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SWINE NURSERY ENVIRONMENT RESEARCH AT NORTH CENTRAL

James J. Boedicker

Minnesota ranks as one of the nation's top states in the production of feeder pigs (at least 8-week old pigs weighing at least 40 lb). In Minnesota many feeder pigs are produced in total confinement. Over the last 10 to 20 years, a trend in the swine production industry here and elsewhere has been toward earlier weaning. Today, many producers wean pigs at 3 to 4 weeks of age and place them in nurseries until they reach a desired weight to be either sold as feeder pigs or transferred to a finishing unit. Earlier weaning permits more efficient use of farrowing facilities and allows sows to be rebred sooner.

A few years ago, swine research at this station shifted from a complete farrow-to-finish operation to a more concentrated program of research in sow herd management and feeder pig production. To accommodate this shift, existing swine facilities were remodeled and a swine nursery added. Presently, the station has a herd of about 90 sows farrowing over 1,600 pigs per year. The nursery addition contains four rooms, each with a design capacity of 64 pigs. In our system, pigs are weaned at 3 to 4 weeks old and moved to the nursery rooms where they remain for 4 to 5 weeks.

Early weaned pigs are more susceptible to disease, particularly pneumonia, than older pigs, and nurseries must be managed properly for pigs to remain healthy and grow quickly and efficiently. Two important aspects of nursery management are ventilation rate and temperature control. In hot weather, ventilation rates need to be high to remove excess heat and hold temperatures in check. In winter, however, rates need to be only high enough to remove moisture and other air contaminants. Presently, for pig nurseries, the Midwest Plan Service recommends a winter minimum continuous ventilation rate of 2 cfm

(cubic feet per minute)/pig for 12 to 30 lb pigs and 3 cfm/pig for 30 to 70 lb pigs. Temperature recommendations call for 85 degrees F for 3-week-old pigs, with a reduction of 3 degrees F per week to 70 degrees F for 8-week-old pigs.

In winter, pig nurseries have among the highest supplemental heating requirements of any animal confinement facilities. Ventilation, even at low wintertime rates, can account for more than 80 percent of the heat lost from such facilities. Supplemental heat is needed to maintain desired temperature any time sensible heat loss from the building exceeds sensible heat production by the animals. (Sensible heat is associated with temperature change; latent heat is associated with moisture evaporation.) Supplemental heating requirements and costs can be reduced by lowering minimum ventilation rate and/or temperature, but air quality will suffer.

Pneumonia outbreaks in young pigs are quite prevalent in Minnesota's swine production industry. Pneumonia costs state producers millions of dollars per year. Often, outbreaks are blamed on poor air quality caused by inadequate ventilation levels and/or

poor distribution. Unfortunately, however, the effects of these and other factors on disease development in nursery size pigs are not well understood.

To investigate the question of environment and pig performance, several trials have been conducted over the last three winters in the swine nursery at this station. The trials are part of a joint project involving personnel both here and at the Twin Cities Campuses in the Departments of Agricultural Engineering, Animal Science, Veterinary Medicine and Environmental Health and Safety. The project, funded in part by the National Pork Producers Council, is aimed at examining the effects of temperature, ventilation rate and air distribution on air quality, animal performance and health, and supplemental heating requirements. Air quality assessment is based primarily on relative humidity and concentrations of carbon dioxide, ammonia, and dust. When the nursery was built, each nursery room was provided with its own separately controlled heating and ventilation system. These rooms have proved to be ideal for conducting studies of this type under production-like conditions.

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REFORESTATION AND IMPROVED TREE PLANTING STOCK

Bill Cromell

The University of Minnesota North Central Experiment Station here at Grand Rapids is currently involved in 47 active tree improvement studies. These projects are cooperative efforts involving several organizations. The three main participants are the University of Minnesota College of Forestry, the University of Minnesota North Central Experiment Station and Blandin Paper Company. I have been actively involved in this work since 1957. Blandin Paper Company has always been deeply involved both in planning and finance. Presently the majority of this work is located on four sites provided by Blandin. Several of our projects that are now providing answers to some of our forestry questions are located on sites made available by Blandin in the late 1950s and 60s.

When I speak of tree improvement projects I am referring to the possibilities of improving tree species that are destined to be used for planting stock under all sorts of reforestation conditions. Forestry in this area has been slow in initiating programs that will utilize improved planting stock, but it appears resource managers now have made the shift to making improved stock a part of their reforestation plans.

One rapidly growing source of improved planting stock is by obtaining superior material produced in special seed producing orchards. In brief, a seed orchard can best be defined as a plantation established using seedlings grown from selected superior trees, isolated as much as possible to prevent pollination from outside sources. The orchard is cultured for early abundant production of seed. As the orchard grows, data is collected, evaluations are made and the inferior trees are removed in periodic thinnings. This method is not the solution to all of our tree improvement needs, but is one desirable way to upgrade planting stock. Our northeast area is beginning to move toward utilization of genetically improved stock; the last decade seems to indicate we are moving from research to development. This change is evident in the area of

seed orchards. Only 15 years ago Minnesota had only four acres that actually met the criterion for a seed orchard. In 1982 this had grown to forty acres and continues to increase.

