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Nutrient Stewardship in PEI



Matches fertilizer type
to crop needs.



Matches amount of
fertilizer to crop needs.



Makes nutrients available
when crops need them.



Keeps nutrients where
crops can use them.



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4R HOTSTOVE: NUTRIENT STEWARDSHIP IN PEI

PEI 4R Overview

Greg Donald

PEI 4R Continuum and Survey

Kayla Nieuwhof

4R Demonstration Plots

Steve Watts

4R - A Growers Perspective

Jonathan MacLennan

- https://youtu.be/OEQ_qboreeg

4R Memorandum of Cooperation in PEI

4R Memorandum of Understanding signed (2012) between the Government of PEI, PEI Federation of Agriculture, Kensington North Watersheds Association Ltd., PEI Potato Board, Fertilizer Canada

PEI was the first province to sign a MOU with Fertilizer Canada and is well positioned to lead the implementation of 4R Nutrient Stewardship on farms in the province

4R Nutrient Stewardship Demonstration Farms and Tailgate Tours:

2013: 5 Demonstration farms

2014: 13 Demonstration farms

2015: 15 Demonstration farms

2016: 10 Demonstration farms

4R Nutrient Stewardship Research Network:

Dr. David Burton, “Reducing Nitrous Oxide Emissions and Nitrate Leaching in Potato Production in Atlantic Canada”

4R Nutrient Stewardship

- Helps farmers to **increase production and profitability** while **enhancing environmental protection**
- A framework based on **proven science**, allowing growers to better **manage nutrient use and water consumption** for crop production
- Acts as a **performance indicator** for economic, social and environmental sustainability objectives



IMPROVE
AGRICULTURAL PRODUCTIVITY
MINIMIZE
IMPACT TO THE ENVIRONMENT

4R nutrient stewardship

“Economic, social and environmental considerations have always been important on our farm, but by having a structured program like 4R Nutrient Stewardship, we are able to showcase our sustainability program and use our fertilizer efficiently to reduce the impact on the environment.”

Jonathan MacLennan - West Cape, PEI

4R farms demonstrate an environmental and economic advantage for PEI

- What can 4R practices look like on PEI potato farms?
 - Split nitrogen applications, reducing N application by 10-20% in some sites
 - Reduced P_2O_5 application to match soil needs
 - Supplement micronutrients where soil tests indicate a potential crop response would be possible (Mg, B, Zn)
 - Use of enhanced efficiency and controlled release nitrogen fertilizers (*ie*: ESN Urea)



Benefits of 4R Nutrient Stewardship to Farmers

- Farmers can prove to external stakeholders what they're doing to be good environmental stewards of their land - the 4R plan backs their actions with hard data
- End-use customers are beginning to require proof and 4R delivers that
- This science and fact-based approach meets government and environmental organization demands and exceeds them
- Improves grower's efficiency and their bottom line



No longer enough to *‘Do the Right Thing’*

Public is demanding credible evidence
that farmers are making sound crop
management decisions for the
economy, society and environment



