-pollination with non-waxy varieties. However, it was estimated that there would be from 250,000 to 500,000 bushels of waxy Leoti grain produced in Nebraska and Kansas.

By fall the industry had decided that Leoti grain could be successfully processed on a commercial basis to provide a satisfactory substitute for tapioca starch. It then proceeded to establish 22 buying points at strategically located elevators in Nebraska and Kansas. The price to be paid was fixed at 50 cents per hundred pounds over the cash or loan price, whichever was higher, of No. 2 yellow corn. Grain of low test weight was necessarily discounted, and none with a test weight of less than 46 pounds per bushel was accepted.

Unfortunately, a state-wide killing frost was experienced on September 24, which is considerably earlier than average for much of Nebraska. Since the growth of sorghums had been somewhat slower than usual, this early frost resulted in almost complete failure of the Leoti grain crop. As a result comparatively little Leoti was marketed.

The Outlook for Leoti in the Future

MANY factors will influence the future Leoti situation. Among those of greatest importance are : (1) the possibility that waxy corn may satisfy some of the demand; (2) the development of waxy sorghum varieties which are superior in several respects to Leoti; (3) the shortage of good Leoti seed; (4) the possibility that other crops will be more attractive to the farmer; and (5) the remote possibility that sufficient shipping space will become available to import tapioca starch from Brazil.

Waxy corn has been grown on a commercial scale in both Iowa and Nebraska. There is in limited production a waxy hybrid similar to Iowa 939, except for endosperm character. Seed stocks for this hybrid are being increased rapidly, and it is anticipated that there will be sufficient seed to plant an appreciable acreage in 1943. There is also an open-pollinated Nebraska variety having the waxy endosperm. Whether waxy corn, waxy sorghum, or some other waxy cereal eventually becomes the principal source of tapioca-type starch will depend upon the efficiency with which these respective crops may be produced and utilized.

There will be about 20,000 acres of a variety known as waxy Blackhull kafir grown in Texas in 1943. This variety was developed by the Texas Agricultural Experiment Station from crosses between Blackhull kafir and an introduced variety which had the waxy endosperm. It is, for the most part, very similar to the original Blackhull kafir, except for the waxy endosperm character. In many respects the grain from this variety is more desirable from a processing standpoint than is Leoti. It threshes free of the glumes, which gives it a higher test weight and eliminates the necessity of removing the glumes, and it has a colorless pericarp and no nucellar layer, which makes it possible to obtain a white starch with less difficulty than when Leoti is used. Furthermore, waxy Blackhull is a grain sorghum type and may, therefore, be expected to yield considerably more grain than Leoti, in the areas where it is adapted. With a favorable season the above-mentioned acreage of waxy Blackhull will produce sufficient grain to supply a considerable part of the processors' needs. However, there should be a demand for somewhat more grain in 1943 than can possibly be provided by the Texas production of waxy Blackhull. In that case there may be a demand for some Leoti grain in addition.

There is also a variety of grain sorghum, Waxy Club (H.C. 397), developed in Kansas, which has the waxy endosperm. The seed of this is being increased from winter planting near Yuma, Arizona, and it is expected that the seed crop will be ripe in time for a second planting of some 10,000 acres in July, 1943.

The shortage of good seed of Leoti may be a serious factor in limiting the production of Leoti grain for industrial use in 1943. As the early fall frost resulted in a reduction in the amount of grain marketed this year, it also resulted in a failure of a large part of the seed crop. Very little of the seed that has been tested is of satisfactory viability. This is true not only in Nebraska, but in much of the Leoti-producing areas of Kansas. It would seem desirable to save and distribute for planting any seed of Leoti that is pure waxy and gives a high germination.

The removal of acreage limitations on corn and the incentives made for the production of certain other crops may lessen the attractiveness of producing Leoti for grain. In view of the scarcity of labor and the fact that Leoti requires much of it, particularly in harvesting and threshing, many farmers may feel that their limited supply of labor can be used to better advantage in producing other crops. There is also the factor of machinery to be considered. Many farmers do not have certain pieces of equipment necessary to produce Leoti, and they may have difficulty in borrowing or renting them. Finally,

moisture was relatively abundant over most of the state last year, and the sorghum acreage is decreased in Nebraska, almost without exception, in years following those with favorable moisture.

Like the common rubber tree, the cassava plant is a native of the Americas which migrated to the East Indies and became commercially important there. Brazil, where it is known as manioc or mandioca, still produces some of this crop commercially. Should the needs of the United States for tapioca starch become critical, there is little doubt but what some of it could be imported from Brazil if priorities on shipping space were allotted. If the shipping situation should improve to the point where this could be done, which is apparently not likely, there might be a slackening of interest in the production of tapioca starch from domestically-grown waxy cereals.

Leoti in Nebraska for 1943

IT now appears that there will again be a market for Nebraska-grown waxy grain of Leoti sorgo. The commercial organization which bought Leoti grain of the 1942 crop has indicated that it will maintain buying points to handle the 1943 crop at Holdrege and Superior. No announcement has yet been made of the price to be paid for the 1943 Leoti grain crop in Nebraska.

There is the possibility of other buyers coming into the market for this crop, but at present only the one company has indicated its intention to purchase Leoti grain for starch manufacture.

Whether or not he should produce Leoti for grain in 1943 must be decided by the individual farmer. However, the recommendation of the Experiment Station is essentially the same as that made in the spring of 1942. It now appears that there will be a market for waxy Leoti grain at Holdrege and Superior. In the vicinity of these towns, farmers who grow Leoti for forage might be encouraged to use seed which is pure for the waxy character and to isolate the Leoti from fields of other varieties of sorghum. In other areas, no market for Leoti is anticipated, yet if car-load lots of waxy Leoti are accumulated they might be successfully marketed.