

Analyzing Site-Specific Soil Test Data to Help Farmers Make Management Decisions

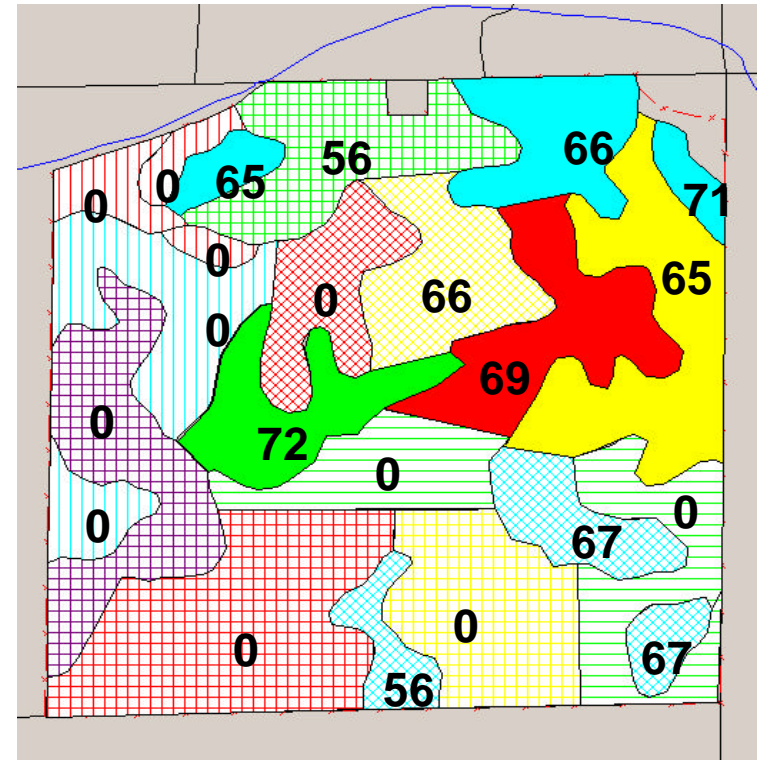
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What are we currently doing with soil test data?

- Mapping soil test levels
- Using these maps to make variable rate nutrient application maps
- Are there additional things we can do with soil test data that would be useful?

Phosphorus recommendations
(lb P_2O_5/A)



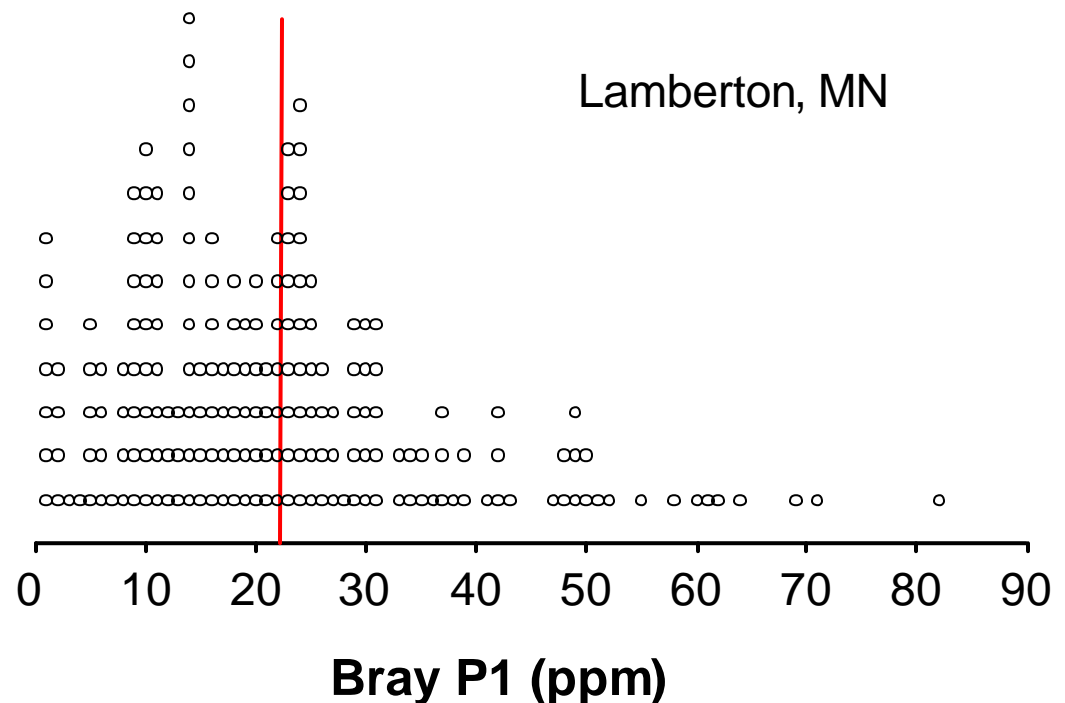
Have we been heading in the right direction?

