# Flax Research In North Dakota

By H. L. Walster[1]

Flax is a pioneer crop. Its pioneer habits began when the seed flax crop became an important one in the latter years of the Eighteenth Century in New York, New Jersey and Pennsylvania. The first mills for the crushing of linseed were located in Pennsylvania and New York in the early part of the Nineteenth Century. The flax disease, flax wilt, soon deprived these early eastern mills of a source of flax for crushing.

Fortunately for the country and for the industry the opening up of new lands of the upper midwest which followed the Civil War, provided thousands of acres of land not yet contaminated with flax wilt so that the source of supply of flax seed for crushing began to come from those lands. The crushing industry established itself very early in the Nineteenth Century in Baltimore, Maryland and Buffalo, New York but after the Civil War an important center of crushing was established in Minneapolis, close to the source of supply. As the crop became an older crop on the lands of the midwest the attacks of flax wilt increased. This new pioneer crop was threatened with extinction.

FIGURE 1.—*Dr. H. L. Bolley, shown in a typical pose inspecting his flax plots at the North Dakota Experiment Station, Fargo.*

In 1894 J. B. Power, then director of the young North Dakota Agricultural Experiment Station, was still optimistic about the fate

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of flax in North Dakota for he wrote in that report, "Flax is attacked by an unknown disease in Minnesota which has not yet been noted as occurring in North Dakota. That disease is said at times to cause a total loss of crop." Director Power's optimism wasn't warranted, the flax wilt disease was undoubtedly already present in North Dakota. In that same year, 1894, the North Dakota Agricultural Experiment Station began its historic experiment of raising flax continuously on old Plot 30 at Fargo, the plot which raised its 56th continuous crop of flax in 1950.

But the flax industry did not become extinct in the United States nor in the midwest. Something was done about it. A young man from Indiana, Henry Luke Bolley, appeared upon the scene as the first botanist and plant pathologist for the North Dakota Agricultural Experiment Station. In 1901, he announced his discovery and isolation of the cause of flax wilt. Writing in North Dakota Agricultural Experiment Station Bulletin 50, published December 1, 1901, Bolley stated, "The fungus which produces the disease belongs to a genus of minute plants which botanists have called Fusarium. As it appears to be a species which is new to botanical descriptions, I shall call it *Fusarium lini*." The term "*lini*" of course refers to the Latin word for flax which is *linum*.

Bolley's actual first public announcement to the scientific world of the cause of flax sick soil was made in an address before the 22nd annual meeting of the Society for Promotion of Agricultural Science at Denver, Colorado, August 26, 27, and 28, 1901 when he said, "I am now able to affirm that this flax sickness of soil is due to the presence of a fungus which persists there from year to year, living upon humus and less decayed vegetable matter, especially the remains of its host. It is found that spores of the fungus are introduced into new fields by way of flax seed and other farm methods and infection areas are started which enlarge from year to year.

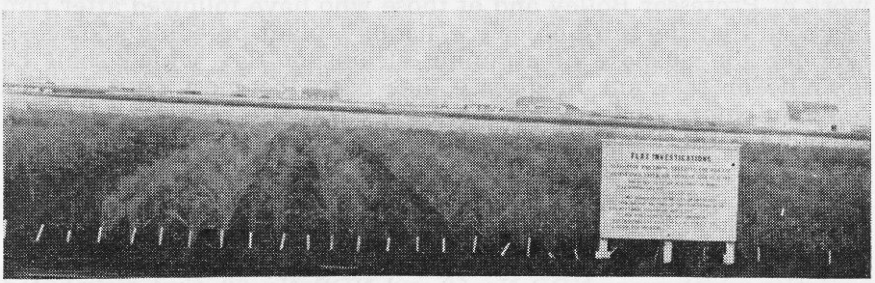

FIGURE 2.—*Plot 30, the "survival of the fittest" plot planted continuously to flax for over half a century, on the North Dakota Experiment Station, Fargo.*

Referring to the old Plot 30 on which flax cropping began in 1894 Bolley stated on this occasion, "Six successive crops of flax upon lands of the college farm resulted in complete flax sickness in the sixth year, most of the plants failing before three inches

high. Soil from this plot readily transmits the disease to soils known to be free from the fungus but when sterilized by boiling will produce a healthy growth of flax plants from spore-free seed. Experiments in the application of chemicals, fertilizers, etc., to the 'flax sick' soil has not lessened the growth of Fusarium."

