

Is application of potash having a negative impact on crops in Minnesota?



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CROP POTASSIUM REQUIREMENTS

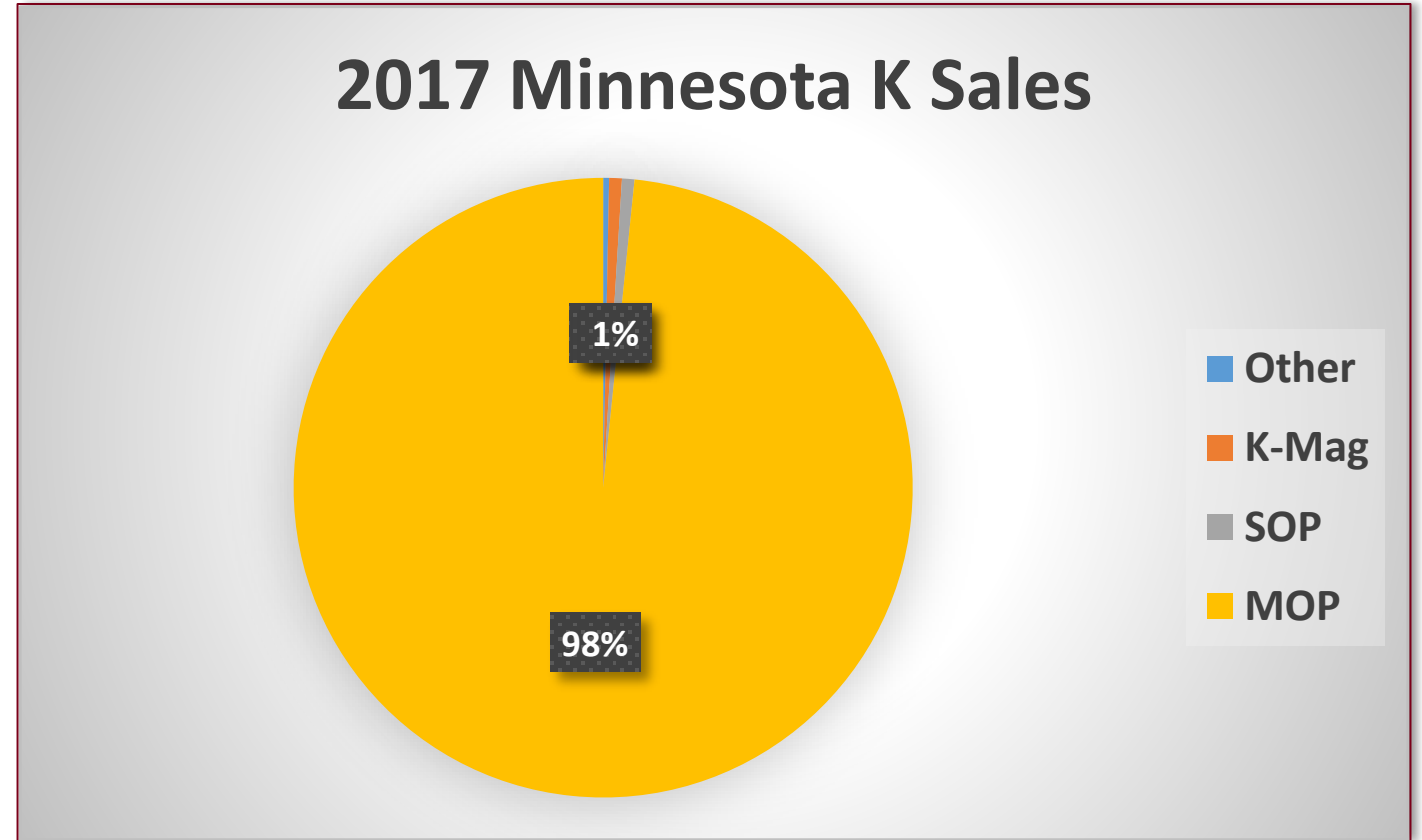
- Potassium is considered a primary macronutrients
 - Crop requirements are in lbs/acre
- Soils in Minnesota can test low in potassium requiring fertilizer to be applied
- Crop demands for potassium vary
 - Soybean and forages ----- High demand
 - Small grains (wheat) ----- Low demand
- The primary source of potassium fertilizer is muriate of potash (MOP) 58-62% K₂O



