# The North Central Quarterly

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# The Status of Minnesota's Dairy Industry

J. W. Rust

The Minnesota dairy industry is at a critical crossroad. There are some concerns about the health of our industry in the state and in the midwest. There appears to be a need to better understand the forces of change and how they impact the industry's profitability and the competition Minnesota dairymen have with other regions of the country.

Agriculture accounts for 33 percent of all goods produced in Minnesota. Twenty percent of the agriculture income is from dairying. There are about 20,000 dairy farms in Minnesota that produce nearly 11 billion pounds of milk per year and generate $1.3 billion of farm sales. It is estimated that the total economic activity generated by the dairy industry adds up to about $2.3 billion when we include the added value from processing, transportation, feed, equipment and other services related to the industry. The Minnesota dairy industry supports around 20,000 families on farms and 20,000 additional families are involved in the various supporting services.

Minnesota has ranked number 4 in milk production among the states for many years. Recently, however, Minnesota's share of the national market has slipped from 8.0 percent in 1973 to 7.6 percent in 1984, while California's and Wisconsin's share of the market has increased and New York is holding their own. These trends appear to be continuing through 1986 and 1987. Pennsylvania, Texas, Washington, Florida and Idaho have also increased their milk production in recent years.

Minnesota has some important advantages to many other regions for producing milk. There is a plentiful supply of competitively priced feeds. Family owned farms are operated with little hired labor. There are areas where other systems of farming are limited because of climate, soil or topography. We have a plentiful supply of fresh water and adequate rainfall. Many dairy farm families in Minnesota place a high value on farming as a way of life and most have a good work ethic.

With these advantages, why is Minnesota losing some of its competitive advantage in production? Recent studies have reported the cost of producing milk in Minnesota to be higher than many other places in the United States and returns on investments are lower. Some factors thought to contribute to these lower economic returns are lower production per cow, small herd size, diversified dairy farms, marginal quality and inadequate hay forage crops. Many herds are too small to profitably utilize many of the newer technologies. Diversified enterprises typical of the midwest require greater investment per cow and create competition for labor and management skills. Prices received for milk in Minnesota are lower due to the distance from large population centers and the pricing system of the federal marketing order.

The annual increase in milk production per cow in Minnesota has been about 142 pounds of milk per cow per year during the 1980s. Incidentally, the rate of increase in the northern part of Minnesota has been above the state average. The rate of increase in Minnesota is below the United States average of 234 pounds and considerably below states such as Washington with 535 pounds increase and California, Pennsylvania and Wisconsin which had increases of 310, 314 and 201 pounds respectively. If these rates of increase continue through the year 2000, it is estimated that the average production per cow in the Pacific Coast area will be well over 20,000 pounds while Minnesota cows will be producing around 14,000 pounds.

What can we do to change this trend and remain competitive? There are some things that we can't change; such as market location, the cold weather requiring more expensive housing and rainfall at haying time. There may be opportunities to increase production per cow and yields of quality forage. No doubt there are proven methods and technology which have not been adopted in all cases as well as new technologies which will come on the scene that would aid in greater and more efficient production if they are adopted. A high level of management will be required to reduce costs of production wherever possible. Government policies and consumer consumption of dairy products will have an effect on the price received for milk and thus the dairy farmers profit.

Minnesota has certain advantages which we can exploit. These would include low feed costs compared to some areas of the country, the potential to produce abundant quality forages, a good image and location for a growing cheese market, a well developed marketing structure and a commitment and tradition for dairying.

## Alfalfa Substitute May Improve Forage Economics

David L. Rabas, Agronomist

Alfalfa is without question the perennial forage species of choice for Minnesota livestock producers. Dairy producers in most areas of Minnesota depend on alfalfa as a major protein and energy component of their rations. For a large number of Minnesota livestock producers, growing alfalfa is not an available option for their high quality forage needs. Alfalfa is not well adapted to the climate, soils and harvest conditions present on many Minnesota farms. Wet, acid soils, high lime prices, unfavorable weather conditions during harvest, traditional harvest time concepts and a lack of haylage storage facilities have eliminated alfalfa as a legume of choice. Farmers who desire a legume for forage have turned to other perennial legume species to supply part of their stored forage needs.