- We recognize that there are potential errors in our current practices
- We need to look back every now and then and see how we did
 - How has the overall fertility level of the field been changing?
 - How has soil test variability been changing?
 - Have nutrient applications been keeping up with or exceeding crop removal of nutrients?



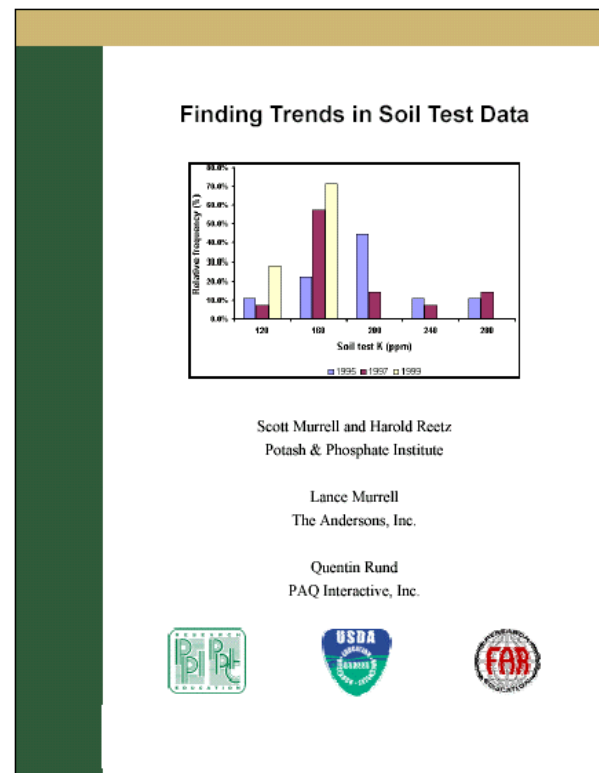
Indicators for assessing trends in soil fertility

- To answer our soil fertility management questions, we need to generate a few simple indicators:
 - We need some measure of the overall fertility of the field (**mean** or **median**)
 - We need some measure of the variability in the field (**coefficient of variation, CV**)