The fact that a Japanese scientist independently discovered the cause of flax wilt at an earlier date, that is, in 1892, does not detract in the slightest from the importance of Bolley's findings. As a further matter of fact it does appear that it was a second Japanese scientist who really announced the Japanese discovery in a Japanese publication in 1903.

The importance of Bolley's discovery of the cause of flax wilt lies in the fact that he did something about it. First of all he found, as early as 1903, that 80 per cent of the seed samples of flax seed from North Dakota and the neighboring counties in Minnesota were infected with the wilt disease. He also found the wilt disease on the flax seed imported from different parts of the world. The first thing that he did about it was to suggest treating flax seed to prevent infection of new soils which have never previously raised flax. But, as he noted in the 13th Annual Report of the Experiment Station Director for February 1, 1903, "The seed treating process cannot be a perfect preventive of flax sick soil."

On February 1, 1903, writing in the 13th Annual Report of the Station, Bolley announced his objectives in flax improvement as follows: "(a) the perfection of methods of seed treatment for the purpose of preventing the introducing of flax parasites into the soil, (b) the study of methods of freeing the soil from the disease after it is once introduced, and (c) plant breeding and selection for the purpose of attaining strains of flax which shall be immune or resistant to disease."

The evidence of the years since 1903 and of all the subsequent work of Professor Bolley and of those who have followed after him has been that the third objective, namely, plant breeding and selection for the purpose of attaining strains of flax which shall be immune or resistant to disease, has been the most fruitful. The problem before Bolley was where to get disease resistant material. He quite naturally turned to the Old World. Through the cooperation of the North Dakota Agricultural Experiment Station and of the United States Department of Agriculture he was sent to the Old World on such a mission.

Material collected enabled him to select the first wilt resistant varieties which were NDR No. 52 and NDR No. 73, first distributed in 1908. Two other early distributions made important flax history; namely, that of Bison which was first distributed in 1925, a selection of flax which traces back to material which Professor Bolley obtained in 1911 from Ghent, Belgium, and Buda flax distributed in 1921 as a variety which traces back to selections of flax seed which Bolley made near Budapest, Hungary, on the occasion of his historic trip to Europe.

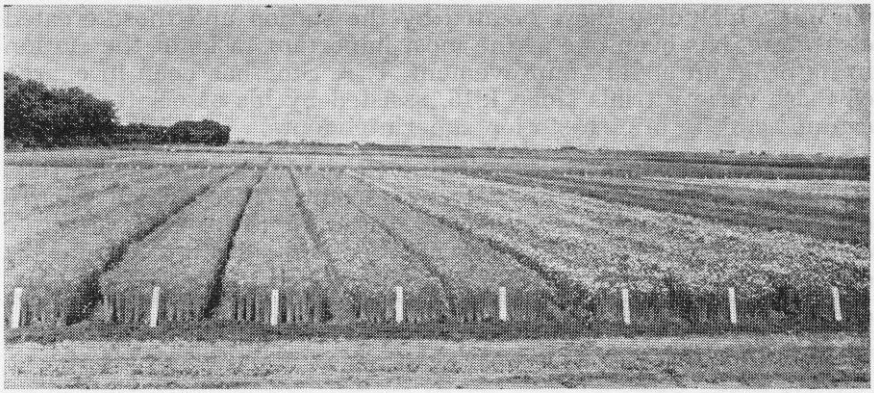

FIGURE 3.—*Typical July view of flax variety plots at the Fargo Station.*

Bolley's report upon his first successful experiments upon the resistance to wilt appears in Experiment Station Bulletin 55 published March, 1903, and reads as follows: "In 1902 after sowing a mixed lot of flax seed, which we procured by sending for samples of seed to a great number of farms in various parts of the Northwest, upon a piece of flax sick soil, we found that a small percentage of plants were resistant to the disease and were able to mature seed, some being slightly blighted by the disease but many apparently living without the slightest injury. These plants were pulled and sowed for a test upon this question of immunity." In 1905 Bolley was ready to appear before the North Dakota Farmers Institute with a special paper on "The Elimination of the Weak and Disease Bearing Types in Farm Crops," a direct application of the "Survival of the Fittest" principle to farming operations.

