MINNESOTA FEED SERVICE

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Minnesota's Seed Industry

Brian G. Gnauck and Dale C. Dahl

This article describes previously unestimated dimensions of the seed industry in Minnesota. Seed consumption and price trends for eight major farm crops are presented for 1949-64 with county usage patterns for 1964. Seed marketing firm specialization, function, sales size distribution, legal organization, and source of seed supplies are inferred from survey data.

The information and conclusions presented here are part of a more comprehensive study of the changing market organization and practices of those farm supply industries that manufacture and distribute feed, seed, fertilizer, and agricultural chemicals to Minnesota farmers.

Seed Consumption

Total estimated seed usage by Minnesota farmers in the production of eight major crops was 680 million pounds in 1964.[1] This usage represented a substantial decline from peak years in the early 1950's when an 820-million-pound usage was common (figure 1). The net decrease in total seed usage over the 1949-64 period resulted from substantial declines in wheat, oats, barley, rye, and flax seed consumption. Corn seed usage remained fairly stable over the period, while soybean seed consumption increased markedly.

Despite a declining trend in oat production, oat seed consumption, in pounds, led the seed poundage used for crops by Minnesota farmers throughout the period. In 1964 oat seed consumption ranked first in poundage consumed, followed by soybeans, wheat, and corn (figure 2).

These changes in seed consumption were accompanied by wide fluctuations in most seed prices paid by farmers over the 1949-64 period (figure 3). Only corn seed prices exhibited a generally rising trend, ending at a 15-percent greater price per pound in 1964 than in 1949. Except for flax and soybeans, seed prices held above the 1949 average until the mid-1950's and rose to near or above their 1949 average by 1964.

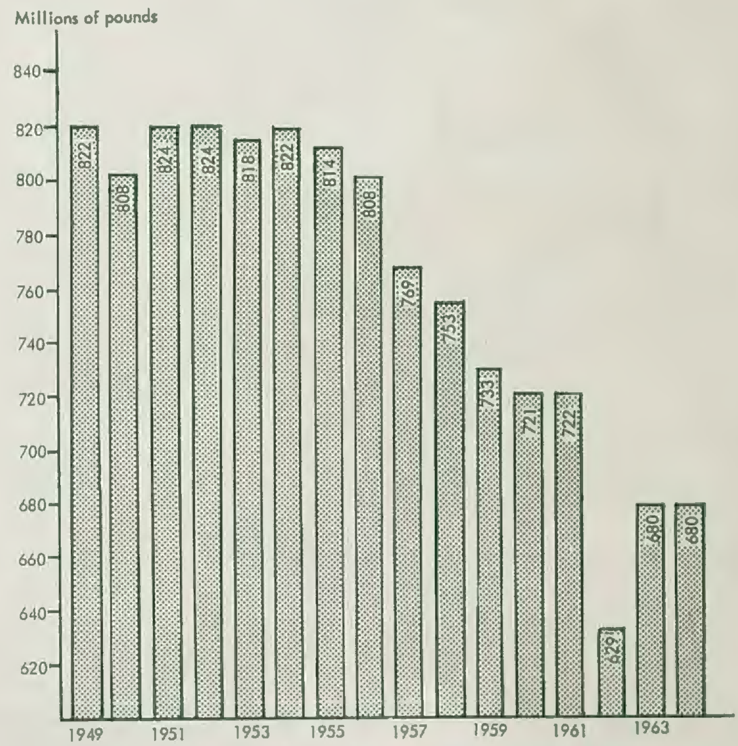

Figure 1. Total estimated seed usage for eight major Minnesota crops, 1949-64.

