Growth in Experiment Station Facilities, Land Holdings is Legacy of Lund Years

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H.R. Lund's years as associate director (1970-79) and director (1979-94) of the North Dakota Agricultural Experiment Station (NDAES) have been a period of physical growth for the station, both at NDSU and at off-campus sites.

During the Lund years, which span nearly a fourth of the history of the NDAES, research land holdings increased by 47 percent with the 1981 acquisition of the 5,283-acre Central Grasslands Research Center near Streeter and the 3,259-acre ranch unit of the Dickinson Research Center near Manning.

Agricultural research and teaching facilities also have grown by an estimated 65 percent during his tenure — and are seen by many as one of his administration's strongest legacies for North Dakota agriculture.

Lund, a builder by nature, became director of the NDAES at a time when changes in federal legislation, along with the growing influence of a U.S. Senator from North Dakota, were opening new opportunities for funding of agricultural experiment station facilities. This confluence of inclination and opportunity, plus a commitment to provide the best possible facilities for research and teaching, fueled Lund's quest to form federal, state and private funding partnerships.

During the 1970s and early 1980s, Lund was instrumental in planning and raising construction funding for Hultz Hall, Van Es Laboratory, the renovation of Morrill Hall, and the start of the plant science greenhouse complex.

The federal Food Security Act of 1985 amended the 1963 Research Facilities Act to provide additional opportunities for federal funding for agricultural experiment station research facilities. This act, along with the late Senator Quentin Burdick's influence as chair of the Senate Agricultural Appropriations Subcommittee and North Dakota's key role in U.S. agricultural production, led to new partnerships for NDSU and the NDAES with the federal government, and new state-of-the-art research facilities in the state.

The Supplemental Federal Appropriations Act of 1987 provided $7.76 million for construction of a crop and weed science research facility at NDSU. This facility, Loftsgard Hall, was completed in 1991 and was one of the first facilities funded by the federal government under this law. In subsequent years, the law was amended to require a 50-50 match.

Also funded and constructed during Lund's administration were the Research Extension Center at Hettinger, the $10.6 million Industrial Agriculture Communications Center (IACC), and a $923,000 NDAES Service Center/Pilot Plant. All received 50-percent federal funding.

The 6,700-square-foot Hettinger facility, with offices, an interactive TV classroom, meeting room and demonstration kitchen, was a funding partnership between the federal government and local support. The IACC, dedicated in 1993, is a facility for industrial agriculture and food science, and computer, technology

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Loftsgard Hall, housing faculty and research laboratories in the plant sciences, is one of the agriculture facilities constructed during Roald Lund's term as experiment station director.

and data services. The Service Center/ Pilot Plant, completed in 1991, provides space for maintaining and repairing agricultural research equipment, plus space where the agricultural researcher can expand research from the laboratory bench to pilot scale.

Among other facilities constructed during the 1990s were a Main Station farm shop and a beef housing unit, an addition to the Carrington Research Extension Center, a veterinary science barn, and a greenhouse range.

A number of other, related, agricultural facilities appeared on the NDSU horizon during this period. The USDA-Agricultural Research Service, the Northern Crops Institute (NCI) and the State Seed Department all constructed facilities on the NDSU campus during this period, including the $8.3 million USDA-ARS Northern Crop Science Laboratory in 1988; the NCI Feed Mill in 1990; the NCI Durum Mill, 1991; and the State Seed Department's Seed Research and Regulatory Facility in 1993. The NDAES, under Lund's administration, provided assistance in obtaining funding for a number of these facilities.

As Lund steps down as director to return to the faculty, planning is under way for several additional facilities: a proposed $10 million animal care facility to be funded through federal, state and industry sources; a 99,000-square-foot engineering and biomechanics facility; and a technology transfer center at the Williston Research Center. All are pending approval by the State Board of Higher Education and funding availability.

A Decade of Herbicide Treatments Controlled Leafy Spurge

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Picloram (Tordon) currently is the most effective herbicide for long-term leafy spurge control (5). Picloram at 2 pounds per acre has given 80 percent or better leafy spurge control for 27 months after application in North Dakota and for 36 to 48 months in Wyoming (1). However, picloram at high rates is often not economical to use on large infestations because the herbicide cost is eight to 10 times higher than the cash rent value of the land.

Leafy spurge control is enhanced when 2,4-D is applied with picloram (5,7). A tank-mix of picloram plus 2,4-D at 0.25 plus 1 pound per acre applied annually increased forage production 70 percent and reduced leafy spurge production 96 percent after three applications in North Dakota (6).

