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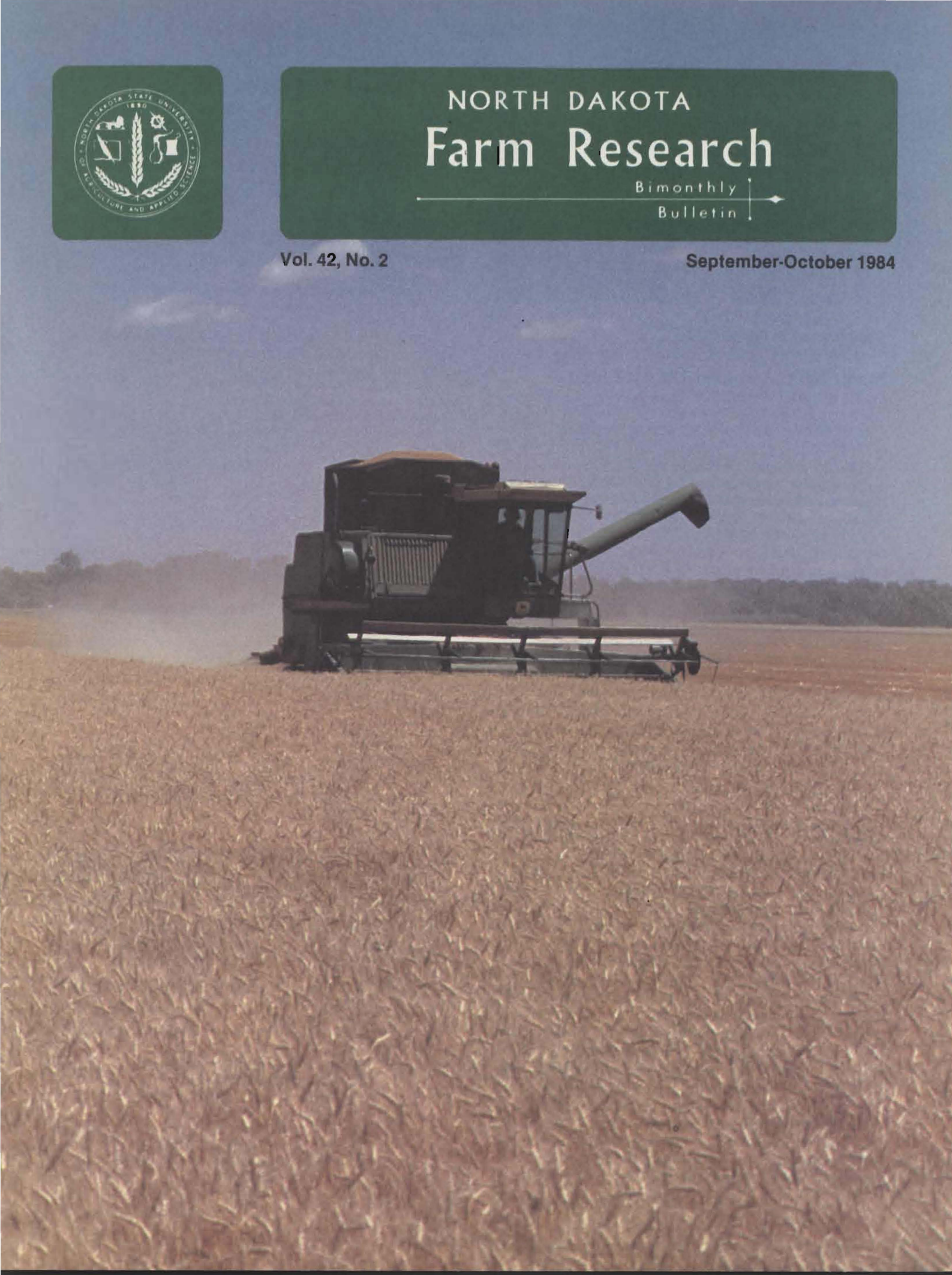

Guest Column

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PLANT BREEDING RESEARCH AT NDSU PAYS BIG DIVIDENDS

A farmer-seedsman walked into my office in late July, 1984, seeking the breeders of hard red spring wheat and barley at NDSU so that he could compliment them in person for development of Stoa hard red spring wheat and Hazen barley. This grower's Registered seed fields of Stoa and Hazen had yielded 77.3 and 116 bushels per acre, respectively. Such words of appreciation and recognition of good results are very welcome to breeders and others at the North Dakota Agricultural Experiment Station. The "breeders" implies the "breeding team," usually the plant breeder, a cereal technologist and a plant pathologist with NDAES and ARS, USDA cooperation. The plant breeder is the key member and leader of this team upon whom the production of new varieties is dependent; that is, the breeder must be a competent, original, efficient and well organized scientist, use a good record keeping system, and use some "art" in plant breeding, that is, "have an eye" for a superior plant. Also, the breeder must have good facilities for research, good technical and financial support, and work agreeably with other scientists.