University researchers have conducted a number of research studies to identify and evaluate potential "alfalfa substitutes" for use by farmers. At the North Central Experiment Station researchers are taking a new look at birdsfoot trefoil as a forage legume species. Trefoil is a long-lived, acid and wet soil tolerant legume with acceptable production economics.

The traditional seeding problems of limited seed supply of improved varieties and very poor seedling vigor have been solved. Long-standing trefoil problems still remain, however. Trefoil is much more difficult to establish than other forage species. Trefoil is not very competitive during the establishment year and invasion of new seedlings by broadleaf and grass weed species is common.

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Visitors at NCES view birdsfoot trefoil research plots.

Research to develop more successful trefoil establishment practices has been conducted at a number of sites throughout northeastern Minnesota. This research has identified well-prepared, firm seedbeds and chemical weed control or summer seeding following timely tillage for weed control as absolute requirements for successful trefoil establishment. Trefoil is a very small-seeded legume. Seed must be placed in firm moist soil within one-half inch of the surface to insure germination and survival.

Control of competition during establishment is essential. Quackgrass must be eliminated. Fall application of glyphosate prior to fall plowing or late summer and fall tillage to eliminate quackgrass is necessary for spring seeded trefoil. Chemical control of annual broadleaf and grass seeds is also required for spring trefoil seedings. Research at this station and on on-farm sites has demonstrated that summer seeding of trefoil may be a more desirable practice for many farmers. It may reduce the need for chemical weed control if frequent timely tillage is practiced prior to seeding to eliminate quackgrass and other perennial weeds.

Birdsfoot trefoil may not be a forage legume species of choice for many Minnesota farmers, but it may be an acceptable alfalfa substitute for some.

# Blueberry Snow Depth Studies

**David K. Wildung, Horticulturist**

Snow is important in the winter protection of blueberry plants in northern Minnesota. Without snow protection Minnesota cultivars may be damaged at temperatures in the -25 to -35 degree F range during midwinter. With adequate snow protection these plants will survive and be productive. In order to understand the importance of snow depth and its effect on blueberry plant survival and productivity, the following field study was conducted during the winters of 1985-86 and 1986-87.

During both winters snow was removed or added to simulate snow depths of 0 to 6 inches, 6 to 12 inches, 12 to 18 inches or 18 to 24 inches. Plants of the cultivar Northblue, planted in 1983, were used in this study. Whole plant and individual branch data were taken on flower bud development, winter dieback, flowers developed, fruit set, fruit harvested and berry size. Temperatures were collected in the various treatments to evaluate the effect of snow depth on plant environment.

The first question we wanted to answer was how much protection does snow provide? The minimum recorded temperatures for the 1986-87 winter are given in Table 1. Temperatures in the 18 to 24-inch snow depth were recorded at 0 inches, 3 inches, 9 inches, 15 inches and 21 inches above the ground. Snow does provide good winter protection. Temperatures on the ground (0 inches) were from 50 to 53 degrees warmer than the air temperature (+18 degrees F compared to -35 degrees F). Even at 15 inches above the ground (snow from 3 to 9 inches deep) temperatures were over 20 degrees warmer than the air temperature (-11 degrees F to -35 degrees F). It is also seen that as the length of the cold period increases temperatures within the snow also continue to drop slowly. Thus after a prolonged cold period, as often occurs in the winter, temperatures in the snow will be much warmer than the air temperature but will continue to drop slowly. The daily fluctuation in temperature in the snow is also much less than in the air. Snow offers much insulation protection to the plants against the cold minimum temperatures as well as against large daily temperature changes.