Picloram applied at 0.5 pound per acre or less generally does not persist in the environment (2,7,9). Thus, annual treatment with picloram at reduced rates plus 2,4-D is both more economical and less persistent than picloram applied at high rates every few years. The purpose of this experiment was to establish the number of annual treatments of picloram applied alone or with 2,4-D needed to provide 80 percent or better leafy spurge control for at least one year after application and to determine the optimum ratio picloram and 2,4-D rates to maximize synergism between the two herbicides.

The experiment was established at three locations in North Dakota and began on August 25, 1981 at Dickinson; September 1, 1982 at Sheldon, and on June 11, 1982 at Valley City. All locations had a dense leafy spurge stand with at least 85 percent weed cover. Dickinson had a loamy fine sand soil with pH 6.6 and 3.6 percent organic matter; Sheldon had a fine sandy loam with pH 7.7 and 2.1 percent organic matter; and Valley City had a loam with pH 6.7 and 9.4 percent organic matter. All treatments were applied annually except 2,4-D alone, which was applied biannually (both spring and fall) (Table 1). Picloram and picloram plus 2,4-D were applied in late August 1981 and in June of 1982 through 1993.

The Sheldon and Dickinson locations were discontinued following the fall evaluations in 1985 and spring evaluations in 1989, respectively. The Valley City site had received 11 picloram and picloram plus 2,4-D treatments and 22 2,4-D treatments prior to evaluation in June 1993.

Evaluations included data for the first four years from Sheldon and for the first six years from Dickinson. Thereafter only Valley City data are included. Evaluations were a visual estimate of percent stand reduction as compared to the untreated control.

RESULTS AND DISCUSSION

The first treatments to maintain 80 percent or better leafy spurge control for one year were picloram at 0.5 pound per acre applied alone or with 2,4-D for three consecutive years (Table 1 and Figure 1A). The total herbicide cost averaged $68 per acre excluding application costs (Table 1). Picloram at 0.5 pound per acre plus 2,4-D also was the first treatment to maintain 90 percent or better leafy spurge control for 12 months, which took four annual applications (Figure 1A).

The most cost-effective treatment was picloram plus 2,4-D at 0.25 + 1 pound per acre. This treatment took four annual applications to maintain 80 percent or better leafy spurge control or one year longer than the picloram at 0.5 pound per acre treatment (Table 1 and Figure 1A). However, the cost of these four treatments was only $48 which was $20 per acre less than three annual treatments of picloram at 0.5 pound per acre plus 2,4-D.

Table 1. The number and cost of herbicide treatments needed to provide leafy spurge control of 80 percent or better for at least 12 months. The experimental locations were Dickinson, Sheldon and Valley City, North Dakota from 1982 to 1993[a].

				Time and cost to 80% or better control	
Herbicide	Rate	Frequency Applied	Annual Cost	Treatment	Total Cost
	lb/A		$/A	no.	$/A
Picloram	0.25	Annual	10	10	100
Picloram	0.38	Annual	15	7	105
Picloram	0.5	Annual	20	3	60
2,4-D	1	Biannual[b]	5	NA[c]	50
2,4-D	1.5	Biannual[b]	7	NA[c]	70
2,4-D	2	Biannual[b]	10	NA[c]	100
Picloram + 2,4-D	0.25 + 1	Annual	12	4	48
Picloram + 2,4-D	0.25 + 1.5	Annual	14	4	56
Picloram + 2,4-D	0.25 + 2	Annual	15	4	60
Picloram + 2,4-D	0.38 + 1	Annual	17	4	68
Picloram + 2,4-D	0.38 + 1.5	Annual	19	4	76
Picloram + 2,4-D	0.38 + 2	Annual	20	4	80
Picloram + 2,4-D	0.5 + 1	Annual	22	3	66
Picloram + 2,4-D	0.5 + 1.5	Annual	24	3	72
Picloram + 2,4-D	0.5 + 2	Annual	25	3	75

[a] Sheldon and Dickinson locations were discontinued after 1985 and 1989, respectively.
[b] Applied twice per year in mid-June and late-August.
[c] 80 percent or better control not maintained for at least 12 months.