4R Nutrient Stewardship can
help grow crops sustainably



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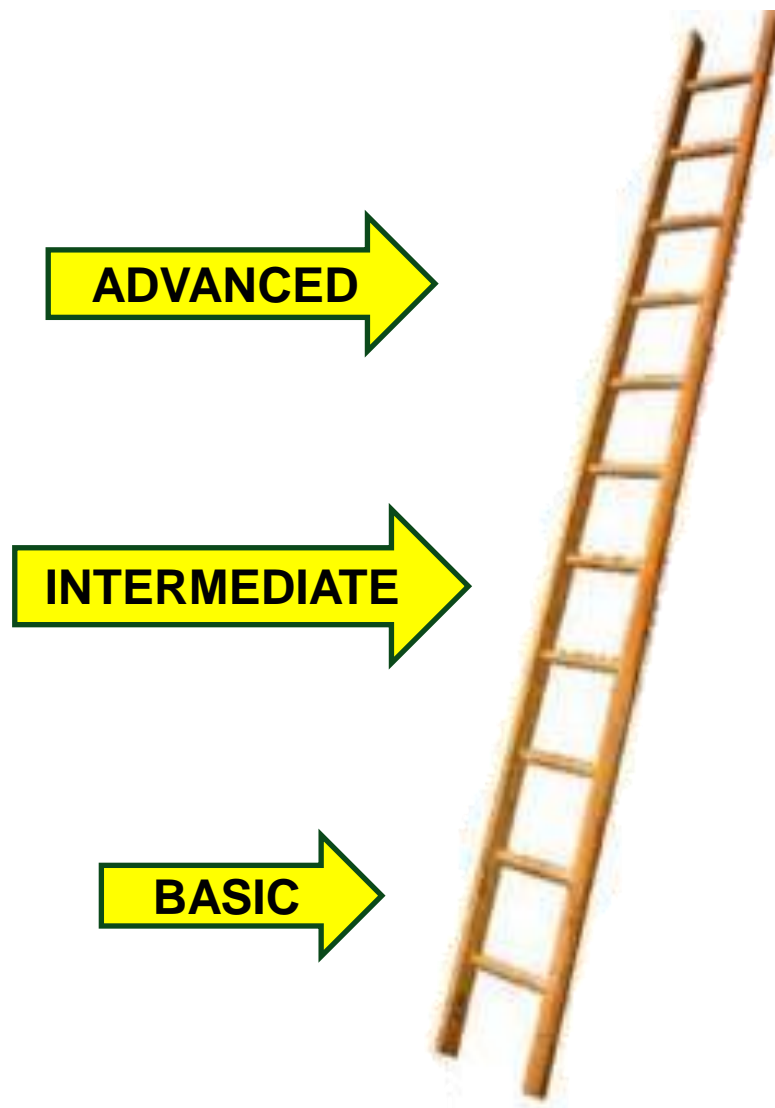


nutrient
stewardship

PEI 4R CONTINUUM

PEI 4R Continuum Version 1.1

- What defines a 4R grower?
- How do nutrient management practices on PEI align with 4R principles?





BASIC

- Soil test each field before planting of potato crop
- Calibrate application equipment
- Discuss nutrient program with a qualified body (CCA, P.Ag, cNMP)
- Maintain fertilizer application records
- Adjust soil pH to target levels

***All Required**



INTERMEDIATE

- Complete *4R Essentials* online training course
- Apply credits for plow down materials
- Delay glyphosate application to “near killing frost event”
- Delay primary tillage until late fall or spring; plant cover crops after early tillage
- Use a post potato harvest cover crop
- Analyze and account for nutrient value of organic amendments
- Attend 4R demonstration/research events
- Split apply crop Nitrogen requirements



ADVANCED

- Use slow/controlled release fertilizer products
- Conduct on farm trials via trained professionals
- Work with local institutions/agencies to monitor application effects
- Collect soil samples using grid sampling technology
- Utilize variable rate technology
- Utilize yield mapping technology to build yield management zones
- Have a comprehensive NMP in place

PEI 4R Continuum Survey



Survey Results

| | |
|-------------------------------------|--------|
| Number of Growers: | 30 |
| Total Potato Acres Surveyed: | 16,690 |
| Total Acres Meeting Basic Criteria: | 12,810 |

| Continuum Tier | Average Criteria Currently Being Met |
|----------------|--------------------------------------|
| Basic | 92% |
| Intermediate | 55% |
| Advanced | 17% |





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**Thank You to all the Growers that
Participated in this Survey!**

CAN WE IDENTIFY AND VALIDATE POTENTIAL NEW BMPs THAT WILL HELP GROWERS MOVE UP THE CONTINUUM

**Steve Watts P.Ag.
Genesis Crop Systems Inc
Feb 14, 2017**

DISCLAIMER

- Every production area has their own unique circumstances
- Dryland systems provide different Nitrogen timing challenges than irrigated systems
- In PEI – the majority of producers apply the majority of the potato crop's fertilizer requirements in 2x2 bands at planting time
- Partial rates of K20 and N are applied prior to planting and/or prior to bed forming/hilling activities

**Dry Fertilizer
Application**



Goals were....try to identify and evaluate various potato fertility strategies that might become new Best Management Practices for PEI Potato Production *while*

- **Maintaining/improving crop yield and quality**
- **Improving grower returns**
- **Lessening impact on environment**
- **Enhancing societal view of the industry**
- **And, getting participants thinking, talking and acting!**



