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Soil Acidification for Blueberry Production

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The following article is an excerpt from a paper published in The Proceedings of the 6th North American Blueberry Research Workers Conference. David Wildung is Professor and Horticulturist and Kay Sargent is Assistant Horticulture Scientist at NCES. Dr. Carl Rosen is an Associate Professor in the Department of Soil Science in St. Paul. Contact Dr. Wildung for a reprint of the complete article.

Blueberry plants thrive on acid, well drained sandy loam or loamy sand soils with high organic matter content. The optimum soil pH for Minnesota cultivars is from 4.5 to 5.5 but plants have been grown successfully on soils with a pH up to 5.8. Soil organic matter contents of from 3 to 15 percent are considered optimum while coarse sandy soils with low organic matter should be avoided. Altering soil pH can be done successfully by addition of sulfur or by using acid peat as a mulch, working it into the soil or adding it to the planting hole at the time of planting.

In Minnesota, the first commercial blueberry plantings were established in 1983. Since 1985 commercial blueberry planting has increased dramatically. Currently most of the blueberry production in Minnesota is marketed through pick-your-own or local marketing channels. While many of the native soils in northeastern Minnesota are acidic and support native lowbush blueberries, the soils near the Twin Cities area with the greatest potential for pick-your-own marketing are not as favorable either being too alkaline, too heavy or both. Even in sites that have suitable soil pH, the soil organic matter content may be low and would benefit from the addition of organic matter. This study was initiated to determine the long term effect of sulfur and acid peat on soil pH and blueberry plant development.

The study was established at a grower cooperator farm in Anoka County, northwest of the Twin Cities area. Normal cultural practices were followed and all plots were irrigated with solid set irrigation. The following soil acidifiction treatments were applied to a sandy loam soil containing 0 to 3 percent organic matter at an initial pH of 7.0.

- Check - no soil amendments added - planted in 1984
- Dispersul* 84 - soil amended in 1984 - planted in 1984
- Peat 84 soil amended in 1984 - planted in 1984
- Peat plus Dispersul - soil amended in 1984 - planted in 1984
- Dispersul 85 - soil amended in 1984 - planted in 1985
- Peat 85 - soil amended in 1984 - planted in 1985
- Peat plus Dispersul 85 - soil amended in 1984 - planted in 1985

*Dispersul (90 percent sulfur)

Northblue blueberry plants were planted in 1984 or 1985 as listed above. Initial soil pH samples were taken in 1984 prior to soil amendment treatment application. Soil pH sampling, plant height, plant spread and plant vigor ratings have been taken each year since 1984 and fruit yields have been recorded since 1986.

By fall 1984 the soil pH of Peat and Peat plus Dispersul treatments had dropped to below 5. This drop was fast and well within the acceptable range for optimum blueberry plant development and in 1989 was still at a level acceptable for plant development. Initially it was felt that peat would provide a fast pH drop, which it did, but that over time the Dispersul in the Peat plus Dispersul treatment would continue to lower soil pH and ultimately react most favorably. This effect has not been evident in soil pH changes over time.

The Dispersul treatment reacted more slowly with a slight decline by fall 1984. Since the drop was only to pH 6.6 a second application was applied in the fall 1984. By fall 1985, the pH had declined to 5.5 where it has remained since. At pH 5.5. blueberry growth and development generally were not optimum.

There was no change in soil pH by fall 1984 for the Check treatment. Since 1984 the soil pH declined to 6.2 and has ranged up to 6.5 in 1989. The soil acidity in the Check treatment has never been close to what blueberry plants need for satisfactory growth and development. The slight decline in soil pH was probably due to utilization of ammonium sulfate as the nitrogen fertilizer source.

