growth, a smaller portion of the nitrogen gathered is left in the soil if the crop is removed.

(7) Cultivation to destroy weeds should be early and continue as necessary. In this way plant competition will be reduced and moisture conserved for use of the soybean plant.

(8) The crop may be cut for hay any time after blossoming, and until the lower leaves begin to yellow. The yield and quality of the hay will be highest when the plant is well podded and beans one-half or more developed. Because of our short season we may have to cut earlier, or soon after pods have formed, sacrificing some in yield in order to escape damage from frost, and to permit the crop to cure while there is satisfactory curing weather. Either a mower or the binder may be used for cutting. In handling, exercise care to avoid loss of leaves as much as possible. The hay should be valued for its high protein content and quality rather than for its yield.

(9) For the production of ripe beans to market the crop is ready to cut when the seed is hard, and the leaves practically all off. Small green wrinkled beans, as a result of cutting too early, or frosted beans, sell at a disadvantage on the market. The seed crop may be harvested with the regular binder and threshed with the ordinary grain thresher, or if non-shattering varieties are used the crop can stand until dry and combined direct. This appears to be an efficient way of harvesting the seed crop.

To prevent splitting or cracking of the beans in threshing, the use of a larger diameter cylinder pulley, which will reduce the cylinder speed about one-half, but which maintains the rest of the machinery at normal speed, is advisable. Beans usually thresh easily and concaves should be adjusted accordingly. When beans are dry concaves often may be removed completely. Threshing machines that have the beater or rubbing type of cylinder as their threshing principle, are widely used where soybeans are extensively grown. Beans not sufficiently dry for safe storage, should be spread out, to permit occasional stirring and further drying out, thus avoiding heat damage.

(10) A light frost in the fall will destroy the leaves, yet may not completely kill the plant. Beans that had reached full size may not have been seriously injured by this frost, and will continue to "ripen" and take on color. Beans less advanced when the leaves were destroyed likewise may "ripen", but the beans will be small and the yield correspondingly reduced.

(11) Jackrabbits have a liking for growing soybeans and if numerous in a community may be very destructive in a small field. Grasshoppers can be very destructive at blossoming time, destroying the blossoms and preventing a good seed set.

(12) A soy bean crop leaves the surface soil fine, loose and somewhat dry, factors to be kept in mind if the crop is grown on soils that may blow easily. Cultivation that destroys weeds and conserves the moisture, however, has prepared the seedbed for the succeeding crop.

Races of Smut and Resistance of Hard Wheat Varieties

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COVERED smut or bunt in wheat may be prevented satisfactorily by cleaning and treating the seed. Varieties of wheat which are resistant to smut need not be treated for this disease but frequently should be treated to reduce seedling blight and other diseases. Some of our best wheat varieties are rather susceptible to smut. Marquis, Ceres, and Thatcher wheat are good

milling varieties but all are susceptible to smut. Ceres wheat is very susceptible while Thatcher wheat is somewhat less susceptible although by no means resistant. Some of the varieties which possess considerable resistance to smut are not very good milling wheats.

Wheat smut or bunt may be divided roughly into two classes or species: (1) "spiny" smut, *Tilletia tritici*, and (2) "smooth" smut, *T. levis*. (Figure 1.) Within each species of smut strains or races may be found which appear to be the same, even when examined under a microscope. However, they may be very unlike in action when attacking different wheat varieties. To identify these different races of smut requires a test of their behavior on a number of different and well established varieties of wheat. One should not forget that there are different varieties (races) of smut, and that a wheat variety which is resistant to one race of smut may not be resistant to another.

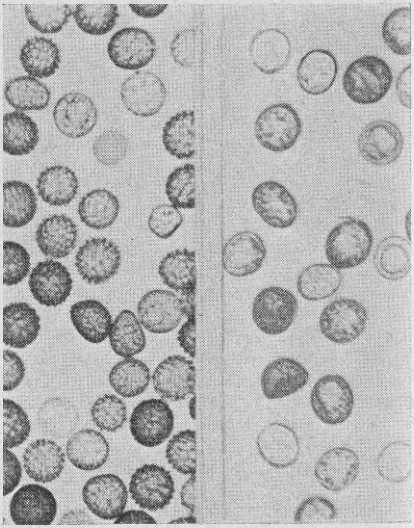

Figure 1. WHEAT SMUT
Left, "spiny" smut, *T. Tritici*. Right, "smooth" smut, *T. levis*. Highly magnified spores.