The next question we wanted to answer was how does the depth of snow affect the winter survival of the plant itself? We found that with snow cover of from 0 to 6 inches the blueberry plants suffered more than 80 percent dieback of wood. There was 30 to 60 percent winterkill when the snow protection was 6 to 12 inches deep and from 9 to 18 percent winterkill when the snow protection was over 12 inches deep. Despite the severe dieback of over 80 percent, all plants in the 0 to 6 inch treatment have survived and have shown excellent regrowth. By the end of the growing season following winter damage regrowth and flower bud formation have been as good or better than plants protected in the other treatments. The same effect has been evident both years of the study. These results show that blueberry plants can be severely damaged when there is a light snow cover (0 to 6 inches), but that the plant is capable of recovering. Further, a snow depth of over 12 inches is necessary to reduce the amount of winter dieback significantly. As the plants get older and larger the minimum amount of snow necessary for plant survival may increase.

The final and most critical question we wanted to answer was how the snow depth affected fruit production. Tables 2, 3 and 4 summarize the effect of snow depth on fruit yield, berry size and berry number following both winters.

As Table 2 indicates, total fruit yield per plant was very low on plants protected with only 0 to 6 inches of snow. This fact was to be expected when the plants suffered more than 80 percent dieback and nearly all of the fruit buds were winterkilled. The other three snow depth treatments showed no statistical difference in total yield. Total yield at the 6 to 12-inch snow depth was highest both years (4.4 pounds in 1986 and 3.0 pounds in 1987). The high yields for the 6 to 12-inch treatment were surprising because of the 30 to 60 percent winter dieback we noted on individual plants in this treatment. Visible winter dieback was evident with the 6 to 12-inch snow depth. Most of the fruit that developed was 6 inches or lower, whereas fruit on the 12 to 18-inch and 18 to 24-inch snow depth treatments developed higher on the plant (in some cases, 18 inches off the ground). Yields remained high on the 6 to 12-inch treatment even with the amount of winter damage that occurred. In order to understand what was happening with these treatments we further examined the two main factors contributing to fruit yield: berry size (Table 3) and berry number (Table 4).

In 1986, individual berry size was significantly greater at the shallower snow depths (Table 3). Individual fruit harvested from the 0 to 6-inch snow depth treatment averaged over 2 grams each (2.14 gm) compared to only 1.19 gram per fruit for the 18 to 24-inch snow depth. At 6 to 12 inches, berry size averaged 1.63 gram and was significantly different from the other treatments. Table 4 shows that berry number was increasing as snow depth increased. There was a reduction in berry number due to winter damage with each reduced snow depth. The decrease in berry number per plant (1736 to 1222) accounts for the visible differences we saw in fruit set on the plants. However, with the reduced berry number per plant we were also seeing a corresponding increase in individual berry size resulting in the similar final

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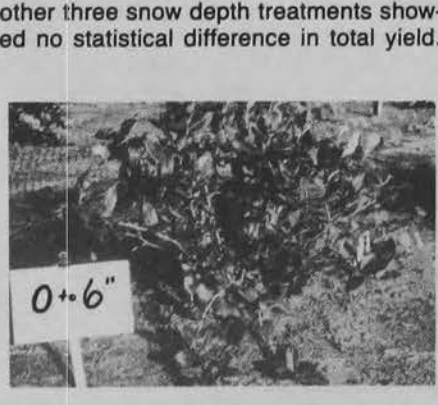


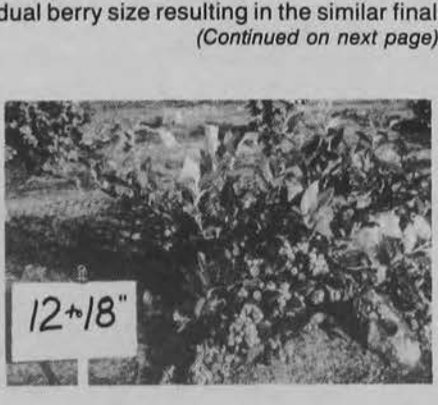

yields we obtained. From these results the plant appears to have the ability to compensate for loss in berry numbers by developing larger berry size. The increased berry size can dramatically increase overall plant yield. With the 0 to 6 inch snow depth an even larger individual berry size was seen (2.14 gram), but berry numbers were so reduced by winter damage that total yield was almost nothing (0.2 pounds per plant).

