Potato Progress

Research & Extension for the Potato Industry of Idaho, Oregon, & Washington

Andrew Jensen, Editor. ajensen@potatoes.com; 509-760-4859

www.nwpotatoresearch.com

Volume XV, Number 13 | *17 September 2015*

Dairy Manure Application Recommendations for Irrigated Potato Production Fields

Amber Moore and Megan Satterwhite, University of Idaho

In regions like Southern Idaho, the overlap between potato field production and dairy has opened the option for potato growers to work with dairy manure as a potentially beneficial soil amendment. Research from the University of Idaho that is partially funded by the Idaho Potato Commission and the Northwest Potato Research Consortium has illustrated that field applications of dairy manure can increase soil organic matter, increase tuber yields, produce larger size class tubers, improve plant nutrient uptake, buffer soil temperatures from extreme highs and lows, and reduce or eliminate the need for fertilizers. Improvements in yields and size class are suspected to be related to improved nutrient and water retention, increased organic matter, improved soil structure, the slow release of nitrogen from organic matter to plant roots throughout the season and reduced fluctuations in soil temperature.

However, growers should be aware that the potato production environment can also respond negatively to dairy manure applications. Intensive (and/or recent) dairy manure applications can increase salt levels above the electrical conductivity (soluble salt or EC) tolerance thresholds. Soluble salts in the soil can lower specific gravity, decrease tuber yields, and compromise tuber quality. Delayed release of nitrogen from manure can also delay tuber maturation, which may also compromise specific gravity and tuber quality. Intensive dairy manure applications also have the potential to trigger environmental issues, including nitrate leaching, phosphorus runoff, and soil copper accumulations.

After sifting through the positives and the negatives, it can be difficult for growers to determine if a manure application will cause beneficial or detrimental effects to potatoes in the crop rotation. The goal of this brief article is to provide directed guidance to potato growers who are interested in applying dairy manure this coming fall. Over the winter of 2016, we plan to publish a University of Idaho extension publication with these recommendations, along with additional recommendations for other manure forms (dairy compost, beef manure, lagoon water) and application timings (fall versus spring applications).

These research studies are ongoing, with researchers working to understand specific relationships between soils receiving manure applications and potato growth in order to provide reliable recommendations for potato growers working with manure applications under irrigated production.

We do not support the use of these recommendations for regulatory purposes.

Is your field manure-worthy?

Use this guide to determine if a fall application of dairy manure is appropriate for your irrigated potato production field.

** "Late-season" refers to the period between the last irrigation event of the season and late-November.*

Based on your responses from page 2, fall dairy manure applications may benefit this field with a few considerations:

Soil test phosphorus (P): Manure applications are restricted to phosphorus based applications by the ISDA for soil test (Olsen) P levels above 40 ppm with surface water as the primary water resource concern. Refer to the 2007 version of the Idaho Code 590 for more information.

Soil nitrate: The soil nitrate threshold may need to be reduced from 45 to 20 ppm for fields that are highly susceptible to nitrate leaching (sandy soils, shallow groundwater, DEQ nitrate priority areas, etc.) The threshold may also need to be reduced to 20 ppm for rotational crops that respond negatively to excessive soil nitrogen, like sugar beets and barley.

Soil copper: Dairy lagoons are often enriched with copper from copper sulfate hoof baths. We recommend a soil copper analysis for fields with a known history of lagoon water or lagoon sludge applications. To avoid potential copper toxicities, do not apply any material containing significant amounts of copper (manure, lagoon water, etc.) to soils with DTPA test copper levels above 25 and 50 ppm on sandy and silty/loamy soils, respectively. Manure copper levels may be determined with an extended manure nutrient analysis. Refer to Extension.org publication "Copper Sulfate Foot Baths on Dairies and Crop Toxicities" for more information.

