SEMI-ANNUAL PROGRESS REPORT

THE USE OF PEAT IN TURKEY AND PIG MANURE MANAGEMENT

By

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The Use of Peat in Turkey and Pig Manure Management

Semi-Annual Progress Report for Minnesota Technology, Inc.

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Objective: This project has three principal objectives: 1) To evaluate scientific and economic merit of using mixtures of peat and wood shavings as litter in turkey finishing (grow-out) barns. The evaluation includes barn environment and health and production of birds. 2) To evaluate the litter manures as a feedstock for compost, and as a composted product. 3) To evaluate the use of liquid hog manure in composting of turkey litter manures.

Background: Peat has been beneficially used in various waste treatment applications. In Northern Europe, peat is often used as litter in poultry, hog, and cattle barns. This project is attempting to transfer the European experience of peat litter to commercial-scale turkey finishing barns in Minnesota.

The participants in this project are: The Natural Resources Research Institute (NRRI); University of Minnesota (U of M) Department of Animal Science (Poultry Extension); Langmo Farms, Inc., Litchfield; Minnesota Sphagnum, Inc., Floodwood; Aitkin AgriPeat, Aitkin; and The Howe Company, Brooklyn Center.

This report covers activities in the first two years of a three year project. Although the reporting is inclusive, emphasis will be on the just concluded second year because some of the first years' results have already been reported.

During the early winter of 1992, four well-characterized mixtures of Minnesota peat and pine wood shavings, and one pure pine wood shavings, were introduced as litter in three turkey finishing barns at Langmo Farms, Inc. near Litchfield. In the two barns that received the peat and wood shavings mixtures, the barns were equally divided with fixed-wall partitions to accommodate two peat and wood shavings mixture ratios per barn. Two kinds of peat were used: a Sphagnum moss peat donated by Minnesota Sphagnum, Inc. and a reed-sedge peat donated by Aitkin AgriPeat. The increased cost of using peat in the litters is between $300 and $600 per year.

Since the introduction of the litters, five flocks of turkeys per barn were finished before the barns were cleaned out. During the time the flocks were finishing, the litters were managed under normal procedures and schedules of Langmo Farms, Inc., including frequent tilling and the addition of supplemental litter mixtures during the course of the year. Barn environment and flock performance and carcass quality were measured during this time period by the U of M Animal Science Department.

Besides litter quality and flock considerations, it is anticipated that peat and wood shavings litter manures would make excellent feedstocks for composting. Fresh manures have high plant nutrient contents, especially nitrogen held by the peat. A high nutrient composted product could potentially be sold to the landscaping and turf industries, or sold for production of granulated or pelletized organic fertilizers. This is the particular interest of The Howe Company which would like to make a granulated organic fertilizer from the compost. These higher valued uses would offset composting and peat costs.

Summary of Progress: Objective 1 was to evaluate scientific and economic merit of using mixtures of peat and wood shavings as litter in turkey finishing (grow-out) barns. This objective was met by monitoring the barn environment of each litter type and then relating the environmental measurements and litter type to turkey flock performance and carcass quality.

Barn environment measurements were taken on air quality (dust and ammonia) and litter moisture. Total dust was determined gravimetrically by using air sampling pumps at flow rates of 1.5 to 2.5 L/minute for a 3-4 hour period. Two sites were sampled in each barn with a pump stationed approximately midway in each half of the barn. Three litter samples were taken for each litter type at three separate locations in the barn. Two duplicates of each sample were oven dried (60°C) to a constant weight to determine moisture content. Ammonia was sampled with gas detector tubes. The reading was taken near the same location as each litter sample. The order of sample collection was ammonia samples, dust samples, and litter samples.

Flock performance was monitored through body weight, mortality cause and rate, bird condition, and health status. Each flock was visited two to three times after its transfer from the brood barn to the grow-out/finisher building, corresponding to about a week after transfer, the week prior to marketing and midway between the initial and end visits. During each visit 50 to 100 turkeys were weighed and scored for feather condition, foot pad condition, and presence of leg problems and/or breast skin defects.

Also, during each visit 10 to 20 blood samples were taken and brought back to the Serology Lab on the University of Minnesota - St. Paul Campus and scanned for the presence of a variety of diseases - mycoplasmas (meleagridis, synoviae, gallisepticum), hemorrhagic enteritis, newcastle, bordatella, and avian influenza. If flock mortality seemed excessive, the farm managers were to save the mortality from the previous night prior to the visit. A sample of 6-10 birds were then taken back to the Diagnostic Lab on the St. Paul campus of the University of Minnesota for examination by an avian veterinarian.

From these measurements and other flock and farm data, multiple regression analyses was initially conducted followed by one-way analysis of variance to look at specific effects. The multiple regression model examined as independent variables the effects of the following factors: barn, flock, visit month (representing season), bird age and bird sex on the observed measurements.

The results and specifics of the analyses are contained in a report prepared for NRRI by the U of M Animal Science Department. Only general conclusions are being reported here. For business reasons, Langmo Farms, Inc. expressed concern about tying specific information to individual flocks, barns, and managers.