Resources for generating indicators

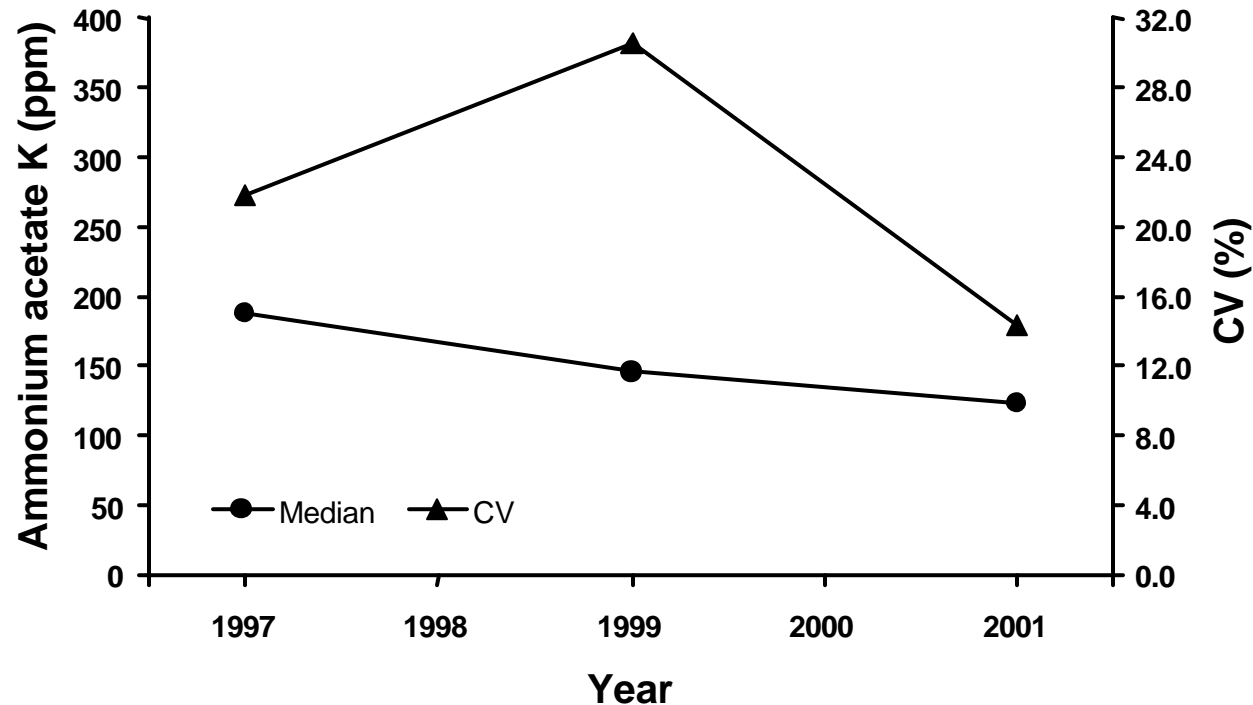
- Get calculations from any basic statistics book
- GIS software may provide you with the statistics themselves or the summary numbers needed to calculate them
- PPI/FAR has put together a step-by-step guide on using Microsoft Excel to generate these indicators



www.farmresearch.com
www.ppi-ppic.org



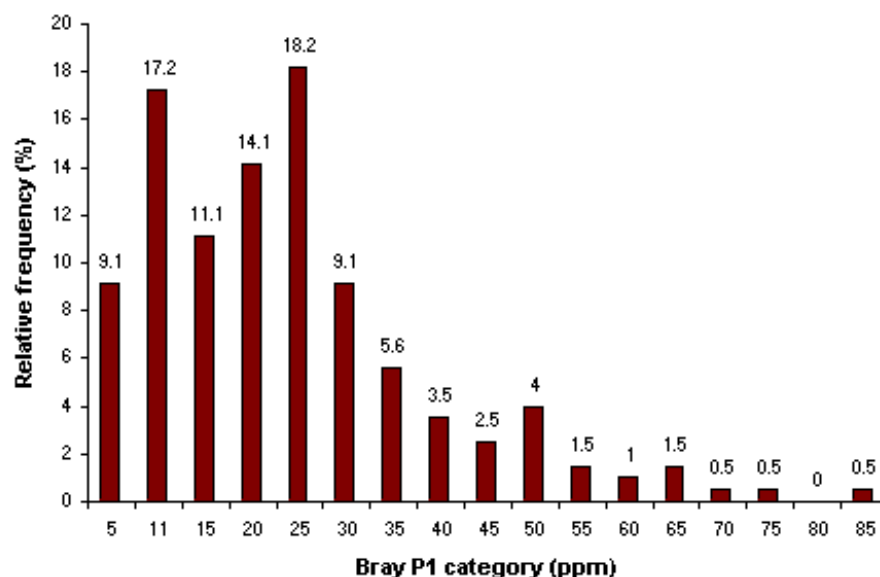
How has the overall fertility been changing?



