



NORTH DAKOTA
Farm Research

Bimonthly
Bulletin

Vol. 43, No. 1

July-August 1985



Guest Column

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In 1903, L.R. Waldron, agronomist and wheat breeder at NDSU, when referring to weeds said, "The price of clean land is eternal vigilance." Everyone who farms or gardens knows the importance of preventing weed growth to obtain maximum crop growth and to prevent weed seed production that would produce future weed problems. The words of L.R. Waldron are still applicable today. No new single application, magical herbicide or crop production technique has been developed to prevent crop losses from weeds.

Herbicides recently have helped control many weeds, increase crop yields, and make possible many changes in agricultural production practices. Early crop seeding, narrow row or solid-seeded crops, chisel plowing, reduced or zero tillage crop production, and direct combine harvesting would not be successful without herbicides. Further, herbicides have reduced the requirement for hand pulling and hand hoeing of weeds for crop production.

People often ask why weeds still cause crop losses with the widespread usage of herbicides. The answer to this question is multifaceted. Changes in production practices have offset some of the benefits of modern weed control. Reductions in hand weeding, delayed seeding, cultivation, and black fallow coupled with increased acreage per farm compared to the preherbicide era have all offset some of the benefits from modern weed control methods. Management systems and limited labor on large farms reduce the likelihood or economics of using hand labor to control weeds when herbicides do not produce 100 percent control.

Weeds surviving control treatments produce seed to increase the weed problem. Weeds produce many seeds per plant. For example, wild mustard produces about 2700 seeds per plant and wild mustard densities of 100 plants per square yard are common. If 99 percent control is obtained, leaving one wild mustard plant per square yard or 4840 plants per acre, the surviving plants would produce 13 million seeds per acre or 300 seeds per square foot. The number of these seeds that produce plants would be influenced by many agronomic production factors. Thus, weeds have been able to survive rather effective control strategies. Weed control methods are not 100 percent effective. As the infestation increases so do the number of weeds surviving a given treatment. However, even 100 percent weed control for a few years would not eliminate weeds because many weed seeds will live several years in the soil.

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On the Cover: An NDSU researcher examines a leafy spurge research plot. Leafy spurge currently costs \$13 million per year in lost production and control costs. This issue contains articles covering several aspects of weed-control research. Photo by J.J. Feight.



Vol. 43, No. 1

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A BIMONTHLY progress report published by the
**Agricultural Experiment Station,
 North Dakota State University of
 Agriculture and Applied Science**
 Fargo, North Dakota 58105
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 of Agricultural Experiment Station*
EDITOR
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The question often is asked, what is the economic loss from weeds? Many estimates have been made. The most accurate losses from weeds in North Dakota were obtained from preharvest surveys of crop fields conducted in 1978 and 1979. Average over years, 42.9 million bushels of wheat and 12.6 million bushels of barley **were not produced** in North Dakota because of seven weed species; foxtail (pigeongrass), wild oats, wild buckwheat, wild mustard, field bindweed, and Canada thistle. These losses were based on production statistics, survey weed populations, and competition data for the various weeds and their densities (plants/unit area) in wheat and barley. The yield loss from wild oats alone was 6,600,000 bushels of wheat and 4,200,000 bushels of barley, even though wild oats infestations in 1978 and 1979 were not unusually high. The wheat and barley yield loss from the seven weed species cost North Dakota \$153.9 million, assuming per bushel values of \$3 for wheat and \$2 for barley. The wheat and barley yield loss from only wild oats was \$28.2 million. The total loss from weeds in North Dakota would exceed \$300 million when crops besides wheat and barley, pasture weeds, and the costs for weed control are added.

A recent unpublished survey of 1984 pesticide use in North Dakota indicates that 24,800,000 acres were treated with herbicides, assuming multiple applications and individual herbicides in a tank mixture separately. At \$3 per acre for **application only**, not including herbicide, annual cost in North Dakota would exceed \$67 million, assuming 10 percent of the herbicides were applied as tank mixtures as one application. The costs for different herbicides vary widely, but their cost for weed control in North Dakota would approach \$125 million for herbicides assuming \$5 per acre as an average herbicide cost, or approximately \$190 million for herbicides and additives. The usage of herbicides returns a benefit beyond their cost as yields would be reduced by more than 50 percent and weed population would increase without herbicide usage.

Wild oats or wild mustard at 100 plants per square yard cause a yield loss of about 35 percent in wheat. Wild oats at 35 plants per yard of sunflower row caused a 42 percent yield loss, and six wild mustard plants per yard of sunflower row caused a 14 percent yield loss. Data on competition are not available for all weeds, but kochia, field bindweed and Canada thistle are considered more competitive than wild mustard and wild oats on a per plant basis.

The total cost to control perennial weeds is lower than for the most common annual weeds like wild oats, because perennial weeds are not as abundant in fields of cultivated crops. Leafy spurge was estimated to cost \$12.9 million in 1982 for both forage yield reduction and control programs. The loss of wheat yield from field bindweed was \$12.4 and \$12.1 million, and the loss from Canada thistle was \$18.3 and \$18.8 million, in 1978 and 1979, respectively. However, the yield loss within densely infested areas frequently is higher from perennial than annual weeds. Also, the cultural and chemical control treatments must be

repeated once or twice per year for several years until the weed infestation is eradicated. The trend toward reduced or no-till crop production has been associated with an increase in perennial weed infestations. Perennial weeds cause high economic losses where they occur, and changing crop cultural practices mean that perennial weed control will be an increasingly important problem in the future.

Information on losses from weed infestations has been developed to help determine the economic return from various control treatments in the year of a given crop. The data from these experiments have not taken into account the importance of weed seed production which will increase future costs. Intensive research will be required on the biology of weeds and the population dynamics of weeds in various cropping systems in order to develop the most cost effective long term weed control system.

Further, information is needed on weed biology factors influencing herbicide action and control strategies for reduced inputs to crop production. Herbicide treatments provide an immediate solution to controlling weeds, but research on weed biology, biological control, and ecological aspects should lead to information to reduce total costs for weed control.

The development and use of herbicides has reduced crop losses from weed competition in recent years and has allowed certain crop production practices that would be impossible without herbicides. However, the great losses from weeds which still occur and the cost for control indicate a need for further research on weeds and their control. Further reductions in the losses from weeds requires the development of production systems incorporating weed and crop ecology, increased efficacy of herbicides through an understanding of environmental influences, and the development of new production systems (for example, reduced tillage). Research and control costs for weeds with limited infestations like spotted knapweed or weeds which are spreading will save production loss and cost for control in the future. Weed control research which would cause a 1 percent reduction of the \$300 million loss to weeds in North Dakota would be a \$3 million yearly benefit. The agronomic and economic significance of weeds to North Dakota is evident when considering that the losses from weeds in some years is nearly as great as the **total net farm income** for North Dakota, which was \$380 million in 1982.

Weeds have been and will continue to be the most important crop pest in North Dakota. Continued vigilance and research to develop better, and less expensive methods to control weeds must be continued or expanded because of the great potential benefit from research.

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NORTH DAKOTA STATE UNIVERSITY
of Agriculture and Applied Science
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Fargo, North Dakota 58105
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