

PLOT 30: PROVING GROUND FOR WILT RESISTANT FLAX VARIETIES

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Flax wilt (*Fusarium oxysporum* f. sp. *lini*) is potentially one of the most destructive diseases of flax. In the early 1900's, it threatened the continued production of seed flax as a crop in this country. Plot 30 was established in 1894 as a flax wilt research plot at Fargo, North Dakota, by Professor H. L. Bolley of the North Dakota Agricultural College. This plot has since proved to be invaluable in establishing the causal organism of flax wilt and in breeding wilt resistant flax varieties.

In 1894, Professor H. L. Bolley of the North Dakota Agricultural College first planted flax on Plot No. 30 of the Agricultural Experiment Station plots at Fargo. At that time, flax was considered a crop that could be successfully grown only on newly plowed prairie soils. This was the general farming practice in this country, because a devastating disease always developed when flax was grown successively on the same fields. The problem was evident worldwide; European farmers used a complicated rotation system in which flax was grown only once every eight years or so to reduce losses due to this flax-specific disease.

The original idea formulated by Bolley and J. H. Shepperd was to plant flax continuously on this $\frac{1}{8}$ -acre plot of ground "until something should happen" (2). This "something" materialized gradually, until in July, 1901, all plants growing on Plot 30 were dead or rapidly wilting.

Using Plot 30, Bolley identified *Fusarium lini* as the causal organism of flax wilt, and in 1903

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Figure 1. Professor H. L. Bolley examining wilted plants on Plot 30 about 1930.

(1) announced, "We have found a small percentage of plants resistant to the disease." He continued to use the principle of survival of the fittest to identify plants genetically resistant to this disease. By 1908, he was able to release the first wilt-resistant seed flax—namely, NDR No. 52 and NDR No. 73. NDR No. 114 was released about 1912; and finally, in 1925, 'Bison' was released. This variety gained immediate popularity with farmers, and in 1934 was being grown on 95 per cent of the flax acreage of the Red River Valley. Bison is still grown to some extent, although it is very susceptible to another disease, flax rust. It is also still valued by breeders as a germplasm source in the development of new flax varieties.

Since that first year of flax production on Plot 30 in 1894, the field has been cropped to flax every year, except in 1897 when it was seeded to wheat, and possibly in 1900, a year for which cropping records do not exist. In 1974, the tradition of growing all promising new flax lines in replicated trials on this plot was continued, to ensure that no wilt-susceptible variety will be released to growers.

From the visual ratings of disease severity (Table 1), it is obvious that flax lines differ greatly in wilt resistance. Check varieties are grown each



Figure 2. Reaction of different lines to wilt on Plot 30 during 1974. The three rows in foreground are highly resistant.

Table 1. Response of Regional Flax Nursery Entries to Wilt (*Fusarium oxysporum* f. sp. *lini*) under Field Conditions at Fargo, 1974.

Entry	Wilt Rating ¹		Average
	7-9-74	7-29-74	
Bison (check)	4.0	7.7	5.85
Nored (check)	2.0	4.7	3.35
Linott (check)	5.7	8.7	7.20
C.I. 2481	3.7	8.0	5.85
C.I. 2489	1.7	5.3	3.50
C.I. 2541	2.3	6.0	4.15
Culbert	4.7	7.7	6.20
C.I. 2797	2.3	7.7	5.00
C.I. 2798	4.0	6.0	5.00
C.I. 2799	1.3	2.7	2.00
C.I. 2800	1.0	3.0	2.00
C.I. 2801	3.3	8.0	5.65
C.I. 2802	3.3	8.3	5.80
C.I. 2803	3.3	8.0	5.65
C.I. 2804	4.3	7.7	6.00
C.I. 2805	2.0	5.7	3.85
C.I. 2806	2.7	7.7	5.20
C.I. 2807	3.3	8.0	5.65
C.I. 2808	1.3	3.7	2.50
C.I. 2810	6.0	8.7	7.35
C.I. 2811	2.0	6.3	4.15

¹ Rated on a scale by which 1 = most resistant and 9 = most susceptible.

year for comparison, since disease severity varies somewhat, depending mainly on temperature, moisture and date of sowing. Bison does not have a superior level of wilt resistance compared to some other entries. For example, Nored, C.I. 2489, C.I. 2799, C.I. 2800 and C.I. 2808 have excellent resistance. These lines reflect ongoing breeding efforts to select even more wilt-resistant types.

Most of the entries in Table 1 are mediocre for wilt resistance, while Linott and C.I. 2810 are inferior. These last entries could sustain yield losses if grown on the same fields year after year.

As in years past, wilt resistance data collected on Plot 30 are used with other yield and agronomic data, as well as determinations of seed oil content and quality, to evaluate breeding lines to be considered for varietal release. In this way, Plot 30 still contributes greatly to continued successful flax production in the upper midwest.

References

1. Bolley, H. L. 1903. *Flax and flax seed selection*. Bulletin 55, North Dakota Agricultural Experiment Station. p 193.
2. Walster, H. L. 1950. *Bolley's conquest of flax wilt*. North Dakota Farm Research, North Dakota Agricultural Experiment Station, Vol. 12, No. 6:187-197.