Table 1. 1986-87 minimum winter temperatures (degree F).

| | | With 18 to 24 inches of snow cover<br>Inches above ground | | | | |
|---|---|---|---|---|---|---|
| | Air | 0 | 3 | 9 | 15 | 21 |
| 1/24/87 | -35 | 18 | 13 | 1 | -11 | -14 |
| 1/25/87 | -34 | 16 | 12 | 4 | -11 | -25 |

Table 2. Northblue fruit yields following snow depth treatments (yield in pounds per plant).

| Snow depth (in.) | 1986 | 1987 |
|---|---|---|
| 0 - 6 | 0.2 b* | 0.1 b |
| 6 - 12 | 4.4 a | 3.0 a |
| 12 - 18 | 3.8 a | 2.3 a |
| 18 - 24 | 4.4 a | 2.6 a |

* Mean separation within columns by Duncan's multiple range test, 1% level.

Table 3. Northblue berry size following snow depth treatments (size in grams for the season).

| Snow depth (in.) | 1986 | 1987 |
|---|---|---|
| 0 - 6 | 2.14 a* | 2.00 |
| 6 - 12 | 1.63 b | 1.83 |
| 12 - 18 | 1.23 c | 1.62 |
| 18 - 24 | 1.19 c | 1.72 |

* Mean separation within columns by Duncan's multiple range test, 5% level.

Table 4. Northblue berry number following snow depth treatments (plant yield divided by berry size).

| Snow depth (in.) | 1986 | 1987 |
|---|---|---|
| 0 - 6 | 43 | 29 |
| 6 - 12 | 1222 | 738 |
| 12 - 18 | 1455 | 756 |
| 18 - 24 | 1736 | 684 |

Fruit berry numbers during the 1986 season on the 12 to 18-inch and 18 to 24-inch treatments appeared to be too heavy (Table 4). Individual berry size of 1.23 and 1.19 gm is small for the Northblue cultivar (Table 3). Plants in these treatments probably should have had fruit removed for maximum size and yield development. In other fruits, such as apples, biennial or alternate year bearing can occur when fruit set is too heavy. This appears to have happened in this experiment. Following the heavy fruit set in 1986, reduced flower bud development occurred on these treatments. Reduced flower bud development would result in less fruit set and a smaller number of fruit developing during the next season. Berry counts from the 1987 season (Table 4) show this did happen. Berry counts for the 18 to 24 inch treatments were reduced much more (1736 to 684) than they were for the 6 to 12-inch treatment (1222 to 738). In 1987, there was very little difference in berry number between the 6 to 12-inch, 12 to 18-inch and 18 to 24-inch treatments (738 to 684) and differences in berry size were fairly small (1.83 to 1.62 gm) and not unusually low because of heavy fruit set as they were in 1986 (Table 3). The 0 to 6-inch treatment again exhibited severe dieback and significantly reduced berry numbers and total yield.

This experiment is being repeated this winter. 1987 fall flower bud counts for all treatments were nearly equal. If the blueberry plant does become biennial in its bearing habit and the plants in the deeper snow treatments survive this cold winter, we may see fruit set patterns similar to the 1986 growing season. The implications of these fruit set patterns and determination of proper fruit density require further study.

These snow depth studies have shown us the importance of snow in blueberry plant winter survival. A minimum of 12 inches of snow would appear necessary to insure good blueberry production in northern Minnesota or against winter minimums of -30 F and colder. Snow depths less than 12 inches may result in some reduction in yield while snow depths less than 6 inches may result in nearly total loss of production.