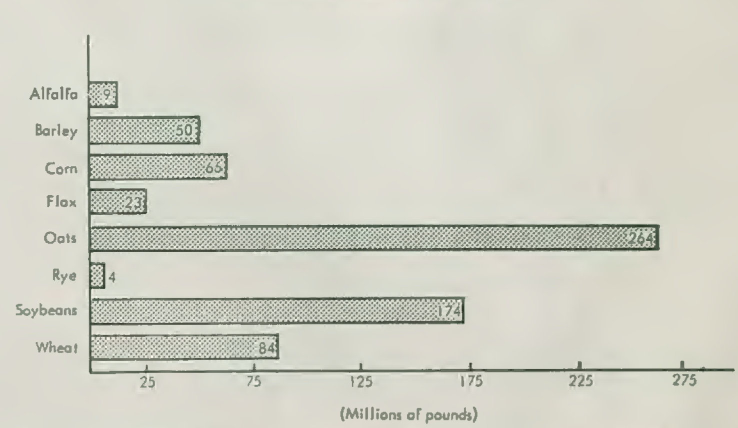

Figure 2. Estimated seed usage distribution among eight major Minnesota crops, 1964.

[1] Seed consumption estimates were made by applying average planting rates suggested by the University's departments of Agronomy and Plant Genetics, and Horticultural Science, to an estimate of planted acreages of alfalfa, barley, corn, flax, oats, rye, soybeans, and wheat as reported in annual issues of Minnesota Agricultural Statistics (State-Federal Crop and Livestock Reporting Service, St. Paul, Minnesota 55101).

Brian G. Gnauck is a research assistant, and Dale C. Dahl is an assistant professor in the Department of Agricultural Economics.

These price varations, in combination with the poundage variations discussed earlier, resulted in variations in total seed usage values from a high of $56 million in 1952 and 1955 to a low of $44 million in 1962 (figure 4). The 1964 seed value of $50 million for the eight Minnesota crops was comparable to the value recorded in 1949.

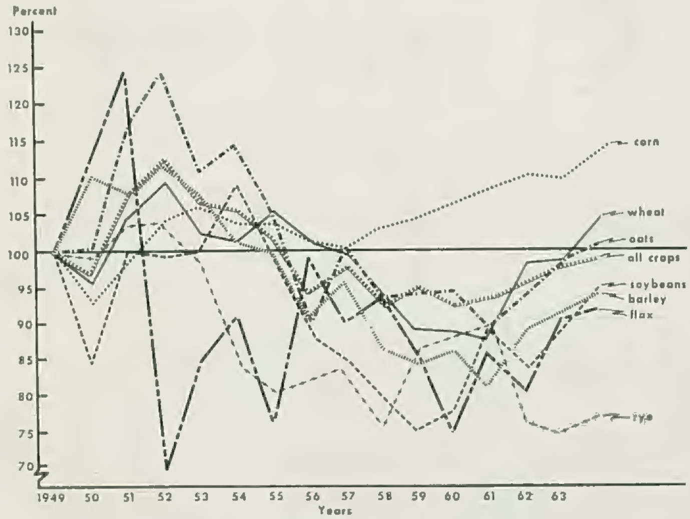

Figure 3. Index of seed prices paid for eight major Minnesota crops and their aggregate, 1949-64. The base period is 1949.

As one would assume, total seed consumpion was geographically related to crop production. Concentrated areas of crop production were the highest areas of seed consumption. Highest seed consumption was evidenced in the Red River Valley (figure 5). Six counties in the Red River Valley, including Otter Tail, Wilkins, Clay, Norman, Polk, and Marshall each had over 3 percent of Minnesota's total seed consumption. The highest seed consumption for an individual county was a 6.4-percent estimate for Polk County. On the map of the state, relative shares decreased moving from the Red River Valley to the southwestern and southern counties, to the east-central counties, and to wooded northeastern counties.

These several changes in seed usage, prices, and values resulted from a complex and interrelated set of market forces, many of which are tied to changing demand and supply relationships for the individual crops in their ultimate feed and food usages. Another contributing factor is an intensively competitive market situation among the seed firms involved in the assembly, cleaning, and distribution of seed to the farm market.