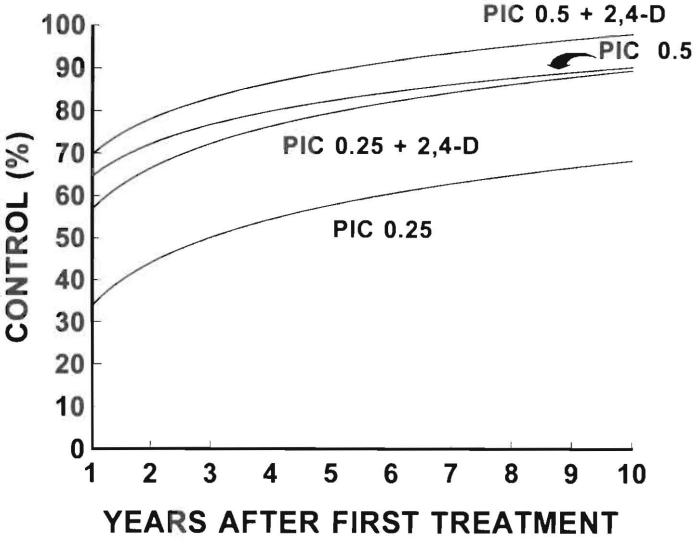

Figure 1A.

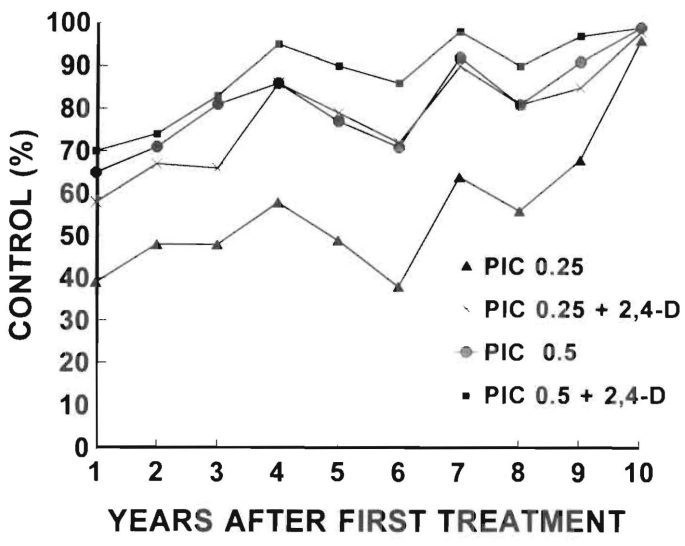

Figure 1B.

Figure 1. Long-term trend (1A) and year-to-year variation (1B) in leafy spurge control from picloram at 0.25 or 0.5 pound per acre applied alone or with 2,4-D annually for 10 years in North Dakota. Picloram plus 2,4-D data are averaged over 2,4-D rates of 1, 1.5, and 2 pounds per acre. Control was evaluated 12 months after each annual treatment.

The addition of 2,4-D to picloram at 0.5 pound per acre or less increased leafy spurge control compared to either herbicide applied alone. The magnitude of synergism decreased as the picloram rate increased. For example, 2,4-D applied with picloram at 0.25 pound per acre increased leafy spurge control an average of 20 percentage points each year (Figure 1A). However, the addition of 2,4-D to picloram at 0.5 pound per acre only increased leafy spurge control by an average of 7 percentage points.

Although leafy spurge control gradually increased over time (Figure 1A), the increase was not always visible year to year due to changing environmental conditions. For example, control declined in Years 5 and 6 for all treatments, which corresponded to the severe drought in 1988 and the subsequent growing season (Figure 1B). The region received less than 50 percent of normal precipitation in 1988, so grass species and other forbs provided minimal competition to leafy spurge and herbicide absorption and translocation were reduced during these dry growing conditions.

Year-to-year variation in leafy spurge control during a long-term management program should be expected. Herbicide treatment even during poor growing conditions sustains a control program better than skipping a year. Research at North Dakota State University has shown that two years of treatment are needed to make up the control lost from skipping one year of treatment.

Leafy spurge control increases when 2,4-D is applied with picloram at 0.5 pound per acre or less, but the 2,4-D rate is not critical for success (Figure 2). For example, picloram at 0.25 pound per acre applied with 2,4-D at 1, 1.5, or 2 pounds per acre provided similar control regardless of 2,4-D rate. Previous research has shown that control declines when the 2,4-D rate was less than 1 pound per acre (5), but increasing the 2,4-D rate above 1 pound per acre only increases cost, without improving control regardless of the picloram rate.

