

MANURE MANAGEMENT IN POTATOES: SALT ACCUMULATIONS IN IDAHO SOILS

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INTRODUCTION

High levels of salt can potentially affect yield and tuber quality. There are industry-wide concerns that dairy manures are contributing significant quantities of soluble salts (potassium, sodium, magnesium, and calcium) to soils, however little is known about the degree of salt accumulation related to dairy manure applications in Idaho areas such as the Magic Valley. Even less is known on how the form of dairy waste, whether as lagoon water, fresh manure, or composted manure, influences soil salt accumulation. The objective of this project was to 1) determine the current impact of dairy waste applications to potato production fields on soluble salts (electrical conductivity) in the soil, soil test phosphorus, and tuber yields, and 2) predict future impacts of lagoon water applications to potato production fields by determining the current impact of applications to corn production fields on soluble salts in the soil, soil test P, and tuber yields.

MATERIALS AND METHODS

Ninety-seven cooperators' potato fields throughout South Central Idaho with varying degrees of dairy manure application were included in our study for two years of soil sampling and tuber yield data collection, which included several locations with no history of manure applications. Soils from three subplots within each field were sampled and separately analyzed for electrical conductivity, soluble sodium, soluble potassium, soluble magnesium, soluble calcium, and Olsen phosphorus concentration. Potato growers provided information on tuber yield and manure application history, as well as additional information (when available/applicable) on fertilization program, crop rotations, potato variety, and planting date. In 2010, five corn fields receiving lagoon water were added to the study for soil sampling to illustrate salt accumulations on fields that were receiving lagoon water applications at significantly higher rates than fields that had potatoes in their rotation.

Table 1. Number of potato fields (unless listed as "corn") sampled in 2009 and 2010.

Treatment	2009	2010
Control (Fertilizer only)	15	18
Fresh Dairy Manure	15	17
Dairy Compost	5	12
Dairy Lagoon Water	9	6
Corn with Dairy Lagoon Water	0	5

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RESULTS AND DISCUSSION

Electrical conductivity (EC) was relatively unchanged in 2009 and 2010 by compost and lagoon water applications on potato fields that were sampled (Figure 1). In 2010, EC on fields that had received fresh dairy manure applications (1.8 dS/m) slightly exceeded EC threshold recommended for optimal potato yields and quality (1.7 dS/m) (Stark, 2003), indicating a slight potential for tuber yield losses and/or reductions in tuber quality. Average EC for soils sampled from corn fields that had received lagoon water applications was 2.6 dS/m, which far exceeded the threshold of 1.7 dS/m, indicating moderate potential for tuber yield losses if potatoes ever were to be grown on these fields.

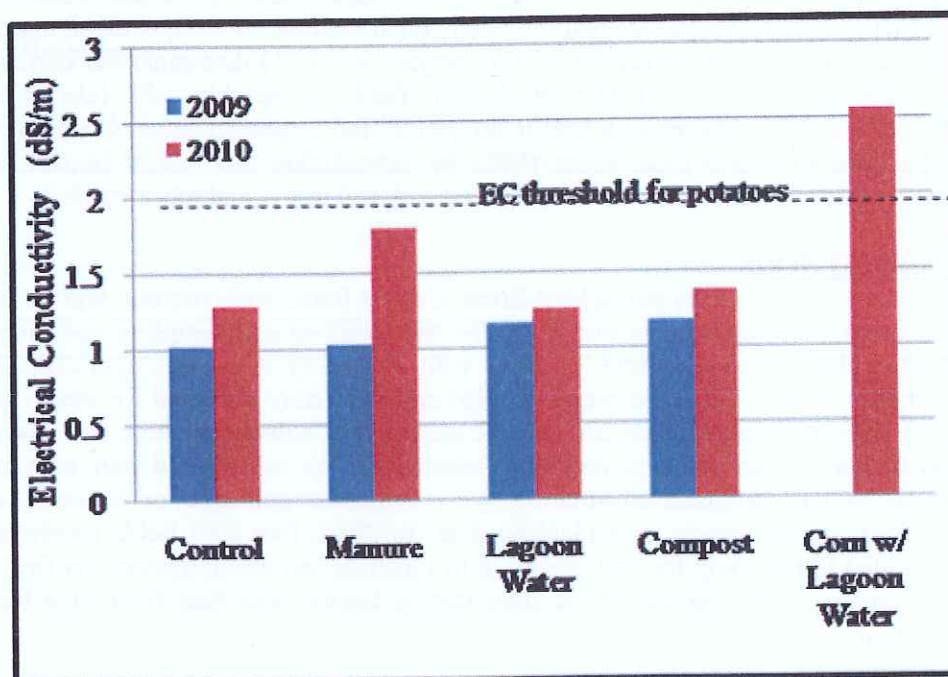


Figure 1. Average soil electrical conductivity in potato or corn (where specified) fields.