The following general conclusions concern the barn environment: 1) litter moisture levels were at acceptable levels and they were similar in all barns, regardless of the litter type, 2) ammonia levels in the air for all litters were primarily affected by month or season - higher in the spring and fall - and litters containing peat tended to lower ammonia levels slightly, 3) dust levels were highest upon initial placement of litters, with litters containing Sphagnum moss peat the highest, followed by litters containing reed-sedge peat, and finally pure wood shavings; after the first flock, dust levels were nearly equivalent for all flocks.

The general conclusions about the flock performance were: 1) the incidence of breast blisters/buttons and leg problems were low and unrelated to litter type, 2) Body weights of the flocks increased linearly with age, irrespective of litter type, 3) weight was primarily correlated with age and poult sex, 4) feather score was somewhat correlated with all the variables, and 5) foot pad score was primarily correlated with the variables of age and month. The general conclusions about carcass quality is that there was low condemnation rate for all flocks and the rate did not seem readily related to air quality or other environmental measurements.

General overall conclusions about peat and wood shavings litters were: 1) peat litters were found to be an acceptable litter source when compared to wood shavings, 2) dust problems were encountered when freshly applying litters containing peat, 3) Sphagnum moss peat resulted in more dust when compared to the reed-sedge peat, 4) dust could probably be reduced from the peat if the particle size was not so small, 5) the presence of peat in the litter tended to reduce ammonia levels, 6) the reduction in ammonia did not result in improved flock performance or reduced carcass condemnation during processing, and 7) the additional $300 to $600 per year cost for peat is not justified on the basis of flock performance.

Objectives 2 and 3 will be summarized together because they are closely related. Objective 2 is to evaluate the litter manures as a feedstock for compost, and as a composted product and objective 3 is to evaluate the use of liquid hog manure in composting of turkey litter manures.

As the last flocks of turkeys were removed from their respective barns, the barns were cleaned and representative litter samples were collected for analysis. Four 16-ton piles of the four combinations of the peat and wood shavings litter manures and one 16 ton pile of the pure wood shavings litter manures were transported and stockpiled at a test compost facility on a farm operated by Langmo Farms, Inc.

The litter samples were analyzed for nutrient content (N,P, and K), pH, carbon content, moisture content, and ash content. These properties are important from both a compost feedstock and a compost product perspective. Analysis of the carbon and nitrogen contents of the manures and fresh wood shavings allowed for calculation of an optimum C:N ratio for composting of each litter manure. The proportions of litter manure, wood shavings (carbon source and bulking agent), and water were calculated for construction of compost piles with an optimum C:N ratio (20:1).

NRRI and Langmo Farms, Inc. personnel constructed four 12-ton compost piles at the test compost facility in mid-winter. Two of the compost piles used the 25 percent reed-sedge and 75 percent wood shavings litter manures. One of these piles used well water as a source of

moisture and the other used liquid hog manure (97 percent water). Two additional compost piles used 50 percent reed-sedge and 50 percent wood shavings litter manures. One of these piles used well water as a source of moisture and the other used liquid hog manure.

The remaining litter manures were stockpiled until June. In June, three 12-ton compost piles were constructed of fresh wood shavings and well water and: 1) 25 percent Sphagnum moss peat and 75 percent wood shavings litter manure or 2) 50 percent Sphagnum moss peat and 50 percent wood shavings litter manures or 3) 100 percent wood shavings litter manure. There were no compost piles constructed using liquid hog manure.

The compost piles made in mid-winter increased in temperature and reached thermophilic temperature (140°F) within two weeks after being constructed. Since construction, the piles have been turned ten times to promote aeration and complete composting. The temperatures remained thermophilic for about 75 days before dropping to and remaining under 100° F until the end of June. The only noticeable difference between the piles containing water and liquid hog manure is that the piles that contained liquid hog manure reached thermophilic temperatures about four days sooner than the piles that just received water.

Samples of the reed-sedge and wood shavings composted turkey litter manure were sampled and analyzed for fertilizer value and manure analysis. The fertilizer and manure analyses were nearly the same. Nitrogen contents were between 1.8 and 2.3 percent; P_2O_5 contents between 2.5 and 4.2 percent; and K_2O between 1.7 and 2.1 percent. When inorganic fertilizers are blended and granulated with this it will be sold as a fortified organic fertilizer, e.g. a 8-8-8 NPK fertilizer.

The Howe Company is preparing for granulation tests of this compost for production of a number of organic fertilizer products. Approximately 15 tons of turkey litter manure compost, from a related project funded by the Agricultural Utilization Research Institute, was successfully granulated at The Howe Company in Brooklyn Center. Although some problems were encountered during the granulation process, a granulated compost product was produced. It is expected that the composts that contain peat as part of the original litter will have better granule binding characteristics than pure wood shavings litter manure compost. Results of this effort will be given in the final report of this project.

The compost piles made in early-June are being monitored, and this information will be presented in the final report of this project.

General conclusions that can be drawn from the work performed in accomplishing objectives 2 and 3 are: 1) the use of liquid hog manure can be used as a source of water for composting, 2) liquid hog manure may be beneficial because it initiates the composting process sooner than water, 3) composting can be successfully performed in the winter, 4) composting turkey litter manure to produce a value-added granulated organic fertilizer has potential, and may justify the costs of composting, and 5) composting is a sound waste treatment alternative to landspreading.

Full reporting of the results and interpretation of the data generated in this project will be presented after all work is completed, and further consultation with Langmo Farms, Inc. and The Howe Company.