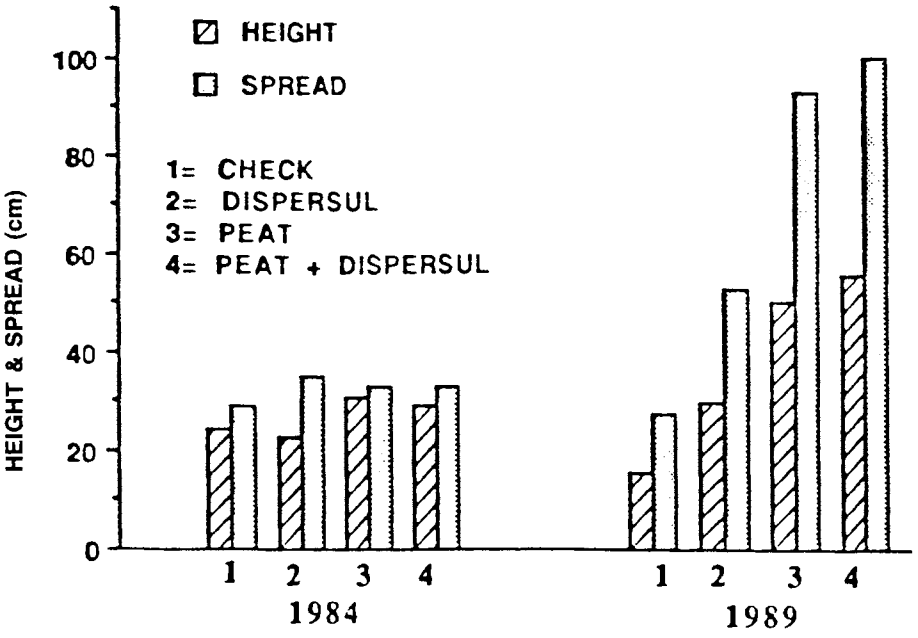
Plant growth at the end of the first growing season was already significantly affected by the soil amendment treatments (Figure 1). Plants growing in the Peat and Peat and Dispersul treatments were much larger. By 1989, 80 percent of the plants in the check treatment had survived while 95 percent of the plants in the other treatments survived. Check plants were small, had low vigor, were chlorotic and produced very little fruit.

Four-year old blueberry plants showing Peat plus Dispersul vs Check treatments.

The plants in the Peat and Peat plus Dispersul treatments produced good crops in three of the four years of the study (Table 1). In 1987 the planting suffered considerable winter injury and crop yields were not significantly different. The effects of soil amendments on fruit production were immediate and similar during the three production seasons. These results indicate that in a sandy loam soil with high pH (7.0) and low organic matter (0-3 percent) Northblue blueberry plants will grow and produce best when the soil is amended with acid peat and sulfur (Dispersul). Amending soil with peat and sulfur provides immediate benefits, a good soil media for growth and is of long duration. Application of peat alone is also beneficial. The addition of

(continued on next page)

FIGURE 1. EFFECT OF SOIL AMENDMENTS ON PLANT HEIGHT AND SPREAD



sulfur alone did not provide an adequate growth media for the plants even though the soil pH was reduced to a pH of 5.5. While it is suggested that planting be delayed one year after soil amendments are added, this study does not seem to show any benefit in waiting if peat is used. If sulfur only is used, planting should be delayed until the desired soil pH is reached.

The addition of acid peat to a sandy loam soil does more than reduce the soil acidity and improve organic matter content. The peat can provide a mulch which will be a better rooting media for the blueberry plants, will allow for better water holding capacity of the soil, assist in buffering alkaline irrigation water to maintain soil acidity, and help keep a sandy soil cooler during the summer, providing a better root-temperature environment for the blueberry root system. With plentiful peat supplies available in Minnesota, it should be utilized more frequently in blueberry production management.

Table 1. EFFECT OF SOIL AMENDMENTS ON FRUIT PRODUCTION (grams per plant)

	1986	1987	1988	1989	Four Year Average
Check	18	4	4	23	14
D 84	50	32	73	127	68
P 84	368	50	654	813	472
P plus D 84	576	45	776	1848	813
D 85	10	4	18	50	23
P 85	4	14	545	962	359
P plus D 85	50	36	422	1208	427

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Wild Rice Doesn't Look Right

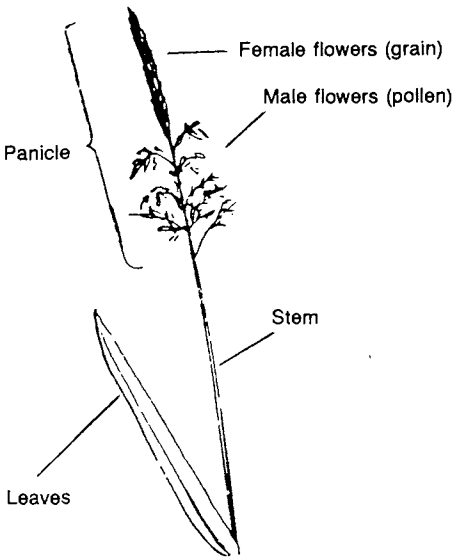
Henry J. Schumer

It's true, some of the wild rice growing at NCES doesn't look right, but that's good.

If you were to walk past our research plots in July and August or look in on our winter greenhouse experiments, you would notice a difference in appearance of some of the wild rice heads (panicles). Normally wild rice plants produce a monecious type of panicle, which means the head contains separate male and female flowers. The female florets which develop the grain being superior or above the male florets that produce the pollen (Fig. 1).