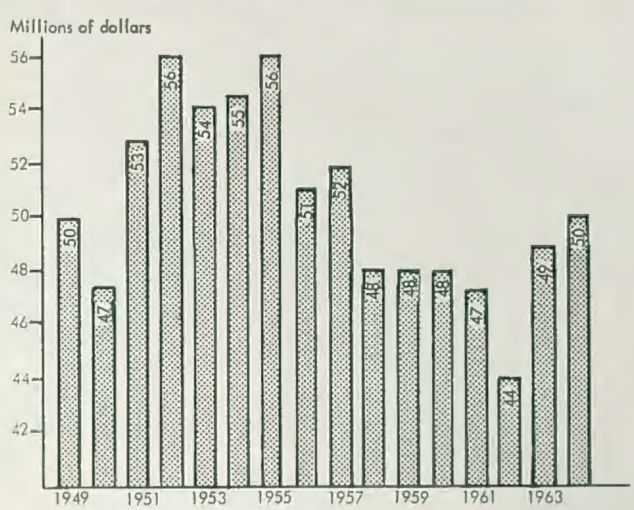

Figure 4. Estimated total values of seed used for eight major Minnesota crops, 1949-64.

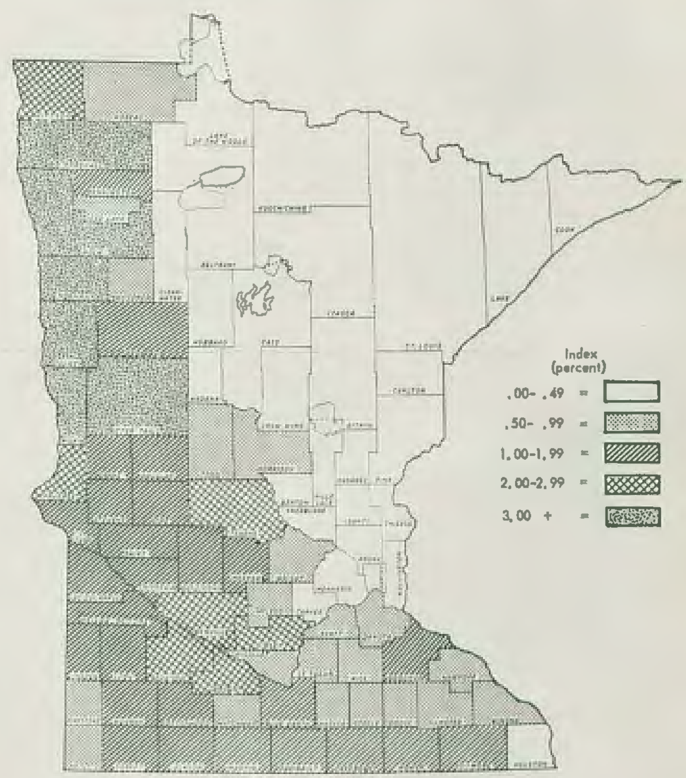

Figure 5. Total estimates of seed consumption concentration in Minnesota for eight major crops, 1964.

Seed Marketing

More than 1,800 firms in Minnesota spent all or part of their time in seed marketing and distribution in 1964. Seventeen percent of these firms handled only seed, but 45 percent dealt in seed, feed, fertilizer, and economic poisons (table 1). These product specialization ratios suggest that most of the firms included in the total are retailers rather than wholesalers and jobbers of seed.

Table 1. The nature and degree of product specialization in the seed industry, 1964

	Products handled in addition to seed			Percent of all firms
Seed				17
Seed	Fertilizer			3
Seed	Fertilizer	Feed		8
Seed	Fertilizer	Feed	Economic poisons	45
Seed	Fertilizer		Economic poisons	7
Seed		Feed	Economic poisons	9
Seed		Feed		8
Seed				3
			Total	100

Data limitations regarding the total group of seed firms did not permit a complete functional classification of all firms. To gain additional information on distributive function, a 10-percent random sample of the 1,800 firms were surveyed by mail questionnaire. Based upon the sample, 87 percent of the firms reporting were retailers, 9 percent were wholesalers, and 4 percent were jobbers.