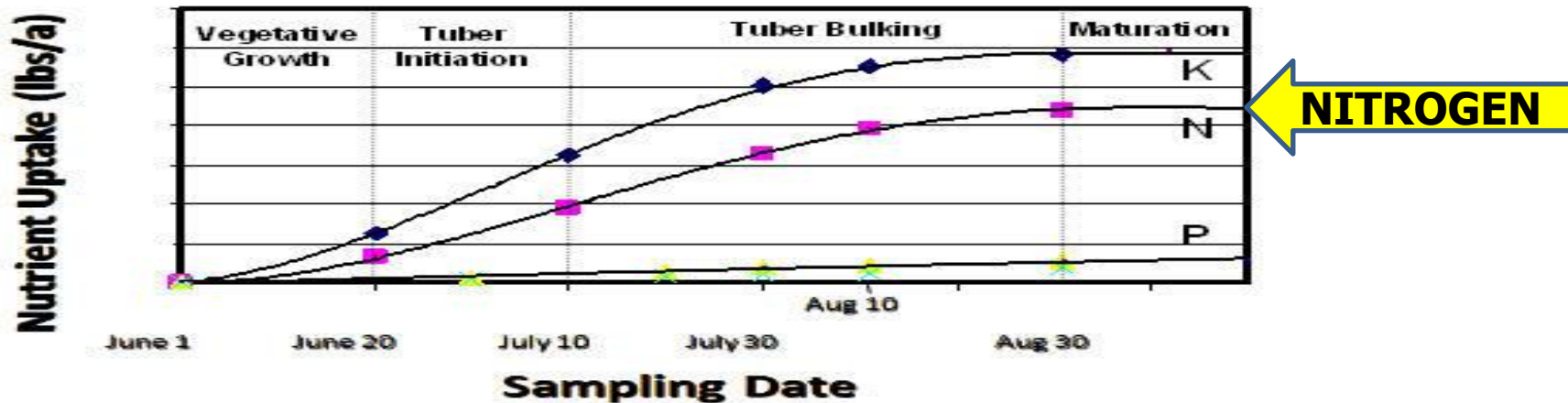
METHODOLOGY

- **NOTE: *most growers already at Basic 4R level re soil testing, pH adjustment, equipment calibration, record keeping, etc***
- **Split field design – grower standard practice compared with....how are they doing things elsewhere?**
- **Split N applications – less in the fertilizer bands; more broadcast/incorporated pre/post planting**
- **Reduce P205 rates based on PSat index – many PEI soils rate high for [P]**
- **Move KCl out of planter box – KMag/SOP**
- **Increase Mg rates**
- **Micros as needed**



WHY SPLIT NITROGEN APPS?

Total potato plant N, P, and K uptake at Aberdeen, 1991-93.