The difference in appearance of some of the heads is due to the fact that they are all female, there are no male florets (Fig. 2). These plants are called pistillate and are considered male sterile. In a cross pollinated crop, such as wild rice, this male sterile characteristic is very important to the plant breeder. Before a genetically male sterile population was created, all cross

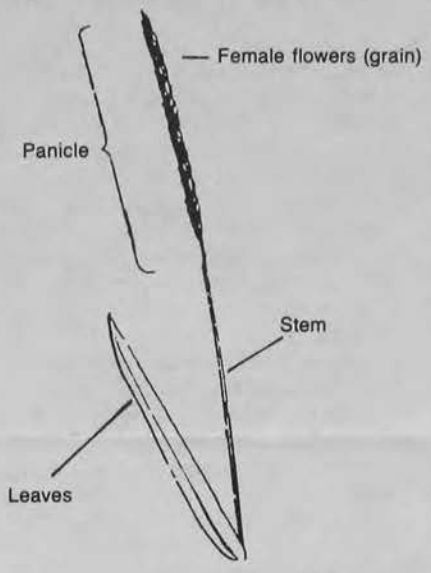
Fig. 1. Normal wild rice head.



breeding experiments would require the physical removal of male florets from one breeding line to insure only pollen from the second breeding line was used to fertilize the first line. In practice this emasculation process involved hand stripping of the male florets and was very labor intensive. Through the utilization of genetically male sterile lines field crosses can be conducted at an accelerated rate, on a larger scale, with reduced labor costs.

In the July 1989 **Quarterly**, announcement was made of the release of the **Pistillate M3** germplasm population by the University of Minnesota. **Pistillate M3** is medium in height, medium to late in maturity and is high yielding. It segregates in a one to one ratio for the pistillate plant type. Seed is maintained at NCES, but is not intended for commercial use as a variety without approval of the Minnesota Agricultural Experiment Station. It is most useful

Fig. 2. Pistillate wild rice head.



to prospective plant breeders to use in hybridization.

Wild rice plants with pistillate type heads are not only important for their male sterile qualities, they also have the potential for increased yields. In our experiments dealing with the pistillate head type we measured the panicle length and counted the number of female florets per head. The results revealed some interesting and useful information. Pistillate panicles are the same length as normal panicles, including male florets, and pistillate heads contain twice as many female florets (grains) as a normal head. We could expect, in theory, pistillate heads to yield two times more grain than normal heads; but to date, our field trials have demonstrated only a 15 to 55 percent increase in yield.

Our genetically male sterile populations may not look right, but they have opened new avenues for rapid and greater advancement in wild rice varietal improvement.

The **MIDWESTERN VEGETABLE VARIETY TRIAL REPORT** for 1990 summarizes statewide vegetable variety trials from Michigan State University, Purdue University (Indiana), Ohio State University, University of Kentucky, University of Illinois and the University of Minnesota.

The cost of this publication is $7.00 per copy (including postage) and is available upon request from Dr. David Wildung, University of Minnesota, North Central Experiment Station, 1861 Highway 169 East, Grand Rapids, MN 55744-3396.

COMING EVENTS

Minnesota Paddy Wild Rice Conference.. ....March 7 & 8

Visitors Day.....July 18

All Class Reunion.....July 20

Horticulture Night.....August 28

New Faces at North Central

Daniel R. Brown

The North Central Experiment Station has initiated a project investigating the requirements and feasibility of angora goat production in northern Minnesota. On an annual basis, 20.8 million dollars of mohair is produced in the U.S. and mostly exported. This is one example of an animal agriculture product not typically considered as part of northern Minnesota's economy. There is a limited but unexplored market potential for this commodity. Animal and economic survival has been questioned and this has hindered angora goat introduction to this region.

The angora goats have been involved in nutritional studies at the St. Paul Sheep Research Unit for the past several years. We will continue the work started there as well as research housing, pasture management, health and marketing issues. Benefits the goats may have in brush control is another area of interest.

Angora goats are typically browsers doing well on range or brush type pastures. Texas produces 90 percent of the American mohair on their native range lands. An average doe will shear six pounds of mohair two times a year. The protein level of the ration dictates mohair quality and quantity. High protein consumption by the goats results in larger quantity and lower quality. While yielding less than the mature does, the initial shearings from kids at six months and one year command a significantly higher price due to the higher quality of the mohair.