In order to point out the production capabilities of a seed orchard I want to briefly review just some of the work that was involved in an existing producing white spruce seed orchard that the University of Minnesota and Blandin Paper Company established in 1967. For your information this orchard is located adjacent to County Road No. 76, on the south side, just beyond the Forest History Center entrance. In April of 1967, 4-year-old transplants raised in the Blandin nursery from selected superior trees grown from seed collected throughout the range of white spruce in Minnesota were hand planted. The collections provided sufficient stock for 30 single tree replications from 239 open-pollinated progenies. Each family was represented once in each block or replication for a total of 7,170 selected plants individually labeled during the lifting process from the nursery. A 95 percent

field survival was the end result for this planting. To date, two complete thinnings have been carried out with a partial removal of some families in 1984-85. This reduced the families to fifty, or about 1,800 trees. The final plan for this orchard will be 450 seed producers or approximately 190 stems per acre.

In order to illustrate the seed producing capacity of this white spruce orchard as a source of seed for future reforestation stock, I have a few average figures to present. Considering the trees have reached the cone producing age of thirty and a good cone year has occurred, a single white spruce tree will easily produce 250 cones. With each cone averaging about 75 seeds, each tree's production is about 18,750 seeds. With a goal of 450 seed producing trees for the Blandin orchard this translates into about 8.5 million seeds. To project this example still further, if the forest managers reforestation plan calls for an 8-foot by 8-foot spacing in the field, one acre requires 681 trees. If we assume that 40 percent of the 8.5 million seeds from



1962 White Spruce seed source study located on a Blandin site at Gunn Park, now providing scion wood for future grafted type seed orchards.

REFORESTATION Continued

the orchard eventually developed into plants, the 40 percent total would provide 3,400,000 superior plants; enough stock to reforest 4,993 acres using an 8-foot by 8-foot spacing.

In a study made eight years ago, 115,000 acres of productive type but non-stocked or understocked commercial forestland existed in Minnesota. These are the kind of acres that must be returned to production. These acres should be reforested with the best stock available. This is one of the key links necessary to keep pace with industry's need for increased wood volume.

The George Banzhof Consulting Firm made a study of Minnesota timber resources in 1980. This study is reason enough to accelerate tree improvement work along with more intensive management. The report states that from 1962 to 1977, Minnesota had an 11 percent reduction in commercial forest lands or a loss of 114,000 acres per year. Using this trend to predict what future losses might be by the year 2000, conservatively speaking, we can expect a loss of 47,000 to 75,000 acres each year. In brief, these losses can be contributed to urbanization, agriculture, lakeshore development, energy needs such as pipelines and powerlines, transportation and the never-ending demand for more recreational uses. This study clearly indicates we must grow more wood on less acres.

Genetically improved stock takes time, but improved materials are now part of the forester's plans. Improved stock coming on line leads to one final point. When superior improved planting stock is used in reforestation, the plan must include intensive management. This is the only way to offer the maximum return on the company's investment. With poor site selection, improper site preparation and hit-and-miss management, the return will be nil regardless of the genetic makeup of the stock. Improved stock and intensive management are becoming an absolute necessity for all reforestation.

The University of Minnesota College of Forestry, North Central Experiment Station, Blandin Paper Companies and other cooperators are proud to be

deeply committed to the job of increasing wood volumes. Our economy in Minnesota is becoming increasingly dependent on the forests and the wood industries. The vast tourism industry continues to grow and its forest related needs are compatible with good forest management. The two industries are inseparable.

SWINE NURSERY Continued

In one study, we compared two ventilation rates, 1.5 and 3 cfm/pig, for four weeks. Temperatures were the same in both treatments. Although the lower rate resulted in higher levels of relative humidity, carbon dioxide and ammonia; we found no difference in animal weight gain or feed efficiency. Relative humidity under both treatments increased over time as the animals grew and their moisture production increased. Dust concentrations initially were higher under the lower ventilation rate treatment, but by the end of the trial, these results were reversed. Apparently, high humidity levels limit dust generation and/or cause airborne dust to settle out faster. As expected, supplemental heat usage was substantially lower at the lower ventilation rate treatment.