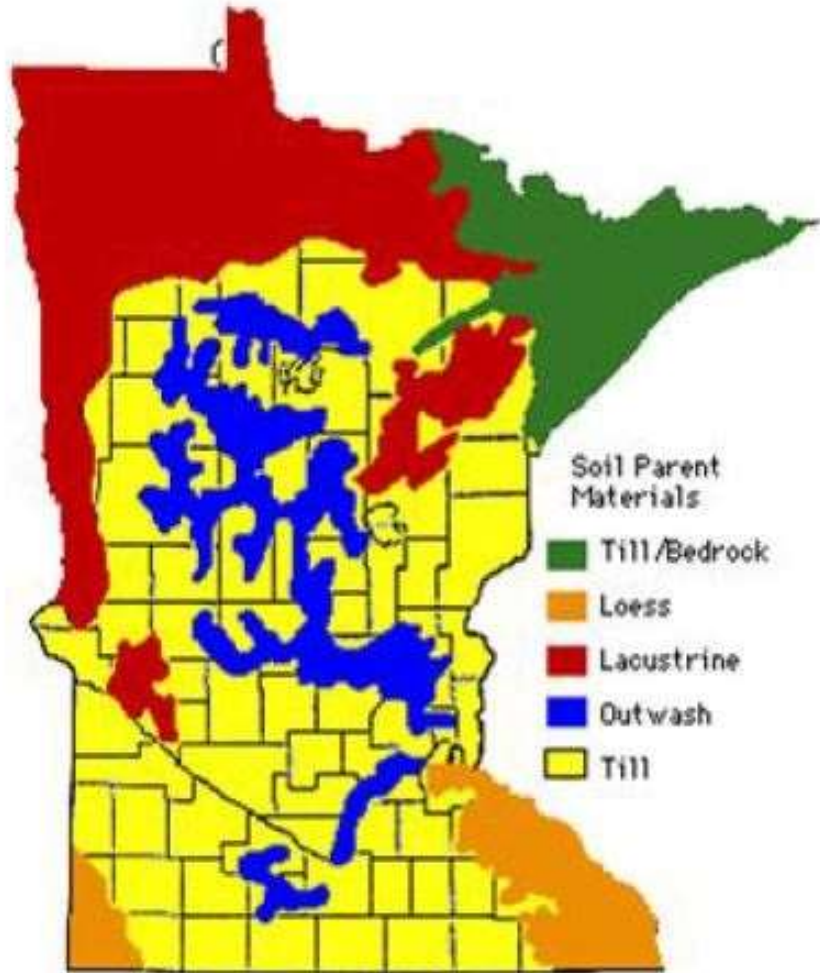
MINNESOTA POTASSIUM FERTILIZER USE

- Muriate of Potash (MOP) is dominant
- Sulfate of Potash (SOP) and Sul-Po-Mag (K-Mag) are minor sales
- This information does not track manure use or multi-nutrient (N-P-K) blends

Percentage of Total Potassium Fertilizer Sold in Minnesota (in tons)
590,572 tons sold in 2017



POTASSIUM AVAILABILITY IN MN



←
Native K availability increases

- Loess – Deep soils, medium to low in K, K soil test values do not drop dramatically with depth
- Outwash – sandy, gravelly soils, low K, low CEC
- Till – significant stratification of K in with majority in surface layers, greater native K availability in west.
- Lacustrine – high clay soils, typically high K availability

Just because potassium availability in soils was high at one point in time where crops did not require fertilizer does not mean K is not needed for crops now!