Division of the firms according to their legal organization revealed that 40 percent were cooperatives and 60 percent were private firms (table 2). Private firms, rather than cooperatives, dominated the legal organization of seed firms at all levels of the marketing chain.

Table 2. Percentage distribution of firms in the seed industry by legal structure of the firm and position in the market chain, 1964

	Retailer	Wholesaler	Jobber	Total
	percents			
Cooperative	43	22	25	40
Private	57	78	75	60
Total	100	100	100	100

Annual sales of the private firms averaged about $38,000. The cooperatives were 37 percent larger, having a yearly average return of almost $60,000. Based on the sample return, the distribution of the firms was fairly equal at the higher sales ranges, but it deviated substantially at the lower sales ranges (figure 6). The highest sales firms in each class were relatively equal in size, the cooperative being about $1.4 million and the private firm $1.3 million.

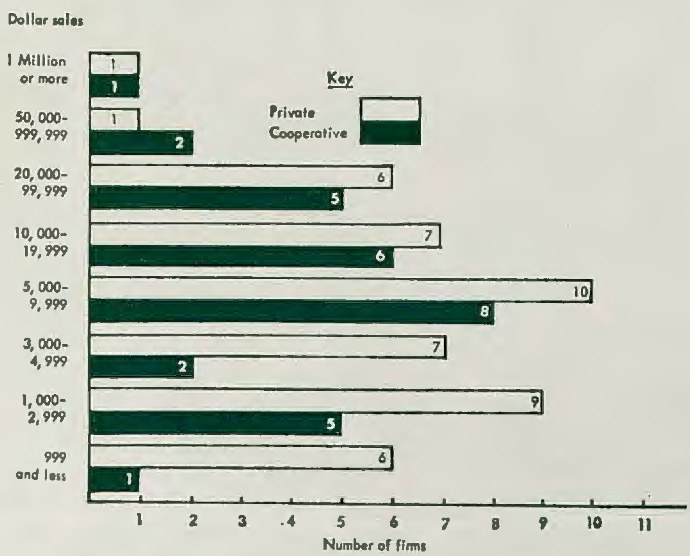

Figure 6. Sales size distribution of the seed firm sample by legal organization, 1964.

Comparison of the firms in physical terms (pounds of seed handled yearly) demonstrated no substantial deviation in size between cooperative and private firms. Cooperatives averaged about 343,000 pounds of seed a year, while the private firms handled 340,000 pounds.

One explanation for this deviation was that more of the cooperatives handled "high value to weight ratio" seed than did the private firms. Of the cooperatives reporting, 97 percent handled alfalfa seed and 92 percent handled clover seeds. The corresponding percentages for the private firms were 77 and 66 percent respectively.

In an aggregate sense, the most important sources of seed for the firms reporting were Twin Cities metropolitan wholesalers, although nonmetropolitan Minnesota wholesalers, outstate wholesalers, and farmers were all important seed sources.

The legal organization of the firm made little difference in the major seed source. In general, the "high value to weight ratio" seeds—alfalfa, clover, and vegetable seeds—were procured from Twin Cities wholesalers. One explanation for this is that high investment requirements are associated with contract seed production in these crops. Since the major source of these seeds, in a geographical sense, is California, Oregon, and Washington, it may well be that only the large Twin Cities wholesaler can support the contract growing and marketing cost associated with such distant production.

Farmers represented the major source of seed in the "low value to weight ratio" seeds. In general, farmer-to-farmer or farmer-to-retailer sales transactions are typical in oats, flax, and rye seed.

Both cooperatives and private firms, as retailers, secured most of their corn seed from Twin Cities wholesalers. This probably reflects a desire to acquire specific hybrids which only the larger wholesalers have developed.

Outstate wholesalers were the major seed source of wheat and flax seed.