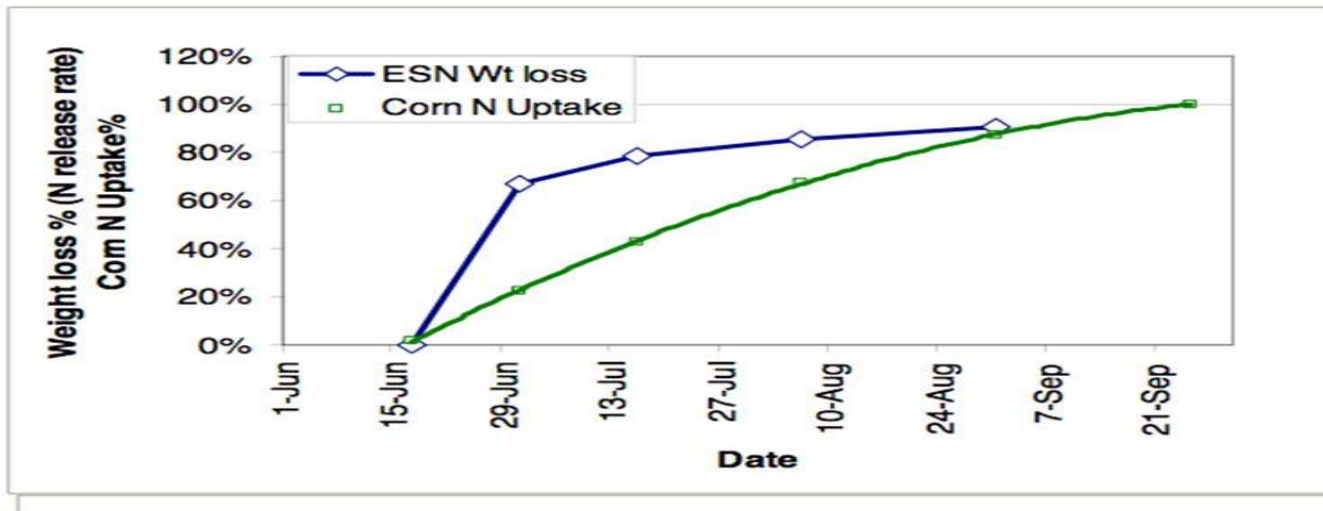
CROP REQUIRES N OVER AN EXTENDED PERIOD

| Fertilizer material | Approximate time until ammonium | Approximate time until nitrate |
|-------------------------------------|--|--|
| Ammonium sulfate, 10-34-0, MAP, DAP | 0 weeks | 1 to 2 weeks |
| Anhydrous ammonia | | 3 to 8 weeks |
| Urea | 2 to 4 days | 1.25 to 2.5 weeks |
| Ammonium nitrate | 25% is ammonium, 0 weeks | 50% in 1 to 2 weeks 50% is nitrate, 0 weeks |
| UAN | 50% from urea in 2 to 4 days 25% is ammonium, 0 weeks | 50% in 1.25 to 2.5 weeks 25% in 1 to 2 weeks 25% is nitrate, 0 weeks |

AT PRESENT WE DO NOT HAVE THE IDEAL SOLUTION

**Rate of release is affected by soil T,
moisture, and other factors**

Release rate of ESN compared to corn N uptake,
Manitoba (Heard and Ginter, MAFRD).



**RECENT, EMERGING & NEW
TECHNOLOGIES ARE LIKELY TO HELP**

METHODOLOGY

- **Forty-two sites over four year period**
- **What factors define the program?**
 - *Past field history (plow down credit)*
 - *Current soil test report*
 - *Use of organic amendments*
 - *Variety to be planted*
 - *Anticipated end use*
 - *Other??*
- **Crop growth monitored regularly via visual observations and in-season plant petiole samples.**
- **Sites represented major growing sites across the Island and fields planted for seed, fresh and processing market use**



METHODOLOGY

- **Prior to commercial harvest - 6 X 15 ft strips were hand harvested from each treatment; the same number of plants were harvested from each strip within each field.**
- **All tubers were evaluated for overall yield, quality and economic value based on a real life processing contract at Cavendish Farms Central Grading in New Annan PEI.**
- **Net crop values were calculated for each sample based on yield, quality, defects, etc taking into account any potential differences in cost of fertilizer programs.**
- **Post harvest residual soil Nitrate levels were measured at 0-6", 6-12" and 12-18" depths from each treatment in each field 10-20 days after harvest.**
- ***New in 2016 N20 & additional NO3 testing via Dr Burton***

RESULTS

- **Presenting Russet Burbank only**
- **Crop appearance, Crop Value, Specific Gravity, Residual Soil N**
- **Did not get consistent results 100% of the time**



RESULTS *Crop Appearance*

- Generally no difference in plant petiole results – some up slightly, some down slightly
- More often than not – change in overall crop appearance – paler green foliage, less vine growth, “more organized?”