CROP CHLORIDE REQUIREMENTS

- Chloride (Cl⁻) is considered to be a beneficial (not essential) micronutrient for crops
 - More important for small grains than other crops
 - Soybean does not tolerate high Cl⁻ levels
- Cl⁻ should be leached from soils and not pose a significant carry over
 - Mobility may be limited in poorly drained soils
- Cl⁻ uptake may interfere with other nutrients
 - Uptake occurs passively and is not regulated by the plant

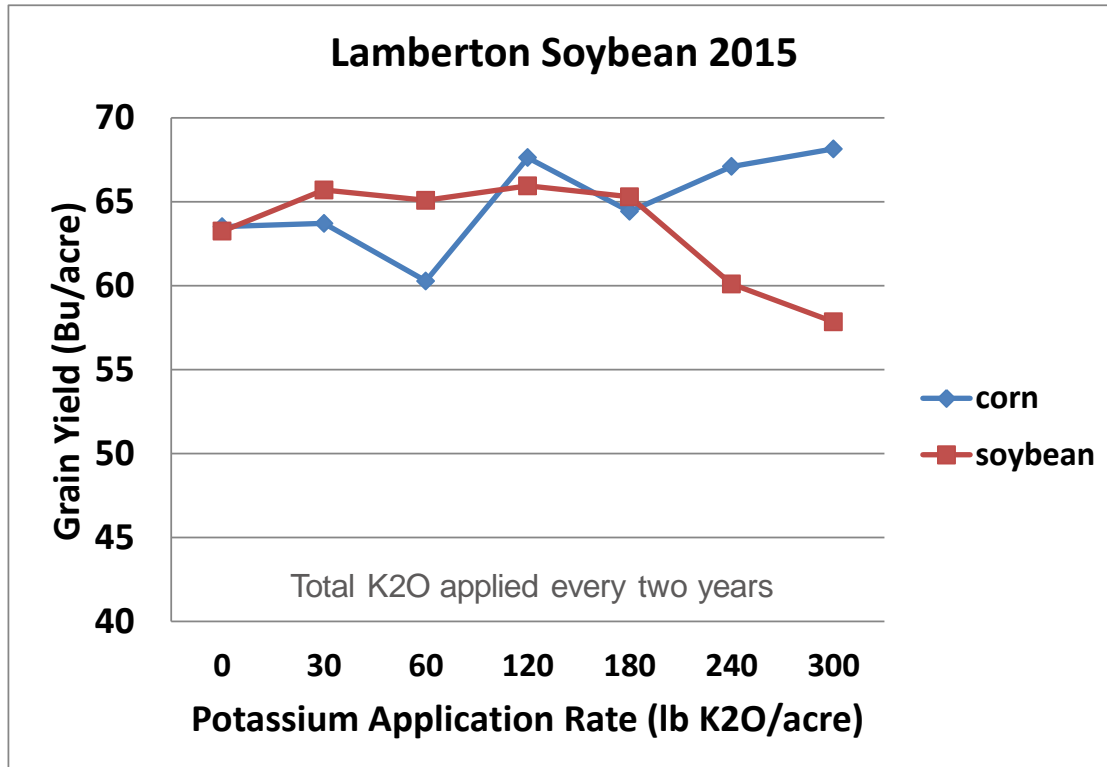
RESEARCH QUESTIONS

- Can Cl⁻ build in soils to levels that impact crop growth in Minnesota
- If a yield reduction in soybean does occur when MOP is applied, which nutrient is causing the reduction
 - Does source of K matter for crop production?
- Can negative impacts be mitigated by changing the time of application
- Are there other options than MOP?
- I am not researching the environmental fate of Cl⁻