- Example field from Indiana (zone managed):
 - Overall fertility has been declining
 - Variability has generally been trending downward

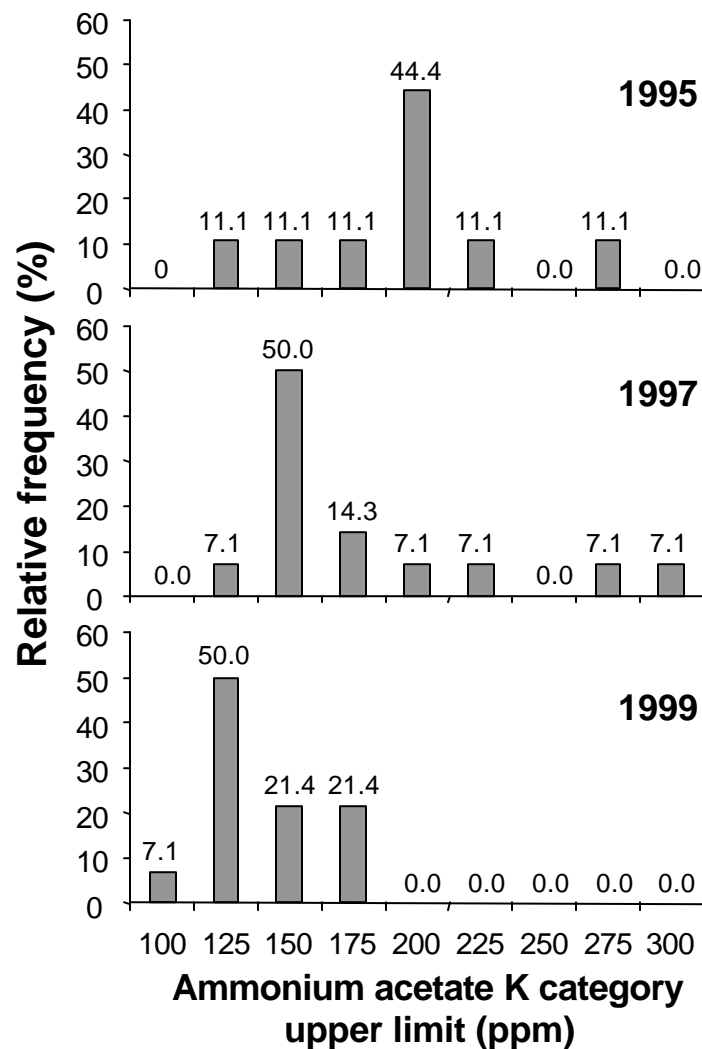
How have soil test distributions been changing?

- Generate distributions of the **percent** of the soil samples that fall into various agronomic categories
 - Use percent because number of soil tests taken may change from year to year
 - What percentage tests “low” vs. “high”



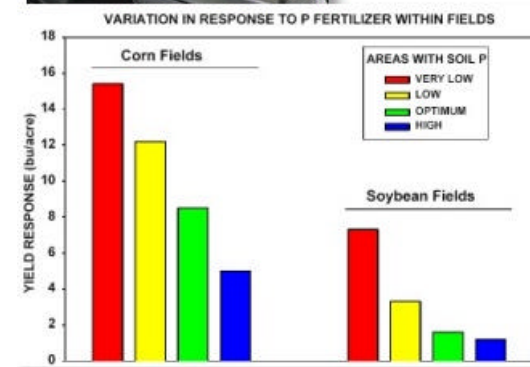
How have soil test distributions been changing?