Summary

In an aggregate sense, seed consumption in Minnesota represents a large annual expenditure in farm business operations. Eight important farm seeds consumed in the state in 1964 were considered in this study. In a geographical sense, the Red River Valley was the highest total seed consumption area. Over 1,830 firms met consumption demands for farm seeds.

Using dollar sales as a measure of size, the cooperatives were, on the average, larger than the private firms. There seemed to be little relation between the legal structure of the firms and the distribution of firms within the market chain. In general, Twin Cities wholesalers were the most important source of seed in the state. Alfalfa and clover, the "high value to weight ratio" seeds, were the most commonly handled. In addition, fertilizers, feeds, and economic poisons were the most commonly handled complementary products. Farmers and the nonfarm public represented the major outlets for these products.

COMING EVENTS

Minnesota Nutrition Conference—September 12, 13, Capp Towers Motor Hotel, 1313 Nicollet Ave., Minneapolis. For programs and registration forms write: Department of Agricultural Short Courses, University of Minnesota, St. Paul, Minnesota 55101.

National Barrow Show—September 12-15, Austin.

Fall Field Days—September 13, Southwest Experiment Station, Lamberton; 14, Southern Experiment Station, Waseca; 15, West Central Experiment Station, Morris.

Beef Cattle-Grassland Field Day—September 22, Agricultural Experiment Station, Rosemount.

SUSPENSIONS: High-Analysis Fluid Fertilizers

H. L. Meredith

Suspension fertilizers are the newest type of "fluid" fertilizers in our changing fertilizer industry; they were introduced into Minnesota recently. The term suspension is given to liquid fertilizers which contain a suspending agent such as clay.

Why add clay to fertilizers?—A "clear" liquid fertilizer is a water solution containing dissolved fertilizer salts. If an excess of fertilizer salts is added to a given amount of water, settling or "salting out" results. Thus, a maximum amount of fertilizer can be added to a given amount of water. One of the shortcomings of liquid fertilizers has been low analysis. Or to put it another way, too much water must be hauled to the field to apply fertilizer.

The clay added to liquid fertilizers suspends small crystals of potash and other undissolved salts which prevents settling or salting out. The clay used is generally attapulgite, a silica-magnesium-silica nonswelling material. Attapulgite is elongated and fibrous-like and is generally referred to as lath-shaped. It appears the rigidity or suspension properties are imparted to fluid fertilizers due to the nature of attapulgite to form bundles of laths.

What is the difference between suspensions and slurries?—A definite and concise agreement as to the definition of suspensions and slurries is as yet unresolved. The fertilizer industry may speak of suspensions and slurries interchangeably. It may be preferred, however, to apply the name suspensions to those fluid fertilizers containing a suspending agent such as clay which prevents settling of the undissolved fertilizer materials. The name slurry may be applied then to a fertilizer material containing solids in a liquid which requires continuous agitation to keep the solids from settling out.

How are suspensions made?—A base suspension grade such as 11-39-0 from wet-process phosphoric acid or 12-40-0 from electric furnace acid is used. The base suspension material is an ammoniated superphosphoric acid which contains about 3 percent clay. Superphosphoric acid is derived from a concentrated 54 percent (P_2O_5) phosphoric acid solution to the range of 70-72 percent for wet-process acid or 83 percent furnace grade acid. The ammoniated superphosphoric acid can be stored in mild steel. Potash salts and nitrogen solution can then be added in the desired amounts to give a wide assortment of grades.

A comparison of grades made from clear liquids and suspension fertilizers is given in table 1.

Other grades as 3-10-30, 9-18-27, 7-14-28, 10-10-30, and many others are also available through a suspension fertilizer program.

A serious limitation of clear liquids has been the inability to add high rates of potash without severe "salt-out" problems. Suspensions offer the opportunity for high potash grades while retaining most of the advantages of liquid mixed fertilizers.

