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

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CROP POTASSIUM REQUIREMENTS

- Potassium is considered a primary macronutrient
  - 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
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

Lamberton Soybean 2015

Grain Yield (Bu/acre) vs. Potassium Application Rate (lb K2O/acre)

- Corn (blue line)
- Soybean (red line)

Total K2O applied every two years

Polyhalite (K source study)

Becker 2016

Soybean Grain Yield (bu/acre) vs. Potassium Application Rate (lb K2O/acre)

- MOP (blue line)
- Poly (red line)

K₂Ca₂Mg(SO₄)₄ • 2 H₂O
14% K2O
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
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
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 Cl in MOP leach......yes
  - Plants will take up some of the Cl applied and the uptake will increase with increasing rates of MOP application
    - Majority of Cl is in the plant residue
- The amount of Cl 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