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Leoti for Starch

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LEOTI FOR STARCH

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THE popular forage crop, Leoti sorghum, has possibilities of becoming an important *special purpose* grain crop for industrial utilization. Investigations of the Department of Agricultural Chemistry have shown that starch manufactured from the *waxy* grain of this variety has properties similar to those of tapioca starch. Tapioca starch, made from the roots of the cassava plant, has been imported by the United States to the extent of 175,000 tons annually. The chief source of supply, the Dutch East Indies, has been eliminated by the war, and domestic substitutes are being urgently sought by the Industry. This type of starch is in special demand for the manufacture of adhesives used on postage stamps and envelopes, for sizings used in the textile and paper industries, and for food in the form of tapioca. Since all of these uses have some relation to the war effort, it is readily apparent that this material is of critical importance.

The final answer as to whether Leoti grain can be processed satisfactorily on a commercial scale, will be forthcoming when experiments being conducted by a large manufacturing concern are completed. Until the results of these studies become known, and until the companies which will process the material have reached their decision, it will be impossible to say definitely that there will be a market for Leoti grain for industrial use. Furthermore, it is almost certain that the necessary information will not be available before the 1942 sorghum planting season is over. Farmers must, therefore, draw their own conclusions as to whether they should or should not grow Leoti in 1942. However, the following is the recommendation of the Nebraska Agricultural Experiment Station: If a farmer is planning to grow some forage sorghum anyway, he might plant suitable seed of Leoti. In this way he will be satisfying his forage requirements and should also have some grain to sell, should the market materialize. *At the present time, no expansion of the Leoti acreage is encouraged solely for the production of grain.*

Origin and Description of the Variety

The true origin of Leoti is unknown. It is possible that it resulted from a natural cross between an Amber and one of the other members of the sorgo group, but this can not be definitely established. The variety is said to have had its origin near Muncie, Indiana, where it was grown for the production of syrup for many years. In 1921, R. E. Getty, of the Fort Hays, Kansas, branch experiment station, found the variety grown locally near the town of Leoti, Kansas. He took some of the seed to the station for testing, and the variety was named for the town near which it was found. Subsequently Leoti was distributed rather widely in southwestern Kansas.

In 1936 seed of Leoti was obtained from Kansas by the Department of Agronomy of the Nebraska Agricultural Experiment Station. It was included that year in the sorghum variety tests of the Experiment Station at Lincoln and North Platte, and in cooperative tests with farmers throughout the state. Seed supplies were increased in 1936 and 1937 on the Experiment Station Farm at Lincoln, and the first certified seed was grown in Nebraska in 1937.

On the average, Leoti requires about 105 days from planting to maturity. Its height varies considerably with the conditions under which it is grown, but averages from five to six feet. Leoti has a medium thick stalk which is juicy and sweet, and, under favorable conditions, tillers profusely. The head is erect and semi-compact, with the upper branches tending to droop. The glumes, or hulls, have a characteristic dull yellowish red color and have short beards. When the hulls are removed, the Leoti kernel is medium sized and buff in color.

The waxy endosperm, which is the character that makes Leoti suitable for the manufacture of tapioca starch, is inherited, and Leoti is one of the few varieties that have it. This character is known to the geneticist as a recessive, which means that it is lost for all practical purposes when Leoti is crossed with a variety having a non-waxy endosperm. As a result, only reasonably pure Leoti will yield satisfactory starch, and numerous tests have shown that much of the Leoti seed now on farms has become so mixed with other varieties as to be unacceptable. The waxy endosperm can be distinguished from the non-waxy only by a chemical test. Mere examination of seed will not reveal whether or not it is sufficiently pure for this character.

Uses of Leoti

In addition to the possible use of its grain in the manufacture of industrial starch, which has previously been discussed, Leoti is valuable for other purposes. It has been used as a forage sorghum in Kansas for many years and farmers in Nebraska have come to use it very extensively in this way. Under average conditions and when properly managed, Leoti produces forage of excellent quality. Its yield has been satisfactory in most parts of Nebraska and it is recommended particularly in the central, south-central, southwestern, and northeastern areas of the state. Atlas is generally superior to Leoti for forage in the southeastern and eastern sections, while in the northwest Leoti is too late to mature consistently except when grown under irrigation.

As mentioned before, at one time Leoti was grown principally for the production of syrup, and it is still considered satisfactory for this purpose.

How to Produce Leoti Grain for the Starch Industry

In order to be acceptable for the manufacture of starches, Leoti grain must meet certain requirements. The most important of these is that the Leoti must be pure for the waxy endosperm character. There are two possible reasons why a given lot of Leoti may not meet this requirement.

First, planting of seed that is not pure for the waxy endoseprm is certain to result in a crop that is unsuitable for starch manufacture. Since the presence or absence of the waxy endosperm cannot be determined by inspection, a grower who wants to produce Leoti that is suitable for this character should use only seed the purity of which has been demonstrated by chemical test.

Lists of growers whose seed has been tested and found suitable are available at the offices of the county agricultural agents. There appears to be an ample supply of suitable seed to plant the usual acreage. Anyone may have Leoti seed tested free of charge by sending a 1-pound sample to the Department of Agricultural Chemistry, College of Agriculture, Lincoln, Nebraska. It may be pointed out that the presence of non-waxy endosperm in no way detracts from the forage value of Leoti.