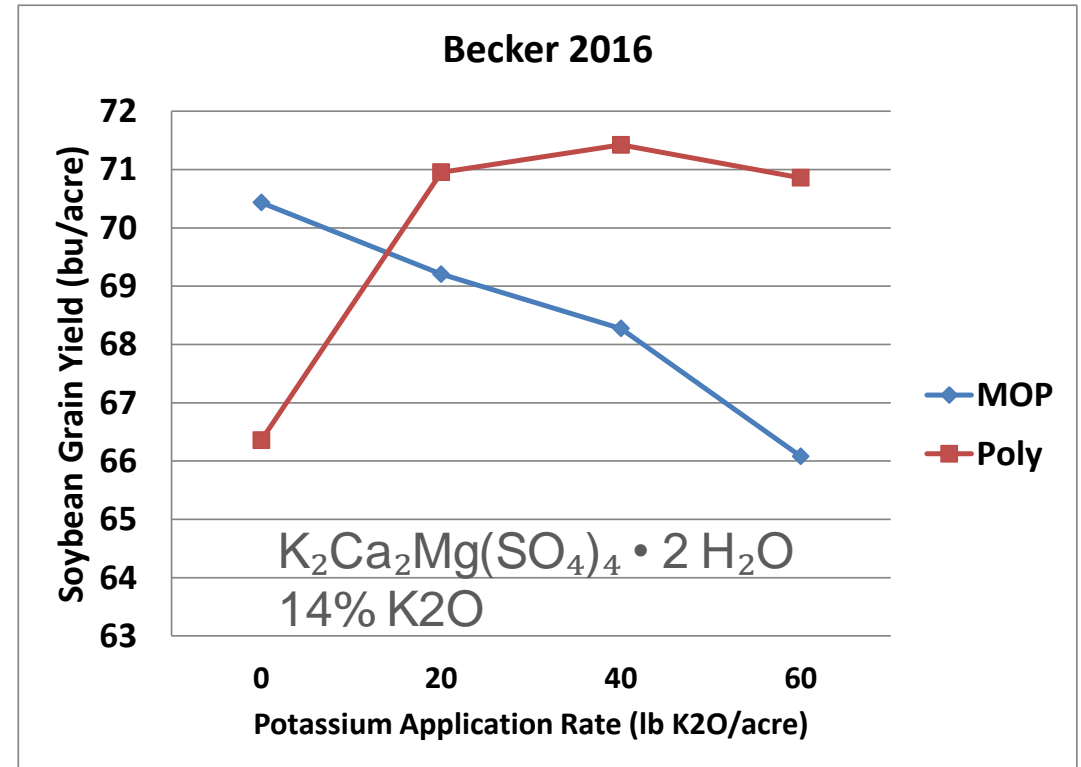


SOYBEAN RESPONSE TO K FERTILIZERS

Long Term K Trial



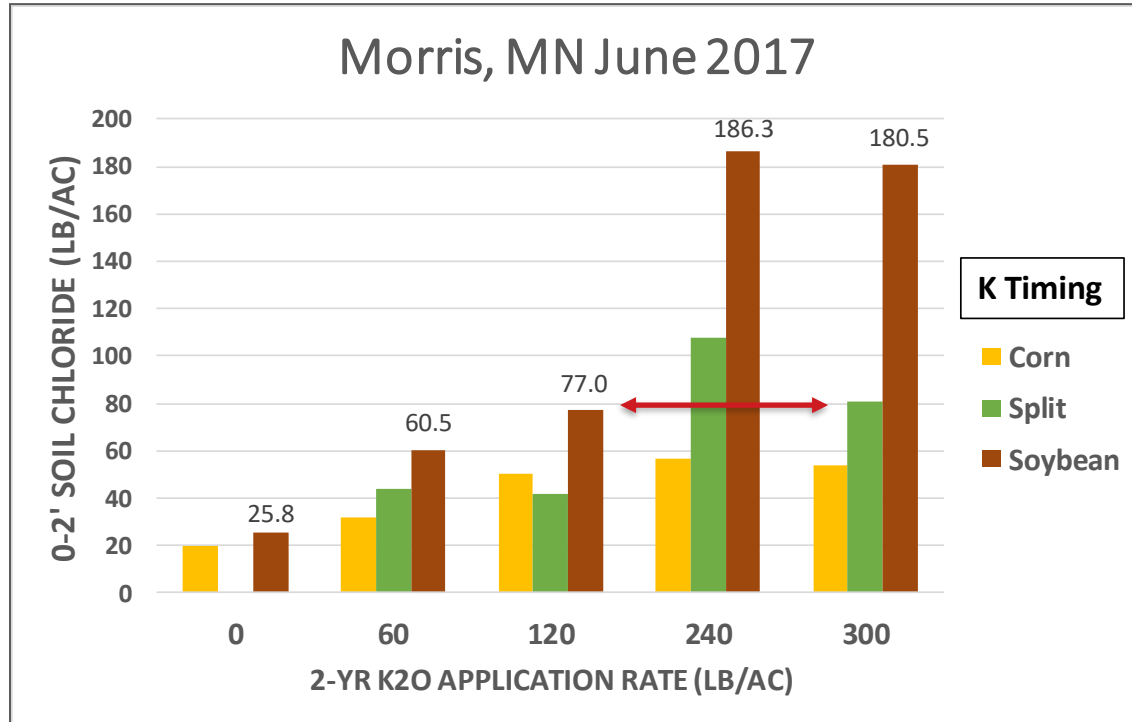
Polyhalite (K source study)