- Example Indiana field:
 - Category with most samples moved downward:
 - 1995: 176 – 200 ppm
 - 1997: 126 – 150 ppm
 - 1999: 101 – 125 ppm
 - K levels are declining under current management practices



Farmer feedback from examining these trends

- Data analysis was meaningful and understandable
- Farmers realized the importance of fertility and the need to stay on top of this part of their operations
- Site-specific management is reducing variability of some soil test levels on some fields
- Farmers hope that continued analysis will help them manage for higher yields
- Analysis encouraged more farmers to collect site-specific information



Potential errors in evaluations

- Potential errors:
 - Too few samples taken to adequately characterize soil test variability
 - Changing environmental conditions from year to year during sampling
 - Shifts in times of year when samples are taken
 - Sampling areas differ from year to year
 - Frequency of sampling may be too sparse
- How well we control these errors determines the accuracy of our assessments of trends



Have nutrient application rates been keeping up?

- Have nutrient applications been keeping up with, exceeding, or matching crop removal of nutrients?
 - During planning, yield goals were estimated
 - How big was the difference between expected and actual yields?
 - Has this caused us to be ahead or behind in our nutrient applications?



Calculations needed to estimate budgets

- Estimate crop removal of nutrients:
 - (Yield)(Removal coefficient)

$$\left[\frac{200 \text{ bu}}{\text{acre}} \right] \left[\frac{0.37 \text{ lb P}_2\text{O}_5}{\text{bu}} \right] = 74 \text{ lb P}_2\text{O}_5 / \text{acre}$$

- Do this for all crops grown in the time frame we want to consider
- Add up all of the nutrient applications

Estimating nutrient budgets

- Budget:
 - Total applied – total removed
- If budget is positive:
applying more than crops have removed
- If budget is negative:
applying less than crops have removed
- If budget is zero (balanced):
applications = removal



Estimating nutrient budgets

- Calculations can be
 - Done by hand
 - Performed in a spreadsheet
 - Performed by PKalc
 - Calculator that facilitates balance calculations
 - Minimizes calculation errors

PKalc MidAmerica Business

Project:

Period from: **to:**

Comments:
Phosphorus is being mined from the soil
Potassium is being mined from the soil

		P₂O₅ ----- (lb/acre) -----	K₂O ----- (lb/acre) -----
<input type="button" value="Edit"/>	Total additions:	94	234
<input type="button" value="Edit"/>	Total removal:	240	259
	Est. net change:	-146	-25

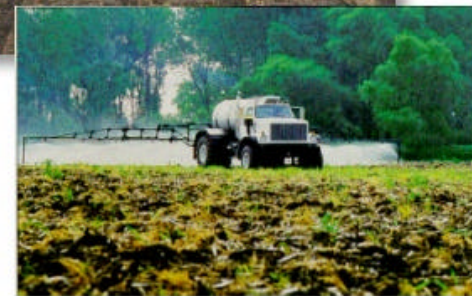
Foundation for Agronomic Research: www.ppi-far.org
Potash & Phosphate Institute / Potash & Phosphate Institute of Canada: www.ppi-ppic.org