Overall, the effects of fresh manure, lagoon water, or compost applications on soluble Na, Mg, and Ca concentrations in the soil were minimal (data not shown), showing that none of these salts have accumulated to significant levels. However, there were possible accumulations of K from fresh dairy manure and lagoon water applications on potato fields (Figure 2). Currently these accumulations do not appear to be a concern, as the K concentrations appear to be approaching non-agricultural soil K concentrations, suggesting that these K accumulations may be more of a benefit than a detriment to potato growers. On corn fields receiving lagoon water, there was a sharp increase in soluble Na, Mg, and Ca concentrations compared to control/fertilizer-only (non-manure) potato fields.

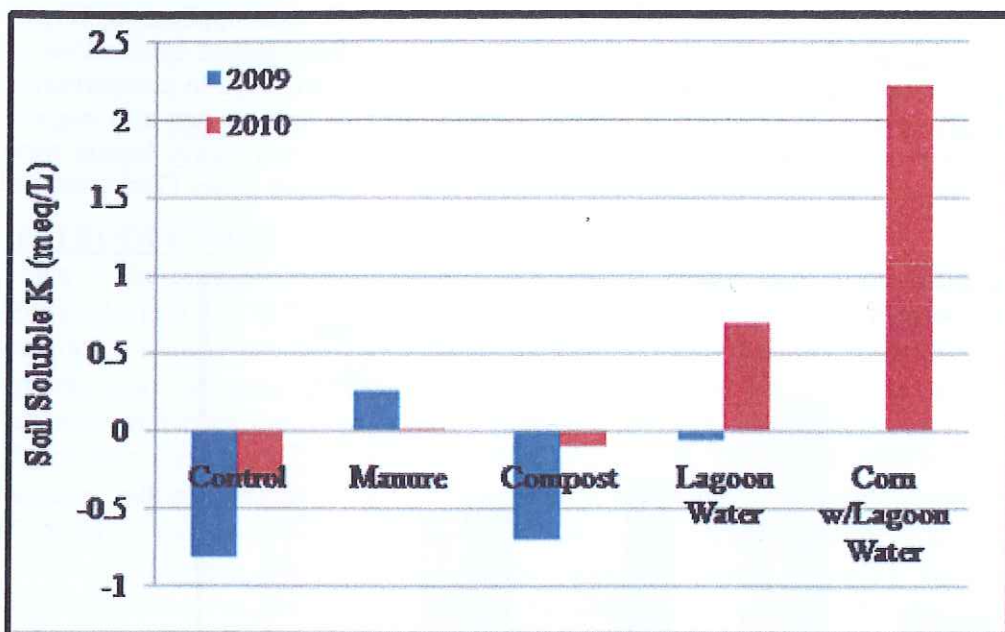


Figure 2. Average differences in soil soluble K between potato or corn (where specified) fields and nearby non-agricultural soil.

Sodium Adsorption Ratio (SAR) appeared to be increasing slightly on potato fields with dairy waste applications, and especially for compost applications (Figure 3). However, all average SAR values were significantly below 6, at which point potato yields and quality can be compromised (Stark, 2003). While there was a sharp increase in SAR for corn fields receiving lagoon water, compared to control/fertilizer-only potato fields (SAR = 2.8), SAR was still far below the growth-restricting threshold of 6. High EC and low SAR values on corn fields receiving lagoon water applications indicates a greater likelihood of salinity issues than sodicity issues on these soils.