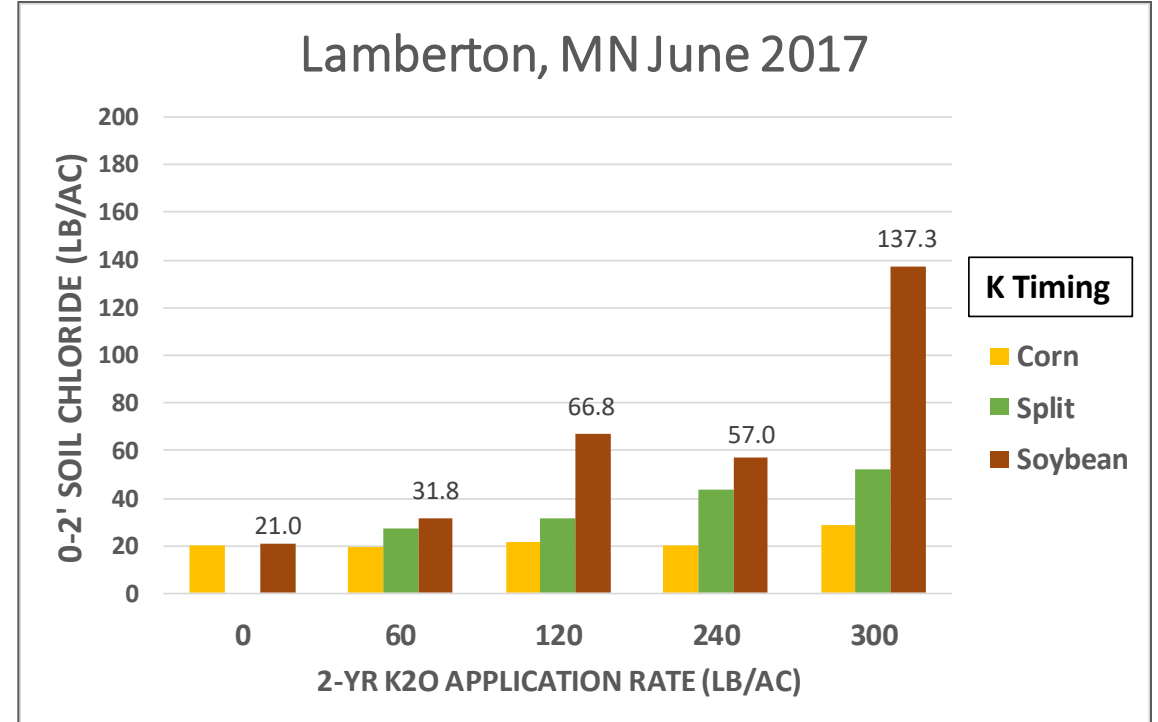


CHLORIDE BUILDUP OVER TIME

Morris Long Term K



Lamberton Long Term K

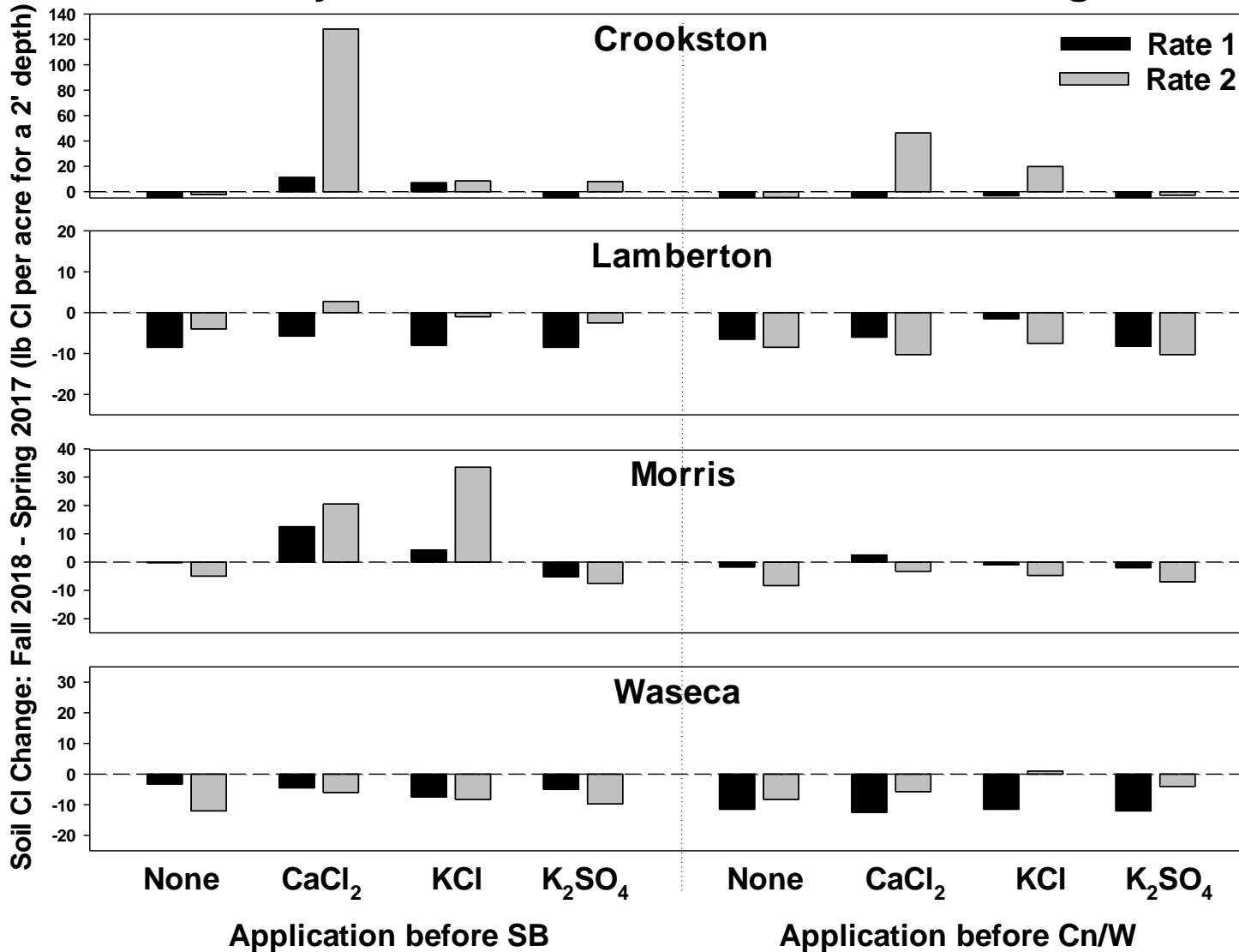


Application rates listed are rates applied over every two years
 2017 is year 9 for the study at each location
 300 lb rates would have had 1 ton of MOP applied through year 8