Other on-going blueberry hardiness research is evaluating the effect of various row covers such as polyethylene, Reemay, nylon net, burlap and Agronet on blueberry survival. Future research involving Dr. Jim Boedicker, Agricultural Engineer, will explore several systems for harvesting and moving snow to help insure plant survival. The ultimate goal will be to develop simple cost effective systems to insure good blueberry production for northern Minnesota producers in winters when snow depth is shallow.

# Fungal Sapstain in Cut Logs and Lumber

F. Thomas Milton

*About the Author: Tom Milton is a University of Minnesota state extension specialist based at NCES, whose expertise is in forest products. Tom is well acquainted throughout the state with sawmills and other manufacturers. His publication "Forest Products Marketing Bulletin" is distributed extensively throughout the United States. Portions of this article were published previously in the FPMB.*

Freshly cut logs and lumber can be stained or discolored by fungal infections or chemical reactions. Fungal stains are considered more widespread and damaging than chemical stains. The word sapstain usually refers to fungal stains, however it is often used to refer to any type of log or lumber stain.

Blue stain and sapstain are terms often used interchangeably to refer to a dark bluish discoloration that occurs on freshly cut lumber or logs. While the most common discoloration is blue, sapstain can be light to dark gray, light to dark brown, black, red, pink, orange, purple or yellow. As the name implies, sapstains generally affect only the sapwood.

The most common log and lumber stains are caused by stain fungi which are minute, threadlike plants that feed on the sugars stored in wood cells. Sapstains, along with mold fungi and decay fungi, comprise the three families of fungi that damage wood.

Mold fungi, like sapstains, are essentially limited to the sapwood, but usually do not discolor wood as deeply as sapstain fungi. Mold fungi produce unsightly surface growths that can generally be surfaced off. If mold is present, it indicates that conditions are favorable for sapstain and wood decay to develop also.

Decay fungi, unlike sapstains and molds, feed on the cell walls of wood and attack both the heartwood and sapwood. This can cause substantial strength losses, but takes longer to develop. Any lumber stored for long periods in favorable conditions should be suspect and checked for decay, especially if appreciable amounts of stain or mold are present.

Because sapstain fungi feed mainly on the food stored in the wood cells and not the wood itself, sapstain does not affect the wood's strength. The wood's toughness

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and shock resistance will be reduced if stained extensively. Wood that has been stained will soak up moisture much more readily than unstained wood.

Sapstain can be present and not show. Lumber sometimes may be perfectly bright on the surface, but when it is surfaced, the underlying wood may be appreciably stained. This is referred to as interior stain and is particularly objectionable to remanufacturers. Interior staining occurs when lumber becomes infected by stain fungi just before the surface is dried or chemically treated. Inside the lumber, where wood has not been affected by external conditions, the stain fungi can continue to grow as long as adequate moisture remains.

There are four conditions stain fungi need to grow: 1) suitable temperature; 2) air (oxygen); 3) adequate moisture; and 4) a food source (wood). The ideal temperatures for stain fungi growth are from 75 to 85 degrees F. Stain fungi cease growth at temperatures below 32 degrees F or above 100 degrees F. For stain to develop the wood must have a moisture content of more than 20 percent but less than fully saturated and the stain must be in contact with air (oxygen). Thus, stain cannot grow in logs submerged in a pond or kept wet under a continuous spray system since the water prevents the stain access to oxygen and also cools the logs. Wood, once dried and kept dry will not stain. However, untreated, dry wood will stain, mold and decay once again if the wood's moisture content rises above 20 percent and the temperature is suitable.

Sapstain is not the year-round problem in Minnesota that it is in the southern United States. However, sapstain can cause serious degrade and profit loss in otherwise high grade lumber during warm, humid weather in Minnesota. Sapstain can lower the value of a high-value board by 50 to 75 percent. The most stain-prone species are white pine, basswood, birch, maple and aspen.