Second, cross-pollination of Leoti by a variety which has non-waxy endosperm will immediately destroy the usefulness of Leoti grain for starch manufacture. If Leoti is to be grown for this purpose, it should be planted a distance of 30 rods or more from other varieties of sorghum, including Sudan grass. This will avoid serious contamination by wind-blown pollen of other varieties.

It is always advisable to treat sorghum seed for the control of kernel smut, and this precaution is doubly important when the grain is to be marketed. New Improved Ceresan applied at the rate of ½ ounce per bushel of seed, or copper carbonate at the rate of 2 to 3 ounces per bushel will completely control this disease.

Comparative Yields

In the event that Leoti is to be grown in part for its grain, information as to its grain yield in comparison with that of standard grain sorghum becomes important. As an average for 6 years, 1936–1941, it has yielded 20.4 bushels per acre at Lincoln compared with 18.3 bushels for Early Kalo. At North Platte, Leoti has given an average yield of 21.6 bushels as compared with 30.8 bushels for Early Kalo, indicating that in this part of the state the grain yield of Leoti is distinctly inferior. As an average of 145 tests planted on farms in all parts of the state during the past six years, Leoti has yielded 17.5 bushels per acre as compared with 27.7 bushels for Early Kalo.

These data indicate that on the average, Leoti may be expected to yield approximately 70 per cent as much as Early Kalo, which is the most widely used grain sorghum variety in Nebraska. On the other hand, in those areas of the state where sorghums are best adapted, particularly in the central and south-central area, the grain yield of Leoti may be expected to compare favorably with that of corn.

Cultural Practices

Most farmers are now reasonably well acquainted with production practices involved in sorghum culture. A brief review of the most important considerations follows:

The absolute necessity of using suitable seed if the crop is to be satisfactory for a grain market has previously been emphasized. This point cannot be stressed too strongly.

Early and thorough tillage is essential in the preparation of a desirable seedbed for sorghums. The principal objectives are to kill weeds, conserve moisture, and warm the soil. Any practical procedure that accomplishes these ends has been shown to be satisfactory. Planting may be done in a variety of ways —with a surface planter, with a loose-ground lister, or with an ordinary lister.

There is commonly no advantage in planting sorghum earlier than about May 25. An exception is found in the southeastern and east-central parts of the state, where chinch-bug infestations are likely to occur, and where a mod-

erate to severe outbreak is anticipated in 1942. Damage from these pests is reduced by planting somewhat earlier than is usually recommended. As a general rule, Leoti should be planted about 10 days to two weeks later than the normal time for planting corn. In most parts of Nebraska this will be in late May and early June. Under special circumstances the question may arise as to how late Leoti may be planted with reasonable assurance that it will mature a crop of seed. Many factors influence time of maturity, but Leoti has been grown successfully at Lincoln from plantings made as late as June 25.

When grown in 40- or 42-inch rows for forage, Leoti plants are commonly spaced 2 to 4 inches apart in the row in eastern Nebraska and 4 to 6 inches in the western part of the state. Somewhat higher grain yields may be obtained with wider spacings, though at the expense of maximum forage quality as a result of the greater stalk diameter. Using seed of high viability and with favorable seedbed conditions, a planting rate of 3 to 5 pounds per acre should give the desired field stand.

Harvesting

Since Leoti is primarily a forage crop, and because production solely for grain is not being encouraged, the harvesting method should be one that will permit saving of the grain and yet be most consistent with efficient utilization of the forage. Binding with a row binder, commonly referred to as a corn-binder, is the most convenient method for handling the standing crop. After binding, there are several possible methods of further management. If the grain is to be saved and the remainder of the plant ensiled, the bundles may be hauled directly from the field to the silo. There the heads should be removed and piled in long narrow ricks for drying previous to threshing. If the crop is to be fed as bundle feed, it should be shocked after binding and left in the shock until thoroughly cured. The grain may then be removed in either of two ways. When a combine with a vertical sickle is available, this machine can be drawn from shock to shock removing the heads and threshing the grain in one operation. When such a machine is not available, the heads may be cut from the bundles with a cheese knife and then hauled to a regular threshing machine or the bundles may be hauled directly to the machine. In any event the stover can be reshocked or stacked.

It is possible that the shortage of binding twine will be so critical as to preclude its use for sorghum harvest. Should this be the case, it will probably be necessary to hand-top the Leoti if it is desired to save the grain. Whether the price paid for the grain if a market develops will compensate for the labor involved in such a procedure remains to be seen. Certainly with the existing farm labor shortage the price would need be unusually attractive to entice farmers to harvest the crop by such a method.

No matter how the crop is harvested and threshed, the problem of storage deserves careful consideration. All grains will spoil in storage if their moisture content is excessive. This problem is frequently encountered with sorghums because of a general tendency to thresh and bin the grain before its moisture content has been lowered to a safe point, which is usually regarded as 14 per cent. Thorough drying, either in the bundle or in the head, will do much to obviate spoilage arising from this cause.

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