Very high yields of hard red spring, durum, and winter wheat, barley, and oats have been reported in North Dakota in 1984 although serious drouth has prevailed in much of North Dakota. Fortunately, relatively cool days and nights prevented great stress on the grain crop through much of the summer. High grain yields in 1984 are attributable to good early spring moisture, timely seeding, good weed control, uniform stands and probably not as much plant disease as usual. But, high yields are due also to much better varieties than in earlier years due to continued advances in small grain improvement. Experiments with corn and wheat indicate that about 25 to 40 percent of the increased yields of the latest hybrids or varieties is attributable to breeding progress; the rest is due to improved pest control, especially weeds, and improved production practices such as more timely seeding and tillage, soil testing, fertilizing adequately for high yield goals, and better methods of moisture conservation. Nearly complete weed control is essential in time of moisture stress, and effective weed control procedures resulting from

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On the Cover: Most of the crop acreage in North Dakota is seeded to varieties developed by the North Dakota Agricultural Experiment Station. In this issue Dr. Jack Carter explains the benefits of the plant breeding program at NDSU. Photo by James Berg.

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research have been very important in the performance of the 1984 small grain crop. Ten or more years ago, some weeds in the grain crop probably would have robbed much of the stored soil moisture that the 1984 crop, under drouth stress, was able to use because weeds were controlled.

North Dakota has a strong crop breeding program at the North Dakota Agricultural Experiment Station at Fargo with cooperation of the Branch Experiment Stations and ARS, USDA. Usually about 100 percent of the durum acres, 75 percent or more of the hard red spring wheat and barley acres, 75-80 percent of the hard red winter wheat acres, and half or more of the flax and oat acres are planted to varieties developed by NDSU. In addition, many of the sunflower and corn acres of this area are planted to hybrids derived from inbreds or other germplasm developed by NDSU and USDA cooperation. The variety names Justin, Waldron, Olaf, Butte, Len, Wells, Lakota, Ward, Vic, Traill, Larker, Glenn, Nodak 307 corn, Hybrid 894 sunflower, Flor, Wishek, Pindak, Holberg, and Roughrider are very familiar names to most North Dakota crop producers. Stoa hard red spring wheat, Lloyd durum wheat, Hazen, Azure and Bowman barley, Agassiz winter wheat, Nodak pinto beans, Steele oats, and additional new variety names will become familiar to crop producers in the very near future.

The "dividend" or rate of return on investment in crop breeding research at NDSU is phenomenal — much better than odds at Las Vegas! Only about 0.4 percent of the value of many North Dakota crops is invested in research to improve the crop but the estimated return from research may be 50 to 100 times that invested. A few examples are discussed below.

DURUM WHEAT: It is estimated that about $130 is returned to the North Dakota durum industry for every $1 invested in durum wheat breeding at NDSU. The durum acreage of North Dakota and adjacent states is seeded almost 100 percent to durum varieties produced by the NDSU durum wheat breeding program. Additional yield potential of the newest variety over the older varieties was valued at $80 million during the 1973 to 1978 period. Four new durum wheat varieties released since 1978 have led to an additional $96 million of increased yield value for a total increased value since 1973 of $176 million. New durum varieties with strong gluten have helped retain domestic and export markets for durum wheat from North Dakota as an important economic crop for North Dakota agriculture.

HARD RED SPRING WHEAT: HRSW is the single most valuable agricultural commodity produced by North Dakota farms. Varieties developed by NDSU usually are grown on about 75 percent of the acres seeded to HRSW each year. In the two-year period 1978-79, it was estimated that the increased yield of Olaf and Butte acreage over Waldron, an older variety, was worth $26,600,000 in 1978 and $41,600,000 in 1979 for a total of $68,000,000. If one considers the increased yield of new varieties having acceptable quality over older varieties at 1 bushel per acre per year, 1980 to 1984, with 25 percent of the actual acreage occupied by new varieties during this period, the annual increased value of the new variety over the older variety is $5,394,000. The value of Len wheat having a 2 bushel per acre yield advantage over older varieties would be at least twice this annual amount, and the new variety Stoa will have sufficient yield advantage, 4 bushels per acre over older varieties, in the 1986 commercial crop to conservatively produce $21,576,000 increased return over older varieties.

The 3,134 acres of Stoa wheat grown in 1984 calculated at 35 average bushels per acre should produce about 109,690 bushels of Registered Stoa seed. Stoa appears to be an exellent variety and all Registered seed should sell and be grown in 1985, producing approximately 3,839,150 bushels of Certified seed, or enough to seed about 60 percent of the acres of hard red spring wheat in North Daktoa in 1986. If Stoa wheat, as expected, yields at least 4 bushels per acre (based on 1981-83 data) more than other hard red spring wheats having acceptable quality, the increased yield benefits in 1986 in North Dakota should be approximately $55,000,000.