Recommended dairy manure application rates for 2016 potatoes, and dry bean, barley, or sugar beet rotation crops: Salts from manure applications can accumulate on irrigated fields in arid climates, which can become an issue for salt sensitive crops like potatoes and dry beans. Late season release of nitrogen has also been suspected to lower sugars in sugar beets as well as raising proteins and lowering yields as result of lodging for barley. We recommend applying between 5 and 20 tons of dairy manure per acre (50-70% moisture content) preceding a potato, dry bean, barley, or sugar beet crop. These rates have the greatest likelihood of maintaining or improving crop yield and quality.

Recommended manure application rates for 2016 corn, alfalfa, or wheat rotation crops: We recommend applying between 10 and 40 tons of dairy manure per acre (50-70% moisture content) preceding a corn, alfalfa, or wheat crop. Again, these rates have the greatest likelihood of maintaining or improving crop yield and quality.

Manure testing and nutrient availability: Manure testing is recommended prior to manure applications, which will allow growers to estimate nutrient application rates and availability. For more information on manure testing, refer to Pacific Northwest extension publication "Sampling Dairy Manure and Compost for Nutrient Analysis."

Discuss with a professional: Interactions between animal manures, soils and crops are complex, and therefore further evaluation may be needed. A crop consultant, company agronomist, or university extension faculty member may be able to give further guidance.

Based on your responses from page 2, fall dairy manure applications may cause more harm than good. Consider the following:

Good Agricultural Practices (GAP) rules: Fall manure applications are usually within GAP guidelines for spring-planted potatoes. The GAP program allows for a period of 120 days between the last manure applications and potato harvest, which would include manure applications up until early spring for most potato crops. For more information, refer to the University of Idaho Potato GAP Audit Organizational Manual.

Late-season soil testing: Salts and nitrates are extremely soluble and can rapidly move downward through the soil profile, therefore pre-plant soil EC and soil nitrate tests are generally dramatically different than late season levels. The addition of these tests can help to prevent salt or nitrogen issues.

Soluble salt accumulations: Salts from manure applications can accumulate on irrigated fields in arid climates typical of most Northwest potato production areas, which can become an issue for salt sensitive crops like potatoes and dry beans. Salt tolerant rotation crops, like small grains and sugar beets, are able to grow sufficiently under saline condition (high EC level), but have shown evidence of yield loss and/or compromised quality. Irrigation can be used to move the extremely water soluble salt compounds lower into the soil profile. For more information on soluble salt management, refer to Pacific Northwest extension publication "Managing Salt-Affected Soils"

Soil nitrate: Soils high in nitrates are susceptible to nitrate leaching, which can lead to nitrate pollution issues in neighboring waterways. Soil nitrogen levels can be lowered by growing crops with high N removal potential, such as small grains (straw removed after harvest), alfalfa, and silage corn. Eliminating nitrogen fertilizer and manure applications will also help to lower soil nitrate levels. Research and extension information regarding nitrate management are under development.

Soil test phosphorus (P): Similar to nitrogen, P movement via surface runoff can lead to phosphate issues in neighboring waterways. However, P is far more difficult to remove from soil than salts or nitrates, with minimal crop removal (20-40 lbs of P2O5/acre) and minimal downward movement. For these reasons, prevention of soil test P is a more effective and achievable goal for P management on manured soils than remediation. Practices such as annual soil testing, infrequent manure applications, and reduced application rates can help to prevent P runoff issues. For more information on P management, refer to University of Idaho extension publication: "Mitigating High-Phosphorus Soils."

Soil copper: Lowering soil test copper levels is extremely difficult, with most crops removing only 0.1 lbs of copper/acre year. Prevention of copper accumulation is a far more effective method for copper management than copper remediation with plants. For more information on copper management, refer to Extension.org publication "Copper Sulfate Foot Baths on Dairies and Crop Toxicities."

Discuss with a professional: If you still have questions or concerns, please discuss them with your crop consultant, company agronomist, or university extension faculty member. Interactions between animal manures, soils and crops are complex, therefore further evaluation may be needed before a decision regarding manure applications can be made.