An extensive housing requirement due to the extreme cold has been cited as a reason for these animals not being raised in this region. The cold we experienced at NCES in December and early January was met with anxiety as to how the goats would fare. On a maintenance diet and in straw bedded, cold sheds, the goats came through better than was anticipated. They did tend to stay inside more than usual, coming out to eat periodically but very briefly. With the younger replacement animals this is a concern, since they often have difficulty in consuming enough of the ration for proper growth.

Lower reproduction efficiency, parasites, coccidiosis, marketing of the males and predators are all problems to be addressed before evaluating this area's ability to obtain a market share of this commodity.

As this project identifies problems, solutions and advantages of mohair production in northern Minnesota it will expand the options for utilizing the resources available. Angora goats and other agricultural livestock not typical of this region can be well suited for the region once we learn the nutritional requirements and management techniques for a profitable enterprise.

Adult angora goats stand 2½ to 3 feet tall and weigh an average of 85 pounds.

Quarterly Report

Robert F. Nyvall, Superintendent

This is my last **QUARTERLY** article as Superintendent. I have resigned my administrative duties to resume research work effective April 1. My successor has not been formally announced as of this writing. I have enjoyed my tenure as an administrator but I am very anxious to resume research in several areas of plant disease.

Dr. Joe Rust officially retired as animal scientist effective January 1. At the present time there are no immediate plans to fill this position. This is due to a combination of University reallocation and the potential consolidation of animal research at all the branch experiment stations. We hope to have an active animal research program; however it is still to be resolved what proper "niche" the North Central Experiment Station will fill in this regard.

A new staff member recently joined the Station. Dr. Bailian Li is a forest geneticist who will be working on the aspen/larch project to develop genetically improved strains of trees. He will be working with scientists Gary Wyckoff and Egon Humenberger. Dr. Li completed his undergraduate studies in Beijing, China, and received his M.S. and Ph.D. from North Carolina State University. He and his wife Ann and 13-month old son Cory moved to Grand Rapids in January. The first night the Li family was here it was 20 degrees below zero, a definite change from North Carolina. We welcome the Li family to northern Minnesota. Even though the weather may be cold in the winter, the people are warm.

A new greenhouse and headhouse is currently being constructed to house the aspen/larch project. This marks the first construction on the experiment station in several years and is a welcome addition to our research efforts.

NCSA Alumni News

Tom Carpenter

The year 1991 is upon us and it hasn't started out too good, snow and below zero temperatures. But a wish for the year to get better is hopeful. By the time you receive this newsletter spring should be just around the corner and then it will be time for our All Class Reunion on July 20, 1991.

I have been trying to put together a fun and enjoyable time for all. We will have tours of Blandin Paper Company, the Forest History Center, Central School (downtown) and the Itasca Community College (so we can see their changes). All of these tours will be provided with transportation from North Central Experiment Station where an Open House will be held. The tours have all been scheduled from 1:00 to 3:00. They are all walking tours and will last about an hour each, so you will have to decide which one you would like to take. The final event of the Open House at North Central will be the entertainment of the Grand Rapids Sweet Adelines at 3:30 in the Davies Theater on ICC campus. We will then have free time until the party time (oh, and a short meeting) at the Sawmill. Hopefully we will have drawings for prizes throughout the evening.

I have received a few new names from lost Alumni that I have not been able to locate before. If you know of anyone who hasn't heard from us, please let me know so we can contact them and have a large turnout. At the last reunion in 1988, we had 192 at the banquet.

Grand Rapids is celebrating their 100-year anniversary this summer, so it will be an exciting place to visit.

Joe Rust Retirement

In December of 1964, Dr. Joe W. Rust accepted the position of animal scientist at North Central Experiment Station. He had previously worked at the St. Paul Campus of the University of Minnesota. Dr. Rust also served as the Superintendent of NCES from 1979 to 1985. After nearly 30 years of service to the University, on January 1, 1991, he officially retired. However, he is still stopping by the office to check the mail and messages and take care of some extension duties.

A retirement dinner party was held to honor Joe at the Sawmill Inn in Grand Rapids on December 1 and was attended by over 100 of his friends and colleagues. Joe has been active in many dairy and beef, youth, church and civic organizations in Grand Rpaids and throughout the state. He plans to continue much of his volunteer work and do some traveling in the future. All of us at North Central wish him many years of the best retirement.

Attending Joe Rust retirement party were, left, Dr. Rust, Mrs. Blythe Thompson, Dr. Roy Thompson, Assistant Director of the Minnesota Agricultural Experiment Station and Dr. Richard Goodrich, Head of the Department of Animal Science from St. Paul.

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