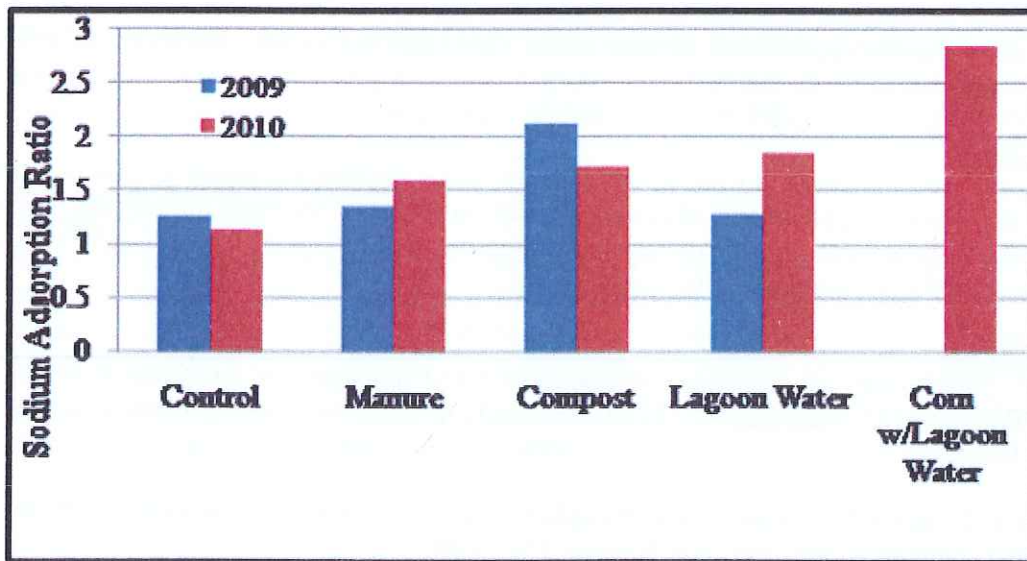


Figure 3. Average sodium adsorption ratio (SAR) in potato or corn (where specified) fields.

Olsen P concentrations in the soil was greater for potato fields that had received fresh dairy manure applications in comparison to potato fields receiving P fertilizer, dairy compost, or lagoon

water applications, and in comparison to corn fields receiving lagoon water applications (Figure 4). This finding suggested that potato fields with a history of fresh dairy manure applications are at a greater risk for P runoff losses and therefore P pollution in waterways in comparison to fertilizer applications or applications of other types of dairy manure. This finding also suggests that high soil test P concentrations do not appear to be a major issue with heavy lagoon water applications, although these soils may be more susceptible to P leaching losses (Tarkalson and Leytem, 2009).

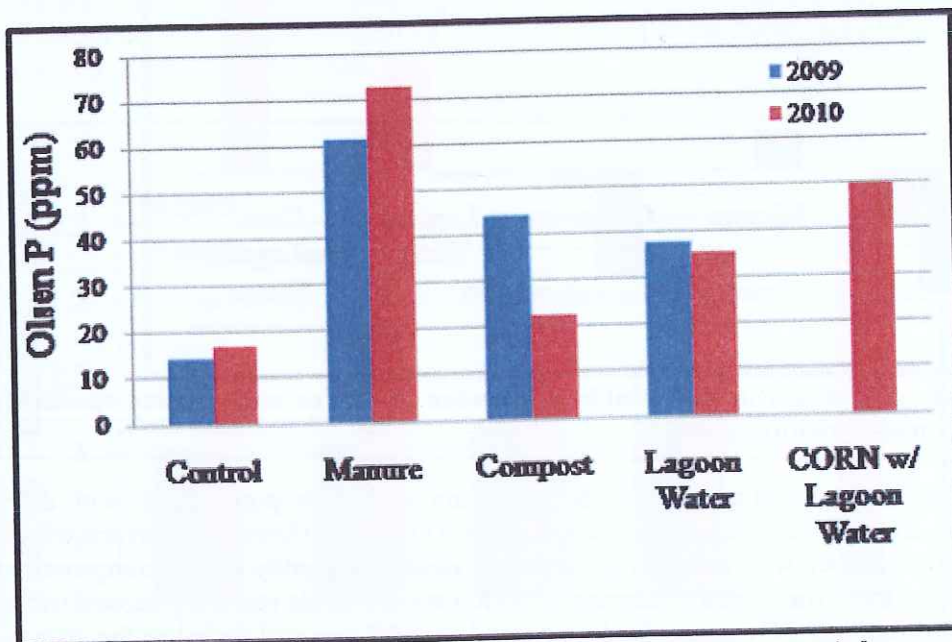


Figure 4. Average differences in Olsen P between potato or corn (where specified) fields and nearby non-agricultural soils.

Based on yield information collected from cooperating growers in 2009, tuber yields, it appears that fresh dairy manure applications increase potato yield (data not shown). However, 2010 data needs to be analyzed to verify this finding.

CONCLUSION

Currently, salt accumulations do not to be a major issue for Idaho potatoes grown on soils receiving dairy waste applications. However, if field space ever becomes limited and potato growers have to rotate into corn fields receiving intensive applications of lagoon water, salinity issues may compromise tuber yield and quality.

REFERENCES

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