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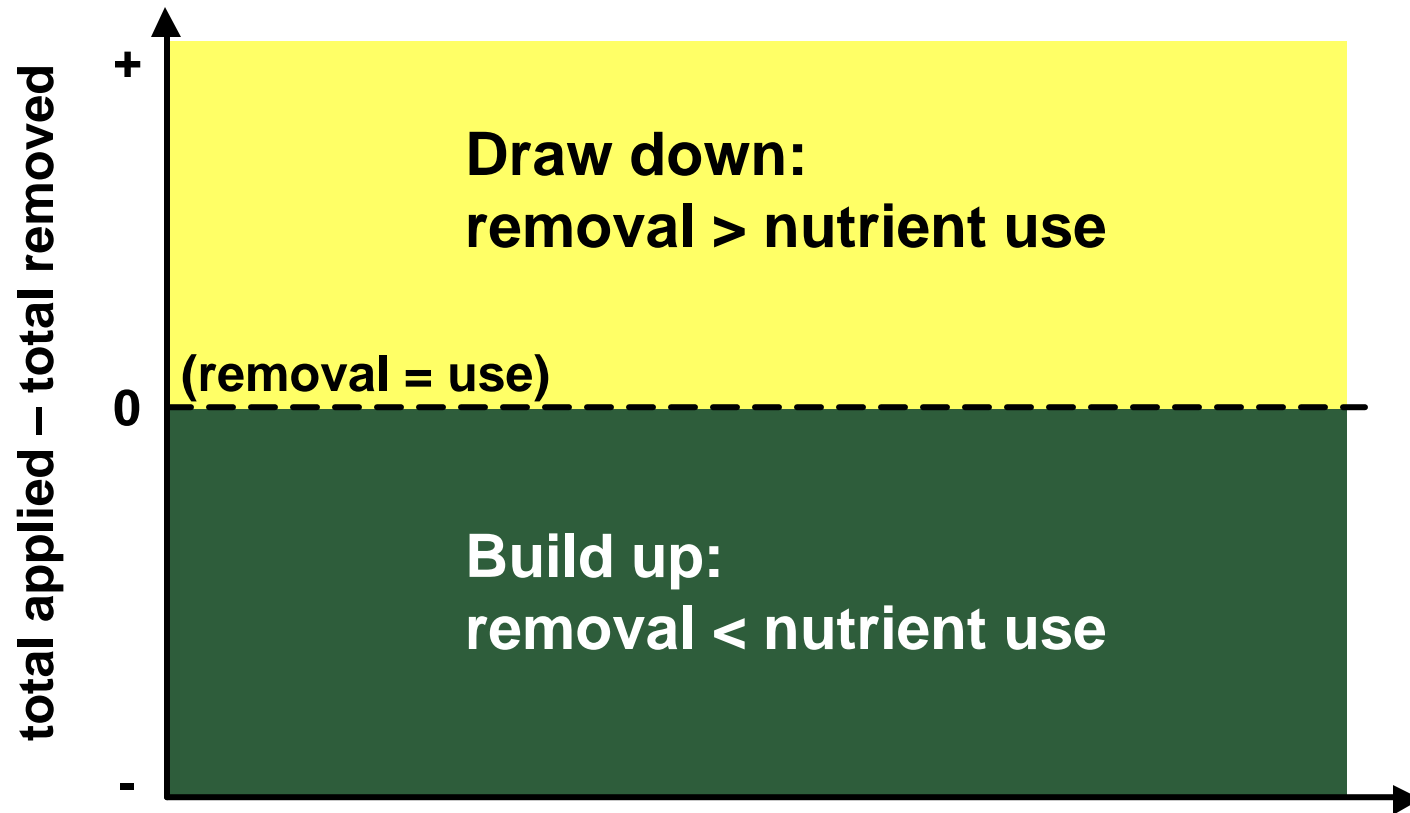