Micronutrients have been added to suspension fertilizers and herein appear to offer considerable promise. Sulfur as flowers of sulfur and zinc as zinc oxide have been added as high as 9 and 5 percent respectively on the elemental basis. Other tests have been conducted by adding micronutrients to a 15-15-15 suspension fertilizer, as indicated in table 2.

Table 2. Micronutrient composition of a 15-15-15 suspension fertilizer

Micronutrient	Percent of element in product
No micronutrient	——
Sodium borate	0.35
Copper sulfate	1.20
Iron sulfate	1.20
Manganese sulfate	0.34
Zinc sulfate	3.60

Table 1. Comparison of fertilizer grades made from clear liquids and suspension fertilizers

Ratio*	Liquid	Suspension†	Increase in plant food with suspensions over liquids (percent)
3 : 1 : 0	24-8-0	27-9-0	12.5
2 : 1 : 0	22-11-0	26-13-0	18.2
1 : 1 : 0	18-18-0	21-21-0	16.7
1 : 1 : 1	8-8-8	15-15-15	87.5
1 : 2 : 2	4-8-8	9-18-18	125
1 : 3 : 1	7-21-7	10-30-10	43
1 : 3 : 2	4-12-8	9-27-18	125
1 : 3 : 3	3-9-9	7-21-21	133

* Ratio refers to $N:P_2O_5:K_2O$.
† Grades made from 12-40-0 base suspension.

APPLICATION EQUIPMENT REQUIRED

Suspension fertilizers are not as free-flowing as liquid fertilizers. Therefore, a gravity field applicator is not satisfactory. Squeeze pumps mounted on grain drills or rowcrop planters provide an adequate means of application of suspensions at planting. The squeeze pumps force the fertilizer through flexible tubes and ensure even and accurate metering of suspensions. Equipment is likewise available for broadcasting suspension fertilizers through flooding-type nozzles.

ADVANTAGES OF SUSPENSIONS

1. Suspension fertilizers reduce the necessity of transporting unneeded water which would be required for clear liquid-mixed fertilizer grades.
2. Fewer refills are required, thereby saving valuable time when using suspension fertilizers at seeding.
3. More acres are fertilized from a given sized nurse tank.
4. The cost of suspension is lower than the cost of clear liquids because of the reduction in volume of handling. This reduction closes the cost gap between mixed liquids and dry fertilizer grades.
5. Micronutrients can be added at rates needed without difficulty of uniform application.
6. High potash grades can be applied in suspension grades.

H. L. Meredith is agriculturist, eastern test and demonstration branch, Division of Agricultural Development, Tennessee Valley Authority, stationed at the University of Minnesota.

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Salmonella in Feeds

M. L. Hamre

THE GENUS SALMONELLA is a group of micro-organisms known to be involved with both animal and human diseases for many years. The salmonellae comprise a large genus, made up of nearly a thousand species or serotypes of these bacteria.

While all salmonellae are considered pathogenic by public health authorities, only a few serotypes characteristically produce noticeable symptoms of disease. Perhaps the most widely known of these are *Salmonella typhi*, the cause of typhoid fever in man, and *S. pullorum* and *S. gallinarum*, the cause of pullorum disease and fowl typhoid in poultry.

Diseases in animals caused by other serotypes are generally called paratyphoid. Salmonellosis is the general term used for human diseases caused by serotypes other than *typhi* and *paratyphoid*. Cultures of salmonella have been isolated from many animal species, including man, livestock, fowl, dogs, cats, reptiles, and rodents.

Control Programs

Programs for control of specific serotypes have shown that a concentrated effort to minimize the hazards of these organisms can be successful. The National Poultry and Turkey Improvement Plans are good examples. These plans, administered by official state agencies and USDA, have been very effective in the control of pullorum disease and fowl typhoid.