In another trial, we compared rates of .5 and 2 cfm/pig. Also, in this trial, half of the pigs were penned with litter mates while the other half were mixed two times per week to test the effect of fighting and stress on performance. At the .5 cfm rate, temperature could not be controlled and hovered at 90 degrees from the second week, and relative humidity climbed to and remained at 100 percent for much of the 4-week period. Initially, ammonia and dust levels were higher at .5 cfm/pig rate, but by the end of the trial, results were reversed with high humidity at this rate appearing to repress both dust and ammonia levels. Carbon dioxide climbed to over 18,000 ppm at the low rate compared to only one fourth this level at the high rate. Also, at the low rate, the pigs, apparently trying to cool themselves, continually jockeyed for position under nipple waterers, and water use was much higher. Although feed efficiency was similar at both rates, feed consumption and gains

were lower at the low ventilation rate, but these differences could have been caused by temperature alone. There was little if any sign of health problems at either rate, and mixing had no effect on performance. Also, rooms at the low rate used almost no supplemental heat as compared to over 2,000,000 BTU/room for the high rate over the 4-week period.

The most recent trial was a study of the effects of cold inlet air drafts directly onto the pigs. Pigs under the draft seemed to eat more initially, but by the end of the trial, there was little difference in gains or feed efficiency between the draft and the control treatment. Pneumonia is sometimes blamed on drafts, but we found no evidence of pneumonia in this trial.

If anything, trials to date have shown that healthy early-weaned pigs can adapt quite well to a range of environmental conditions. It could well be that maintaining a "comfortable" environment in a swine nursery is more important for the workers and the life of the building and equipment than for the pigs. However, the fact remains that pigs on farms do get sick. Perhaps, further work will shed light on how and why.

COMMERCIAL BLUEBERRY GROWERS CONFERENCE

A conference for persons interested in growing blueberries commercially in Minnesota was held on April 18 at the Rainbow Inn in Grand Rapids. The conference was sponsored by a grant received from the Governor's Council on Rural Development and conducted by the North Central Experiment Station and the Minnesota Extension Service with cooperation from the Itasca Development Corporation.

At the morning session Dave Wildung, North Central Experiment Station horticulturist, reviewed the Governor's Council blueberry program and gave general site considerations for blueberry plantings. Jerry Wright, extension agricultural engineer from the West Central Experiment Station in Morris explained irrigation considerations and alternative systems for irrigation.

Carl Rosen, soil extension specialist from St. Paul, explained soil testing

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ROBERT F. NYVALL, SUPERINTENDENT

Since the last **Quarterly**, much has been happening at the North Central Experiment Station. Funny that I should write that because that's the same thing I wrote at the beginning of the last **Quarterly**. I think that says that the Experiment Station is a very busy place.

I have been asked about University retrenchments and how the Experiment Station will be affected. No doubt we are experiencing difficult economic times. As of this writing we do not know exactly what the effect of these retrenchments will be on North Central; however, there very likely will be some. We are also experiencing some of the same financial strains that many farmers have. A large percentage of our expenses is paid out of income we earn from station commodities. These funds have also been reduced this year due to poor prices.

We will shortly know who the successful bidder was for the Superintendent's House. Assuming we have a bidder and that the house will be moved this summer, we are tentatively planning to build a picnic shelter on the area occupied by the house. This shelter could conceivably be used by staff from the station or students and faculty from Itasca Community College. These plans are still not firm.

Perhaps the biggest news this winter is the retirement of two "old-timers," both of whom will be sorely missed. At the end of March, Cliff Underwood, our station carpenter, and Russ Namchek, our station mechanic, decided to "hang it up." Many thoughts race through your mind at a time like that when you realize two people who have given the Experiment Station their

loyalty and part of its personality are gone. They will be missed. At the farewell lunch for these two, many retired station employees were present. It was great to see these people and I think it speaks highly of the loyalty many past employees have for the Station.

We will be phasing out our research on the Sisler Farm and moving it elsewhere. The Sisler Farm is located in the City of LaPrairie and zoned residential. As such we were a nonconforming use. Additionally, and perhaps more importantly, our experiments required the use of pesticides and other chemicals. This posed a threat to city drinking water and possibly nearby residents. Our potato research will be moved to the main station. The blueberry and strawberry plots will be grown on the Sisler Farm this summer without using chemicals and then moved to new sites in 1987.

Tom Carey has been hired as the new station carpenter. Tom brings us the skills and background that are necessary for the myriad of building tasks required around the Station. As of this writing a station mechanic has not been hired, but a qualified person is expected to be on the job sometime in April. There will be a vacancy in our

COMING EVENTS

Visitors Day
Thursday, July 17, 1986

Horticulture Night
Wednesday, August 27, 1986

BLUEBERRY CONFERENCE Continued procedures, methods of fertilization, amending soil and pH modification in the afternoon. Jim Luby, fruit research specialist from St. Paul and Dave Wildung gave updates on the blueberry breeding and cultural studies in the University program. Kay Sargent invited attendees to the North Central Experiment Station for a tour of a four-year-old one-acre blueberry planting to close the program.

Anyone wishing more information on commercial blueberry plantings may contact either Dave Wildung or their local extension agent.

animal crew in the swine barn. This is Tom's old position. With these latest retirements, our personnel situation should hopefully remain stable for some time.

It looks like spring is finally coming, dead skunks have been seen on the highway. We look forward to seeing many of you during Visitors Day or stop by the Station any time this year.

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