An experiment was planned which involved 20 separate collections of smut (largely from North Dakota) and 5 varieties of wheat. Each collection of smut was purified and increased by inoculating a susceptible variety of wheat with spores from a single smut ball. After growing the smut in this manner one year there was sufficient smut produced to carry out a test.

The collections of smut included 13 lots of "spiny" smut, and 7 lots of "smooth" smut. Each variety of wheat was carefully inoculated with each collection of smut and sown in duplicated rows (Table 1).

Ceres wheat was most susceptible to both species of smut. Thatcher wheat was more resistant than Ceres to all collections of smut and

Table 1. PERCENT INFECTIONS OF SMUT ON 5 VARIETIES OF WHEAT—1940.

Smut Collection No.	Species	Variety of Wheat				
		Ceres	Rival	Mercury	Premier	Thatcher
L 264	*T. levis*	23	1	0	0	6
L 312	" "	38	0	0	0	5
L 320	" "	19	0	0	0	0
L 368	" "	69	2	2	0	10
L 370	" "	69	0	0	0	15
L 371	" "	70	1	0	0	11
L 372	" "	71	1	0	0	20
L 373	" "	51	0	0	0	5
L 374	" "	56	3	0	0	16
L 375	" "	66	4	1	0	13
L 391	" "	61	0	0	0	8
L 428	" "	64	1	1	0	20
L 429	" "	47	1	0	0	3
T 303	*T. tritici*	35	0	0	0	1
T 383	" "	26	0	0	0	1
T 384	" "	16	0	0	0	0
T 386	" "	17	0	0	0	0
T 387	" "	1	0	0	0	0
T 412	" "	5	0	0	0	0
T 427	" "	7	0	0	0	2

especially to the *T. tritici* group. The new wheats Rival, Mercury, and Premier showed marked resistance to all collections of smut used in this test.

The different collections of smut varied considerably in percent of infection on Ceres and Thatcher wheat. Collection L320 developed 19 percent smut on Ceres and 0 percent on Thatcher wheat, while L372 developed 71 percent on Ceres and 20 percent on Thatcher wheat. These differences in infecting ability of pure lots of smut, when persistent through repeated tests, are used to establish races of smut.

Viking Flax

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VIKING flax is a selection from a cross, B-Golden x Burbank's Golden, made by the writer in his home garden in 1926. The cross was made not so much to produce a new flax variety, as to carry on my "hobby" of cross breeding. I have made hundreds of crosses on flax, wheat, oats, and flowers.

The reason for using the Burbank Golden was that Burbank considered his flax so valuable he sold his seed for $1.00 an ounce and kept his supply in a vault. The reason for its high value, as stated by the originator, was that its oil had a superb quality and could be used in making artists' paints. Previously oil for these paints had been imported.

The crop from this cross was grown in my garden for some time. Later, seed was planted on plots at the Experiment Station. It grew short and only the tallest plants were harvested. A single plant was selected and the seed increased.

Because of its short straw, not much attention was paid to this flax nor to the other parent, B-Golden. On good soils in eastern N. Dakota they always gave good yields of extra quality, but they were said to be too short for general use. In 1930-32, a flax called "New Golden" was grown in Walsh County. This "New Golden" had good, tall straw but didn't yield so well as Bison. A farmer from Hoople, N. Dak., was visiting our flax plots and among other flax experiments, I told him about Viking. He said he would like to grow a shorter-strawed flax if it would yield as much as other flax varieties. About 10 pounds of seed was furnished him in the spring of 1932. On September 18, 1935, he wrote: "I got about 350 bushels golden flax from 18 acres, nice quality too."

In the same year, the Department of Botany and Plant Pathology had a comparative test of several hundred flax selections including Viking, Bison, Buda, and Linota on good, clean land. The yield per acre, oil content, iodine number, height of plant, is recorded in the table below.

Some may be skeptical about such high yields of flax, but they are not unusual under good cropping conditions. In California, 50 bushels of flax per acre has been obtained, and in Arizona, they have records of 60 bushels per acre or more.

In 1938, some of this flax was planted at Gardner, N. Dak. That year, 1938, was very dry. As there was hardly any rain during the growing season it grew very short. The crop on 90 acres averaged about 13 bushels per acre with much dockage, 17%. A chemical analysis of this seed showed it had an oil content of 41.91% and an iodine absorption number of 197

CROP GROWN AT THE NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION IN 1935

Exp. No.	Variety	Yield acre	Oil content	Iodine No.	Ht. In.
5684	Viking	31.8 bu.	38.5%	181	19
6400	Buda	23.3 "	34.8%	167	26
6401	Linota	25.7 "	33.7%	176	26
6402	Bison	27.9 "	36.5%	161	27