Rapid air drying or prompt kiln drying can reduce or prevent sapstain on fresh-sawn lumber. When rapid drying cannot be achieved, then anti-stain chemicals should be applied immediately. A second article in a following issue will deal with control of sapstain.

## Robert F. Nyvall

The question is often asked or may be put in the form of a statement that since winter is here things must be slow at the Experiment Station. Far from it. Now is the time of the year when last summer's data is tabulated, meetings are attended and preparations are well underway for next summer's research. Personally, this may be the busiest time of the year for me with correspondence to take care of, meetings to attend, personnel to review, reports to write, together with the numerous day to day activities.

We are currently conducting searches for our marketing position and our post doctorate in wild rice research. These searches require a great deal of time but must be carefully conducted to insure hiring the best possible person and to conform to University affirmative action policies. Hopefully we'll have people hired by spring. Dr. Dave Rabas and Dr. Dave Wildung have been very active in these searches and have put in a great deal of time. Both of these positions will be funded for two and a half years by a grant from Blandin Foundation. I'd like to take this opportunity to thank the Foundation for their generous support of these important positions.

The City of LaPrairie was concerned that contamination may have occurred in homeowner's wells due to the Station's use of pesticides and fertilizers in research projects. Samples from wells have been taken over the last two years by the Minnesota Pollution Control Agency and by a private consulting firm that specializes in pollution. The results were no chemicals were found in any wells. No pollution or contamination occurred over the several years research was conducted. We have ceased all research activity for the last two years on this property and do not intend to pursue research there in the future.

Not all research occurs in the summer. Dr. Jim Boedicker is currently involved in research on swine housing and Dr. Howard Hoganson is working on forestry-related computer programs. The livestock continue to function in ongoing experiments for Dr. Joe Rust.

Because employees of the Station may not always have an opportunity to know what the various departments are doing in the way of research, various faculty have been giving seminars on their research. This gives everyone on the station an opportunity to know what's going on.

Shortly after this newsletter comes out all station personnel will undergo CPR and emergency first aid training.

While on the way to Grand Rapids from St. Paul, the station car I was driving stalled on the highway. This particular automobile has had a mind of its own on several other occasions. Since it is a high mileage vehicle and has a temperament of a mule we've had all the reasons we need to trade it in for a new station car. Automobiles can be frustrating!

Sometime this spring we will have a sale of several items from the station that are no longer needed. Further information on what, where and when will be issued later.

A quick word — Visitors Day is July 21, Horticulture Night is August 31 and an All-Class Reunion for the North Central School of Agriculture will be Saturday, July 23.

## North Central Alumni News

The North Central Alumni Association met on January 26. At the meeting we decided to make the All-Class Reunion this year the best we have ever had. The Reunion will be held on Saturday, July 23, 1988, at the Sawmill Inn in Grand Rapids. We have also decided to have a dance, so we are on the lookout for some music.

I will be attending a School of Agriculture Alumni meeting in St. Paul on April 30. This meeting will involve alumni from all the Minnesota Schools of Agriculture and should provide more information for our North Central Alumni Association.

Alumni who are on our mailing list will soon be receiving a letter on the upcoming class reunion. Please help us by returning your registrations early. Remember, we are inviting all employees, former employees and instructors to attend the reunion.

Do you know any alumni who have not attended a class reunion? Please try to encourage them to come. If you have addresses of any alumni that have not received our notices, send them to me.

If you have any questions, or suggestions, or other information about alumni, or the All-Class Reunion, please send them to me. Tom Carpenter, 1861 Highway 169 East, Grand Rapids, MN 55744

COMING EVENTS

Visitors Day, Thursday, July 21
All Class School of Agriculture Reunion, Saturday, July 23
Horticulture Night, Wednesday, August 31

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