Potential errors in budget assessments

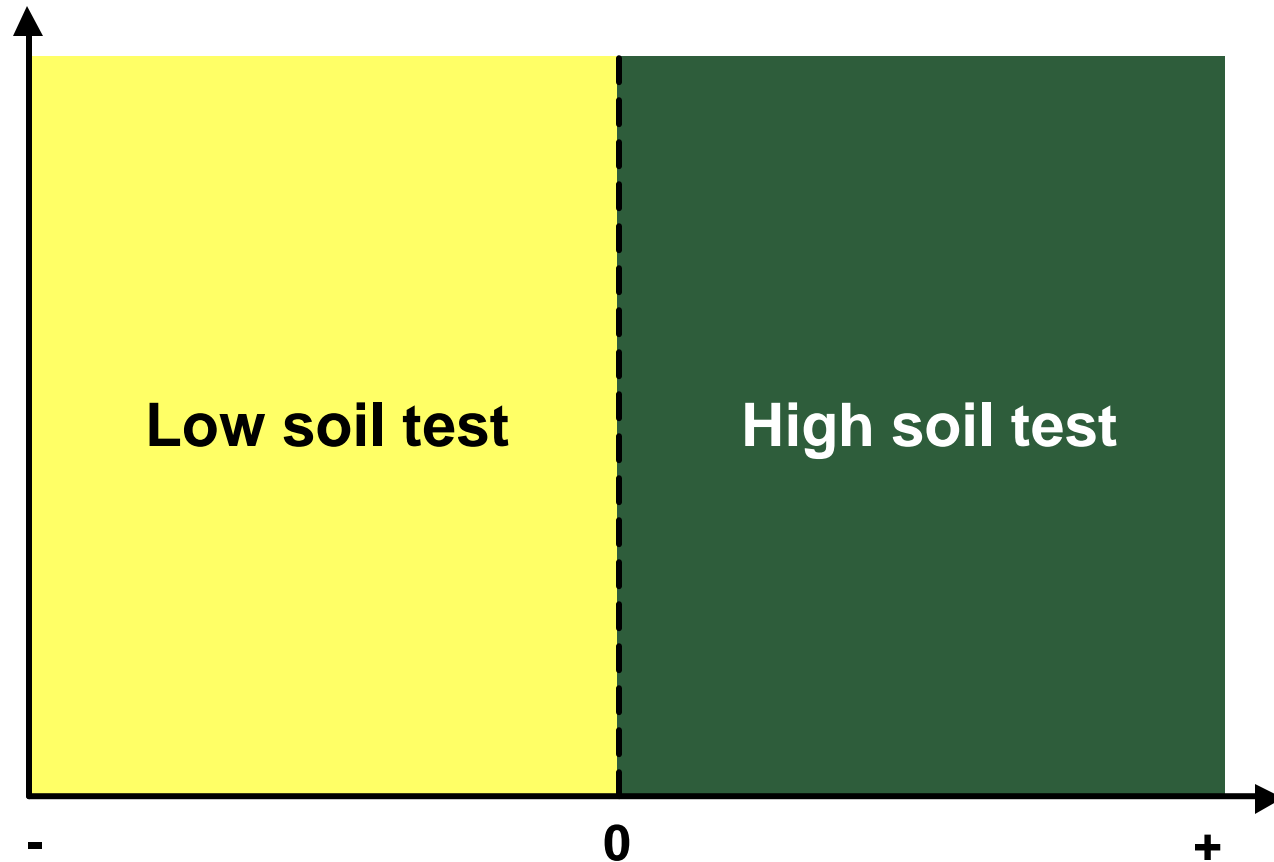
- Estimates of nutrient removal may not be sufficiently accurate
- Nutrient application history may not be entirely known
 - Unknown manure nutrient analyses
 - Unknown quantities of manure applied
- Areas where nutrients were applied may not be adequately recorded
- Areas where nutrients were applied may not have received expected rates



What are budgets supposed to be?