Biannual (twice per year) application of 2,4-D at 1, 1.5 or 2 pounds per acre did not achieve 80 percent or better leafy spurge control even after 10 years or 20 total treatments (Figure 3). Treatment with 2,4-D always provided short-term topgrowth control but only a small reduction in root density. This short-term reduction may allow pasture to be hayed and the forage utilized (8). However, cattle avoid grazing in areas with even a 10 percent cover of leafy spurge (3,4) so treatments that only provide short-term top-growth control do not result in normal utilization of available forage.

When reduced leafy spurge density is a primary objective, not just short-term topgrowth control, picloram plus 2,4-D at 0.25 plus 1 pound per acre would be the most cost-effective choice in most situations. To reduce the time needed to reach 80 percent or better leafy spurge control, a land manager could apply picloram plus 2,4-D at 0.5 plus 1 pound per acre the first year, and then reduce the picloram rate to 0.25 pound per acre plus 2,4-D in subsequent years.

Leafy spurge control must be considered a long-term management program. A land owner should attempt to contain present infestations to keep the weed from spreading and design a long-term

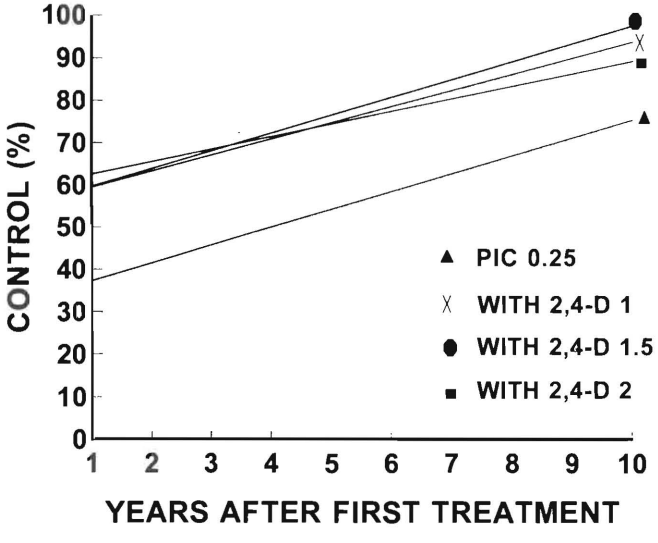

Figure 2. Leafy spurge control with picloram applied at 0.25 pound per acre alone or with 2,4-D at 1, 1.5 or 2 pounds per acre for 10 years in North Dakota.

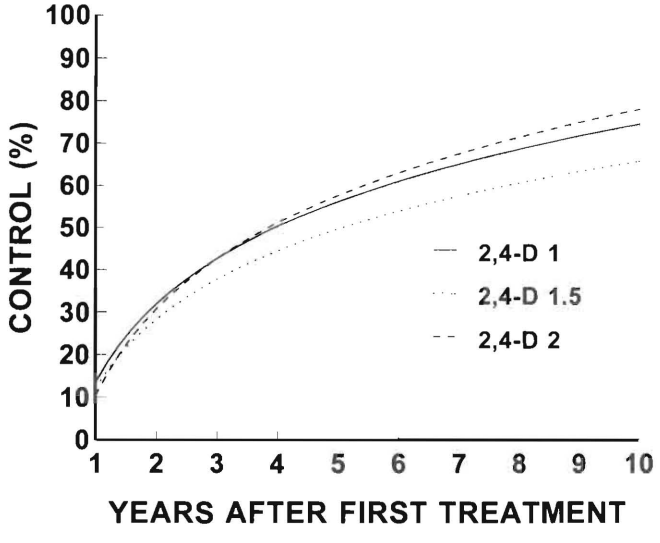

Figure 3. Leafy spurge control with biannual (twice per year) treatments of 2,4-D at 1, 1.5 or 2 pounds per acre for 10 years (20 total treatments) in North Dakota.

program to gradually eliminate dense infestations of leafy spurge. The well-established root system allows the plant to regrow from depths of 15 feet or more for several years. **No single treatment will eradicate this weed.** An annual treatment program provides the best long-term control. **Do not skip a year** until control reaches 90 percent or more; otherwise leafy spurge will reinfest rapidly (Table 2). After a high level of control is achieved, often only isolated patches remain. These patches can be spot treated, or a less expensive herbicide such as 2,4-D can be applied for one or more years to maintain satisfactory control.

Table 2. Longevity of leafy spurge control when an infestation is not retreated; a summary from many experiments conducted by North Dakota State University from 1963 to 1992.

Control 12 Months After Last Treatment	Years without Retreatment		
	1	2	3
	% control		
95 or more	85	70	<20
80	60	<20	0
70	<30	0	–
60	20	0	–

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