The incidence of typhoid fever in humans in this country fell steadily from 1946 to 1963, but reports of paratyphoid and other salmonelloses increased more than 20 times. In these cases of the control of a specific serotype, the methods of transmission were determined and a program outlined to restrict the spread of the disease. Increased awareness of bacterial problems and improved diagnosis have and will continue to result in reporting more cases of salmonellosis, although reporting is still quite inconsistent and incomplete.

Feeds May Be Contaminated

During the past few years several reports have shown that feeds and feed ingredients are frequently contaminated with salmonella organisms. Until recently the relationship between contaminated feed and infections in animals has received little attention. While many feed industry leaders have recognized the problem and worked toward means to minimize feed contamination, a considerable amount of effort is still needed to eliminate these organisms from some of our feeds.

The Food and Drug Administration (FDA) can be expected to pay increased attention to feed mill sanitation and prevention of contamination with organisms such as salmonella. While animal and marine protein products have been blamed for much of the salmonella contamination, failure to exercise the basic principles of sanitation in feed processing operations is a contributing factor in the spread of these organisms.

At a recent conference the food and drug commissioner stated that FDA intends to take whatever action is necessary to break the cycle of transmission of salmonella so that these organisms will disappear from the "most wanted" list of organisms dangerous to public health. Strong emphasis on cleanliness and avoidance of contamination must receive even more attention by the feed industry.

Animal and marine protein products are initially processed under conditions that normally result in a salmonella-free product. Recontamination after processing is considered to be the major source of salmonellae found in these products. Contamination of other feed ingredients likely occurs through the use of contaminated storage and transit containers, spreading by rodents and birds, airborne transfer within processing areas, and lack of a good sanitation program in ingredient-handling areas.

Surveys to Gain More Information

A USDA survey is being conducted to obtain more information on the presence of salmonellae in feeds and feed ingredients. The Animal Health Division of the Agricultural Research Service, in cooperation with the states involved, will sample feeds and ingredients from basic feed manufacturers in 26 states. Minnesota is one of the cooperating states, and 24 mills will be included in the survey of this state.

Samples of finished poultry, swine, and cattle feeds will be randomly selected from these plants. The sampling will also include grains and their mill products, plant proteins, animal proteins, and marine protein ingredients. Samples will be coded and findings on a plant basis will be kept confidential. Plant mangers will be given the results of samplings taken from their feeds and ingredients.

When the results of the survey are compiled, a better picture of the prevalence of salmonellae in feeds and ingredients should be obtained. A comprehensive survey of this type will also provide data on where contamination of the feed occurs in the manufacturing process.

The Animal Health Division is also conducting a sampling program with rendering establishments in the state. Their goal is to sample all rendering plants six times during a 6-month period. The data obtained will be helpful in developing procedures to eliminate salmonellae contamination of animal protein products produced in these plants.

Feeds Can Be Salmonella-Free

All possible steps must be taken to reduce the possibility of feed being implicated as a source of salmonella in our livestock and poultry production enterprises. Leading manufacturers have found that a strict quality control program reduces the contamination levels in their finished feeds. In many instances the pelleting of feeds has been shown to be effective in reducing the number of salmonella recoveries made from finished feeds. Feeds can be formulated with salmonella-free ingredients, but not always on the most economical basis. Once a salmonella-free product has been produced, it must be protected from recontamination until it reaches the ultimate consumer. □

M. L. Hamre is assistant professor and extension poultry specialist.

Controlling Canada Thistle

Gerald Miller

CANADA THISTLE is a serious problem that merits the attention of every landowner in Minnesota. A perennial weed, Canada thistle persists because of an extensive root system that grows more than 10 feet deep and spreads 12 to 15 feet in a year. The roots grow new shoots from root buds.

Also, Canada thistle is widespread by seeds. A tuft of hair attached to each seed enables the wind to carry it for many miles. So, to prevent reinfestation it is essential that Canada thistle be controlled on noncropland as well as in crops. Canada thistle now infests about 1.5 million acres in Minnesota and costs Minnesotans at least $25 million annually in reduced crop yields and weed control expenses. Studies show that yield reductions can be quite serious. For example, stands of 2, 12, and 25 thistles per square yard caused small grain yield losses averaging 16, 36, and 60 percent.