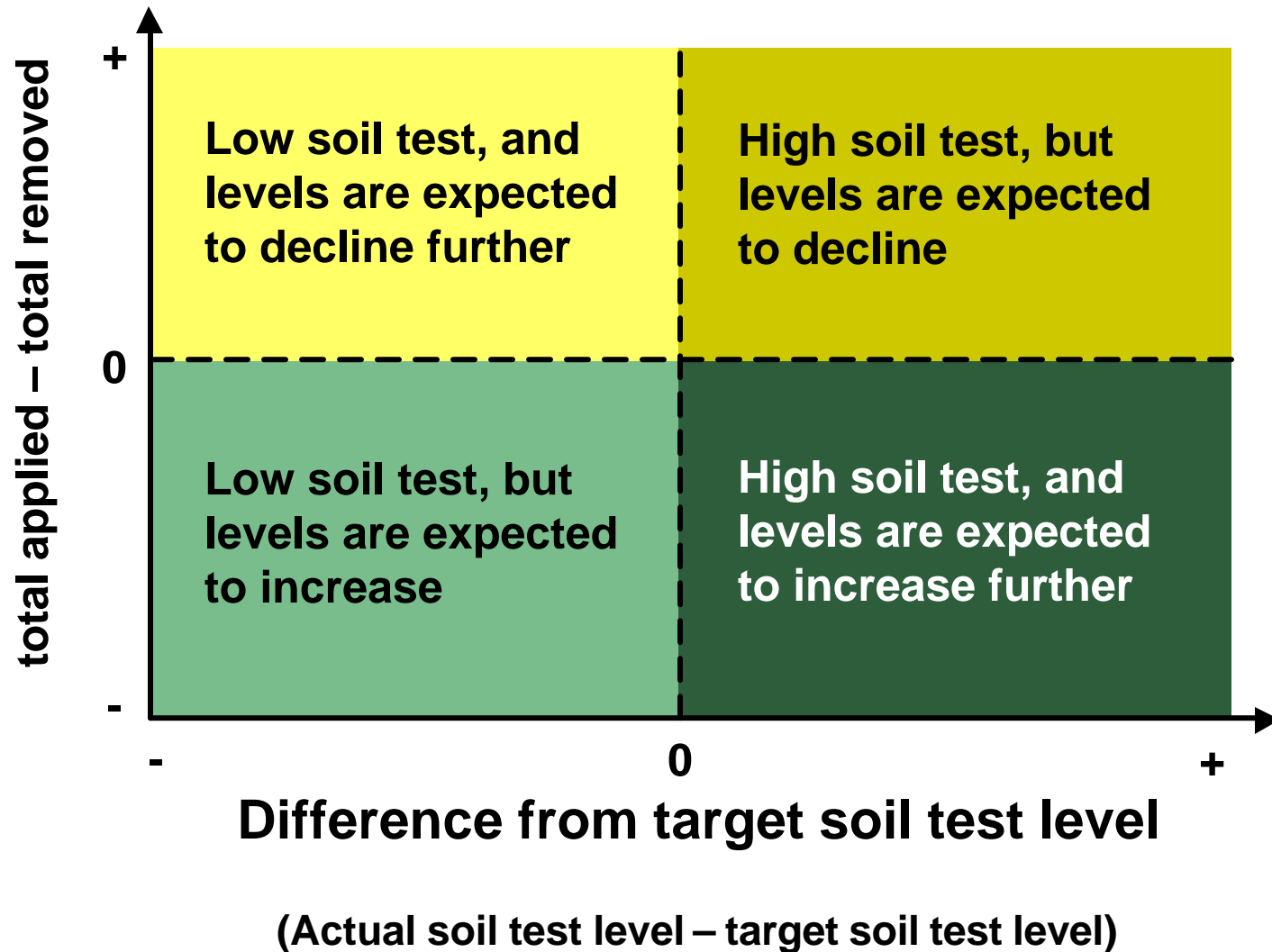
What are budgets supposed to be?



Difference from target soil test level

(Actual soil test level – target soil test level)

What are budgets supposed to be?



How else can we use soil test data?

- Two types of analyses:
 - Ones that you will want to show and explain to your customers (what we have shown so far)
 - Ones that you will want to run to help you evaluate your fertility programs:
 - Expected vs. actual changes in soil test levels
 - Calculating buffer capacities (how much fertilizer is needed to change soil test levels by 1 ppm)
 - Seeing how buffer capacities change with initial soil test levels
 - Determining if trends in soil test levels are statistically significant

What can examinations of soil test data do for us?

- Help us manage soil fertility at desired levels
- Improve our planning process as we decide how much of each nutrient to apply to reach fertility objectives
- Tailor nutrient management approaches to local conditions