Efforts to learn more about flax and flax cropping, about the character and quality of linseed oil, and about marketing of flax and flax products have long been a major interest to the Agricultural Experiment Station here in North Dakota. The station has staked down more than 200 milestones in published records of facts about the flax crop. The roll of honor of men who have made contributions to these investigations is a long one. It is, of course, headed by Dr. Bolley, now retired. A long list of varieties which he introduced which became widely grown in the state include NDR 52 and NDR 114, both now practically extinct, and his later varieties Bison, Buda, Victory and B5128.

To the list of flax breeders we must add T. E. Stoa, who introduced Linota; O. A. Heggeness, who introduced Viking; H. H. Flor, a plant pathologist assigned to the North Dakota Experiment Station from the United States Department of Agriculture, who introduced Sheyenne and Marine, and A. C. Dillman of the United States Department of Agriculture whose Dakota flax was largely introduced through the efforts of the North Dakota Station.

Flax breeding has not been the only interest in flax of the North Dakota Station. In many respects the annual routine testing of

varieties, including those created by the station and those created elsewhere, has been one of the most important tasks of the station in its program of flax improvement. T. E. Stoa has been in charge of these variety trials since 1916, assisted by his associates on the campus and by branch station superintendents.

Stoa has also contributed improved methods of growing flax. His early experiments on dates of seeding flax, which clearly established that early seeding was necessary to promote effective competition with pigeon grass, has been important, as have his experiments on minimum rate of seeding and on rotations for flax.

(EDITOR'S NOTE: This is the first of two articles by Dr. Walster. The second, dealing with the diseases of the flax plant and methods taken to combat those diseases, will appear in our next issue.)

## NEW STUDY OF EGG BUYING

Egg buyers in stores, creameries and produce houses in North Dakota will be interested in "Egg Supply and Marketing in the North Central Region," a new regional publication based on a study in a dozen north central states. The North Dakota representative in this project was L. W. Schaffner of the Department of Agricultural Economics.

Interesting North Dakota data: Of eggs bought from North Dakota farmers in the spring 72 per cent were purchased ungraded and 28 per cent graded for size and quality; in the fall 76 per cent were bought from farmers ungraded, 26 per cent graded for size and quality.

As these primary dealers in North Dakota sold these eggs, however, 46 to 47 per cent were ungraded, about 45 per cent of them were graded for size and quality, and 16 per cent of spring-purchased eggs were sold as liquid eggs, broken and packed in North Dakota plants.

In the region as a whole 41 per cent of the laying hens were Leghorns, 13 per cent New Hampshires, 11 per cent White Rocks and the rest divided among other breeds and cross breeds. Average size of laying flock is 144 hens—but among the leghorn flocks the average size of flock is 160. North Dakota's flocks are about 40 per cent Leghorn flocks, while in Minnesota Leghorns make up some 75 per cent of the flocks. In South Dakota about 45 per cent of the flocks are Leghorns.

There is much more—all of it intriguing to folks who have laying flocks or who buy eggs. If you wish a free copy of the bulletin write the NDAC Bulletin Room, Fargo, asking for North Central Regional Publication No. 61, "Egg Supply and Marketing in the North Central Region."

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We in North Dakota still have a long way to go in this business of improving our dairy practices. Here's a little bit of statistics which is small enough to remember: In the 25 years from 1930 to 1955 the average number of pounds of milk produced per cow increased as follows:

In Michigan, from 5160 to 6510 ..... an increase of 1350 pounds.
In Minnesota, from 4980 to 6180 ..... an increase of 1200 pounds.
In Wisconsin, from 5680 to 7100 ..... an increase of 1420 pounds.
In North Dakota, from 4100 to 4700 ..... an increase of 600 pounds.

Not only have we increased production per cow only half as much as any of these other states, but our production is so much lower that increased production—through better sires, through better feeding, through artificial insemination, through generally better dairy management—should be much easier in North Dakota than in these other states whose production is already up to a respectable level. (Data quoted is from USDA reports)