CONTROL PRACTICES

Because of Canada thistle's growth habits, an effective control program must: (1) prevent seed production, (2) kill the underground parts, and (3) prevent reinfestation by seedlings. Specific control practices depend on the degree of infestation and how the infested area is used. Control practices also differ for small dense patches and light to moderate infestations over large areas.

Control of Patches

Patches of Canada thistle can be controlled on noncropland or cropland with nonselective chemicals that require the loss of crop production for 1 or more years. These chemicals usually eliminate 95 to 100 percent of the thistle stand. Table 1 lists nonselective chemicals, rates, and approximate costs for patch control.

Table 1. Nonselective herbicides for Canada thistle control

		Approximate cost	
Chemical	Lb./acre*	Per acre	Per sq. rod
Amitrole	4	$ 23	14¢
Picloram	2	40	25
2,3,6-TBA	15	45	28
Dicamba	8	60	38
TBP-2,4-D	15	75	47
Fenac	15	82	52
Sodium chlorate	800	140	87

* Rate listed is of active ingredient or acid equivalent broadcast.

Gerald Miller is assistant professor and extension agronomist.

Amitrole can be used on dense patches of thistles with loss of crop only during the year of treatment. It is somewhat less consistent than the other chemicals in table 1; some strains of Canada thistle appear to be resistant to this chemical. When sprayed on Canada thistle in the bud stage at 4 pounds per acre in 40 to 60 gallons of spray per acre, amitrole usually reduces thistle stands about 90 percent. If applied in the spring prior to the bud stage, root kill may be slight. Therefore, spring treatments before cropping have not been as effective as later treatments.

Tillage and Mowing

Nonselective chemicals are usually not practical for controlling thistles in large areas because of costs and crop loss. But farmers with thistle-infested fields diverted from crop production have an excellent chance to eliminate thistles while their land is out of crop production. Tillage may be effectively used in this situation or for patch control in combination with chemicals.

Because of its deep underground root system, Canada thistle is more effectively eliminated with chemicals than with tillage. Since much of the root system is below the plow layer where it cannot be reached by tillage operations, little of the root system is killed by exposure to freezing or drying at the soil surface. Therefore, repeated destruction of top growth by tillage is used to kill the plants by depleting the food stored in the roots. To continually reduce the food supply, top growth must be destroyed when it reaches 2 to 3 inches. Once plants are 2 to 3 inches tall, a few additional days of growth allow the thistles to rapidly replenish food reserves and defeats the purpose of tillage.

Mowing may prevent seed production by Canada thistle. But mowing is not as effective as tillage or chemicals for eliminating thistles. To prevent seed production Canada thistle must be mowed by the late bud stage or very early flowering. If flowers are open for only 8 to 10 days, seeds will already be mature enough to germinate and produce new seedlings.

Once Canada thistle patches have been eliminated, thistle seedlings must be controlled for many years. Seeds in the soil may continue to germinate for 20 or more years. And new seeds may blow in from uncontrolled plants. Seedlings can be controlled with 2,4-D.

After-Harvest Treatments

After-harvest treatments of tillage or 2,4-D applications are essential to reduce thistle regrowth in cropland. Rates of ¾ to 1 pound per acre of 2,4-D are effective in fall treatments. If tillage follows, it should be delayed at least 2 weeks after treatment. Because of the late harvest of corn, after-harvest treatments may not be possible. But after-layby treatments of 2,4-D may be used in corn to suppress thistle regrowth.

A well-planned program combining chemical and cultural practices can free Minnesota farms of Canada thistle. But each control practice and chemical application must be faithfully carried out on time. **Note: "Controlling Canada Thistle," Extension Bulletin 329, has greater detail; it is available from your county agent.**

Agricultural Extension Service
Institute of Agriculture
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LUTHER J. PICKREL, director
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