

**Department of Agriculture, Trade and Consumer Protection
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Grant Project Final Report**

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Grant Project Title: Evaluation of Dairy Manure Use in Potato Production Systems

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Final Report

This project was conducted to evaluate the significant number of production-related questions as to the advisability of using dairy manure preceding potatoes. Potential concerns expressed by the potato producers related to using manure in their production systems include: (1) the availability of manurial nutrients to potatoes; (2) the influence of manure on diseases such as potato common scab and tuber decay; and (3) the amount and timing of manure applications that could result in compatibility problems for the merging of dairying into potato production systems.

This research was conducted over a 3-year period in an attempt to resolve potential production problems and ease grower uncertainties when manure is used as a nutrient source for potatoes. The specific objectives of this research were:

1. To determine the availability of manurial nutrients, especially N and P to potatoes;
2. To determine the influence of manure on incidence and severity of potato common scab, tuber decay, and other potato diseases;
3. To evaluate the effect of time after manure applications on common scab incidence and severity;

4. To determine the interaction of varietal susceptibility to the common scab pathogen and other diseases and manure applications;
5. To evaluate the relative movement and accumulation of N and P within the soil from manure and fertilizer sources; and
6. To determine if potato production practices can be defined which allow for the integration of the potato and dairy industry.

Accomplishments —

- (1) We determined that the N and P availability from liquid dairy manure to potatoes is about the same or only slightly lower than the availability to corn. Our recommendation is that potatoes should be given an N credit of 30% and a P credit of 60% for unincorporated manure.
- (2) We demonstrated that where manure is properly applied (modest rate at least 6 months prior to potato planting), total yields of tubers can actually be increased by the manure application. The cause for this manure-associated benefit was not specifically identified, but may be due to improvements in soil physical condition, stimulation of soil biota, or addition of nutrients in the manure not added as a part of the commercial fertilizers.
- (3) Since the addition of manure consistently resulted in a lowering of tuber specific gravity, this work showed that manure should not be applied where the potatoes are intended for processing or other uses where high dry matter content is critical.
- (4) This research showed that for common scab susceptible varieties, the addition of manure may increase the incidence and severity of the disease, but when more resistant varieties such as Snowden and Superior were grown, no negative impacts were seen. This demonstrated that variety selection is important where high rates of manure have been applied.
- (5) Manure applications were shown to reduce the expression of *Verticillium wilt* symptoms possibly because of the slow-release nature of the manurial N maintaining higher levels of available N within the soil for a longer time during the growing season.
- (6) Where manure is applied in the spring immediately prior to planting potatoes, the potential for increasing scab was much higher. We concluded that where scab-susceptible potatoes are to be grown and manure is to be applied to that field, it is best to apply the manure as one rotates out of potatoes as opposed to when one is preparing to rotate into potatoes.
- (7) Overall, this study demonstrated that the dairy and potato industries can be integrated through the use of manure on land to be cropped to potatoes if several guidelines are followed:
 - (a) Limit manure application rates to the amount that will supply the needed N for the crop to be grown (<25,000 gal/acre);
 - (b) Apply the manure at least 6 months prior to planting potatoes;
 - (c) Where possible, plant scab-resistant varieties;
 - (d) Avoid use of manure as a direct nutrient source for potatoes on sandy soils because the sands would dictate that the manure be spring applied which results in greater disease risks.

- (8) This project has put Wisconsin at the forefront of scientific investigations on the practical aspects of using manure in potato production systems. As a result of this work, presentations have been made to scientists and grower groups in Ontario, Pennsylvania, Colorado, Idaho, and Wisconsin. From these experiments, one refereed journal article has been published; two more are in review and one is in preparation; seven semi-technical proceedings papers have been published.

Project Limitations —

- (1) Because of the magnitude of this study, it would not have been possible without a graduate student in place who also had access to a significant amount of additional labor. Portions of this study were extremely labor intensive.
- (2) By doing the work in Langlade and Oneida counties, the results are directly relevant to the growers most likely to use the information; however, significant resources were consumed in the necessary travel.
- (3) This project would not have been possible without the funding provided from four different sources. This then resulted in multiple reports and substantially more time spent on project administration.

Future Plans —

- (1) We will complete the publication of the two papers currently in review and paper still in preparation.
- (2) The Wisconsin growers have heard the results of this project at several different venues so I see little need for additional Wisconsin extension activity (presentations or written materials) on this topic.
- (3) Questions continue to arise as to how these results compare to results from other types of manure (e.g., turkey manure in northwest Wisconsin) and how the system needs to be modified on sandy soils. If more research were to be done, I believe these questions should be addressed.

Use of Results —

- (1) Potato growers should welcome the opportunity to use manure on their land, but only if they adhere to the constraints itemized above.
- (2) Dairy farms in potato-producing areas should attempt to enter into long-term agreements for use of their manure, but recognize that they may not be able to apply as much manure as they might like at certain times when potatoes are a part of the expected rotation for that field.
- (3) Results from this study did not suggest that new rules or guidelines for manure use on potato fields are necessary.