IMPACTS ON YIELD

- Yield impacts have been sporadic
 - I have encountered yield decreases in corn from increasing MOP rates – Rare, and was on an irrigated field
 - Irrigation water 20-30 ppm chloride
 - Soybean yield decreases to chloride are more common and can be found across the state depending on application rate
 - Conclusion – rate of MOP should be a consideration for farmers for fall or spring application ahead of a soybean crop
- Yield decreases (soybean) following MOP do not appear to be related to potassium

Soybean Trials - Fall 2018 2' Soil Cl Change



CHLORIDE BUILDUP – MORE RECENT STUDIES

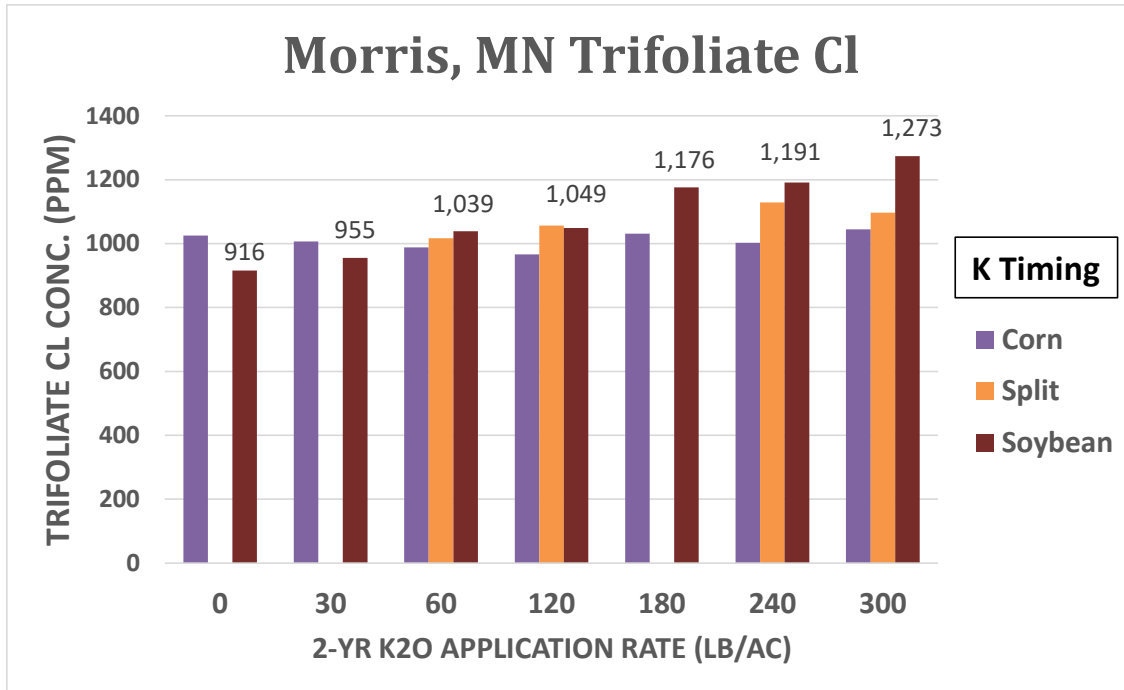
- Change from initial soil samples collected spring 2017
- Legacy impacts of MOP application on soil Cl content are highly dependent on rainfall and drainage