Newly established crop breeding programs also can yield early significant benefits to North Dakota. The edible dry bean breeding program, started at NDSU about five years ago with financial and lobbying support from the Red River Edible Bean Growers Association, has produced three new pinto bean varieties, Pindak, Holberg and Nodak. Cooperation with Michigan State University also has made the new C-20 navy bean available very quickly to North Dakota farmers. Potential seed yield increases from Nodak, Pindak, Holberg and C-20 over older varieties such as UI-114 should net North Dakota farmers $2,000,000 to $3,000,000 additional annual income in 1985 or 1986 of these newer varieties are used by producers of edible dry beans for commercial food sales. The growth of a Registered and Certified seed bean industry in North Dakota to provide home-grown seed to commercial bean growers will yield additional financial benefits to North Dakota agriculture.

All new, NDSU-developed crop varieties are increased from Breeders and Foundation seed in the NDSU system of the Agronomy Seed Farm, the Branch Station system, and some contract growers. New crop varieties from other states also are increased in the NDSU seed increase system. There are additional financial benefits from the seed increase system to North Dakota agriculture in addition to those gained by the farmer producing a superior new crop variety for the commercial grain trade. (A paper by Dr. LeRoy A. Spilde, "The Agronomy Seed Farm — a 35-Year Dividend," provides details elsewhere in this issue of ND Farm Research.)

Indeed, public crop breeding research at North Dakota State University has paid big dividends in the past, does now, and will in the future. However, productivity from crop breeding research at NDSU will be dependent on retention of good scientists, providing technical and adequate financial support, and provision

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a materials cost of $913 per mile. The wood post—barbed wire fence material costs exceeded the two designs used by $362 and 372 per mile. This is a 32 percent increase in material costs for this design.

Post costs were greatest for the wood post—barbed wire fence. Since all fences were designed similarly with posts spaced 30 feet apart, the price per post was the major variant between fences. Posts were $3.36, $2.50 and $2.68 each for wood 3½-inch, steel and fiberglass, respectively.

Barbed wire was two or more times as expensive as either of the smooth wires. Barbed wire was $37.00 per ¼-mile roll for a cost of $450 per mile of three wire fence. Telephone wire was figured at half the price of barbed wire for a cost of $225 per mile of three wire fence. High-tensile wire was priced at $52.70 per coil (4000 ft.) totaling $211 per mile of three wire fence.

Miscellaneous costs of fence construction were minor compared to post and wire prices. Miscellaneous costs ranged from $15 to $19 for the three fence designs.

Certain construction and equipment costs for electric fences were not assigned to these designs due to the great variety and costs of equipment available. However, additional costs would need to be included in electric fence designs to better compare these designs. Additional costs for our electric fences were: 36-cell solar generation panel, $316, rechargeable 12-volt battery, $105; high output fence energizer, $240; and 120-foot high voltage, copper, double insulated cable, $90.

Maintenance Requirement

Climatic conditions are second only to livestock pressure in increasing fence maintenance requirements. Severe climatic conditions are an annual occurrence in North Dakota. Annual temperatures range from highs of approximately 100°F in summer to lows of – 40°F in winter. Ice storms commonly occur in late fall and spring. Annual snowfall averages nearly 3 feet in western North Dakota with snowdrifts of 6 feet possible. Where snowdrifts bury fences, spring thaw commonly pulls wires to the ground. Climatic influences have played a significant part in annual fence maintenance requirements in this study.

Annual maintenance has been required of only the steel post—telephone wire fence. Following winter, an average of two eight-hour days of labor has been required to repair winter and/or native herbivore damage. Another average of two eight-hour days of labor has been necessary during the grazing season for this fence design due to livestock pressure. No maintenance has been required for the wood post—barbed wire fence and only one wire repair in the third grazing season has been required of the fiberglass post—high tensile wire fence.

SUMMARY

Fencing can be a cost effective means of improving the condition and increasing the carrying capacity of rangelands when used in a sound management plan. All fence designs studied provided adequate control of livestock grazing an intensively managed, rapid rotation grazing system at the Dickinson Expeirment Station. Smoothwire electric fences with steel or fiberglass posts cost 40 percent less to build when compared to a conventional wood post—barbed wire fence. Smooth wire electric fences have required more maintenance but have been equally effective in controlling cattle when compared to conventional fencing.

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of facilities such as greenhouses, research fields, laboratories, winter nurseries, and other research support. The financial and "lobbying" support of the several crop commodity organizations in North Dakota also is essential to the financial support received from the North Dakota Legislature as appropriated funds, from Congress, and from gifts and grants from private organizations.

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