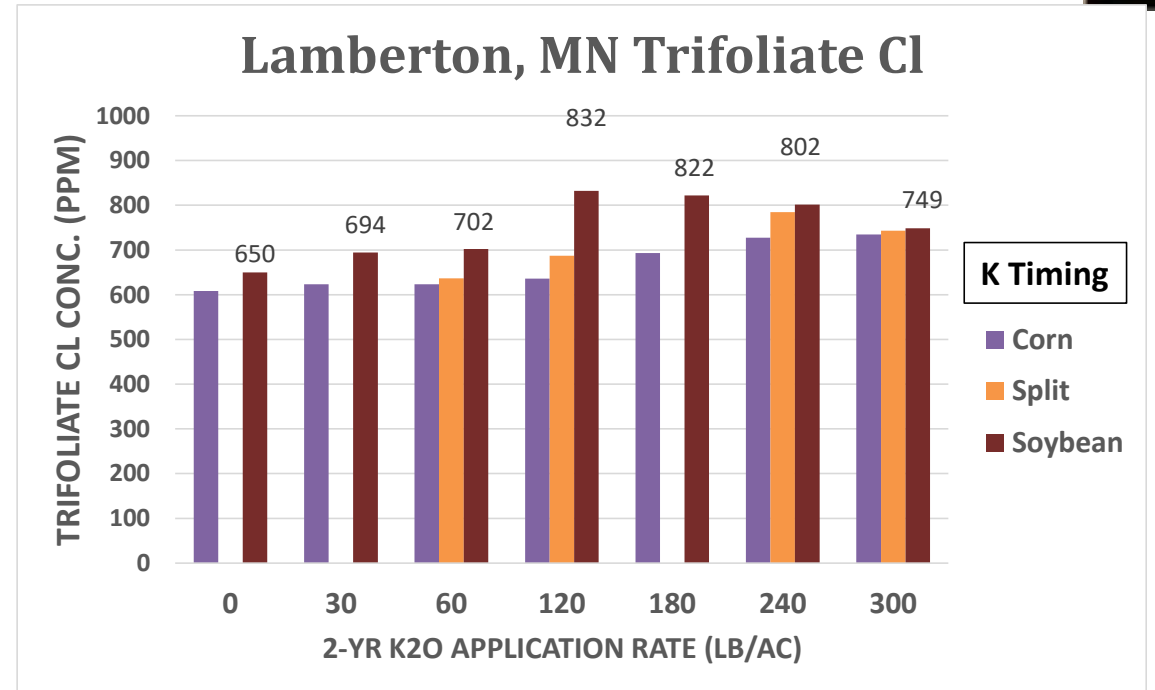
CHLORIDE IN PLANT TISSUE



Morris Long Term K



Lamberton Long Term K



Application rates listed are rates applied over every two years
2018 is year 10 for the study at each location
300 lb rates would have had 1.25 ton of MOP applied through year 10

LONG-TERM IMPLICATIONS OF MOP USE

- I do not have adequate information related to environmental issues as a result of MOP use in agriculture
 - Is it a problem.....I don't know?
- Could CI in MOP leach.....yes
 - Plants will take up some of the CI applied and the uptake will increase with increasing rates of MOP application
 - Majority of CI is in the plant residue
- The amount of CI applied is small considering the volume of soil it is applied to

WHAT DOES THE FUTURE HOLD FOR MOP

- MOP is the single most important source of fertilizer K for crops
 - It is the cheapest sources with the highest K content
- The good news is that soil testing can help direct where K is needed
 - In general I don't get the feeling growers pay a lot of attention to K needs in some areas of the state
 - Soil testing isn't a perfect tool
 - Crop K requirements may vary based on soil chemical properties
- Research is ongoing

IS APPLICATION OF POTASH HAVING A NEGATIVE IMPACT ON CROPS IN MINNESOTA?

- For soybean – in some areas it is possible that over application of MOP may reduce yield
 - Revise current fertilizer guidelines for soybean to suggest limits of MOP applied ahead of soybean
- For corn – not really
 - I have seen yield reductions on rare occasions, not consistent enough to warrant new guidelines
 - New guidelines for sandy soils may suggest less MOP application – we are finding we do not need as much



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