Fig 1: UAV Generated Plant Health Map – Site W14 PEI 4R Trials

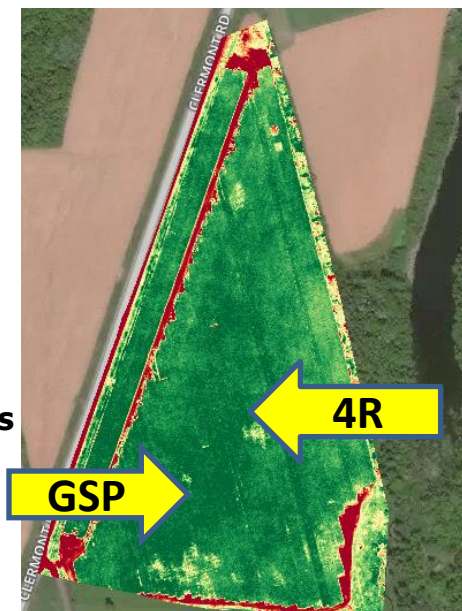
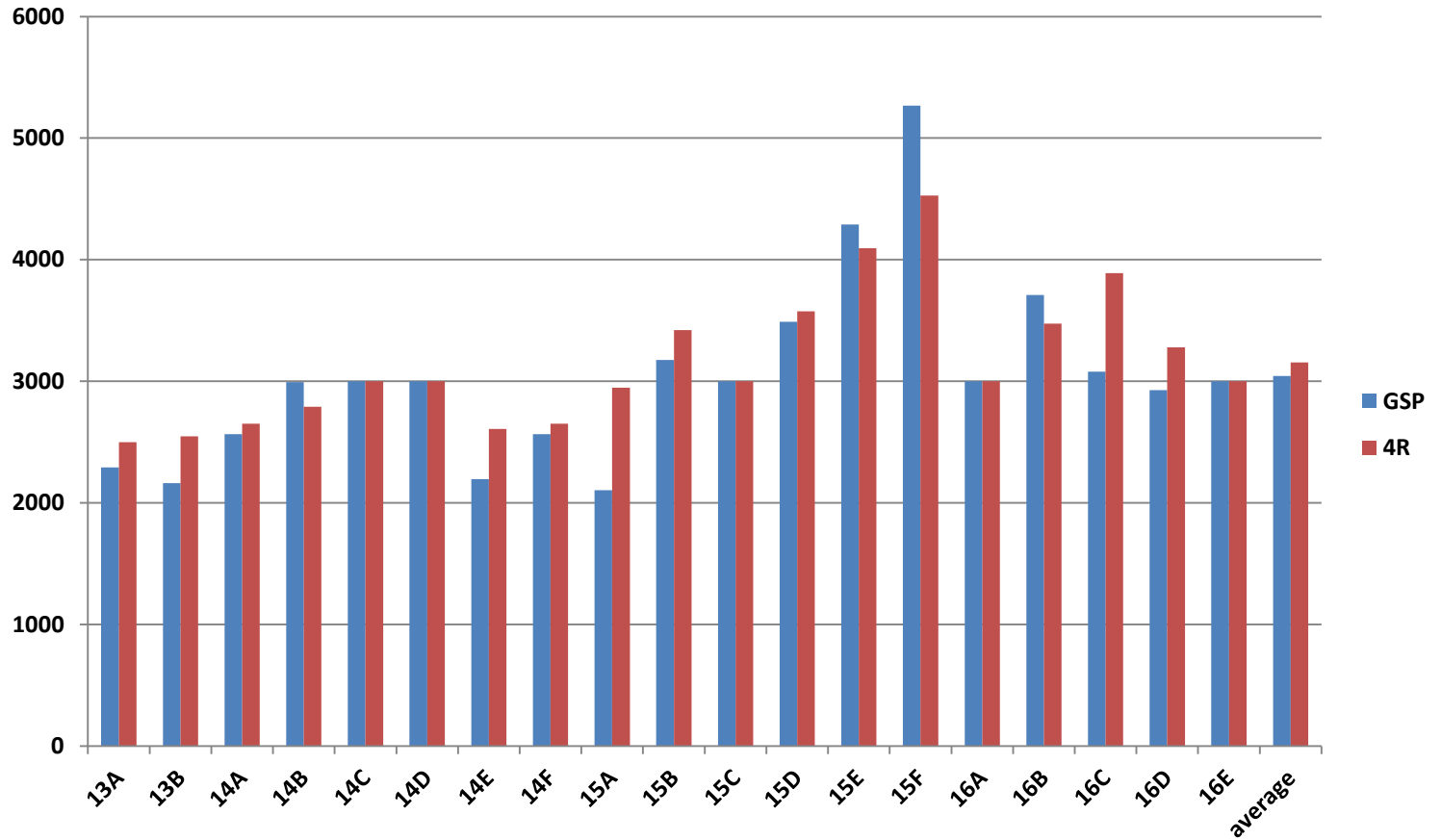


Figure 2: GSP and 4R treated sections Russet Burbank – site N14 PEI 4R Trials.



RESULTS *Crop Value*

**Net Crop
Value \$/acre**



Average GSP \$3043

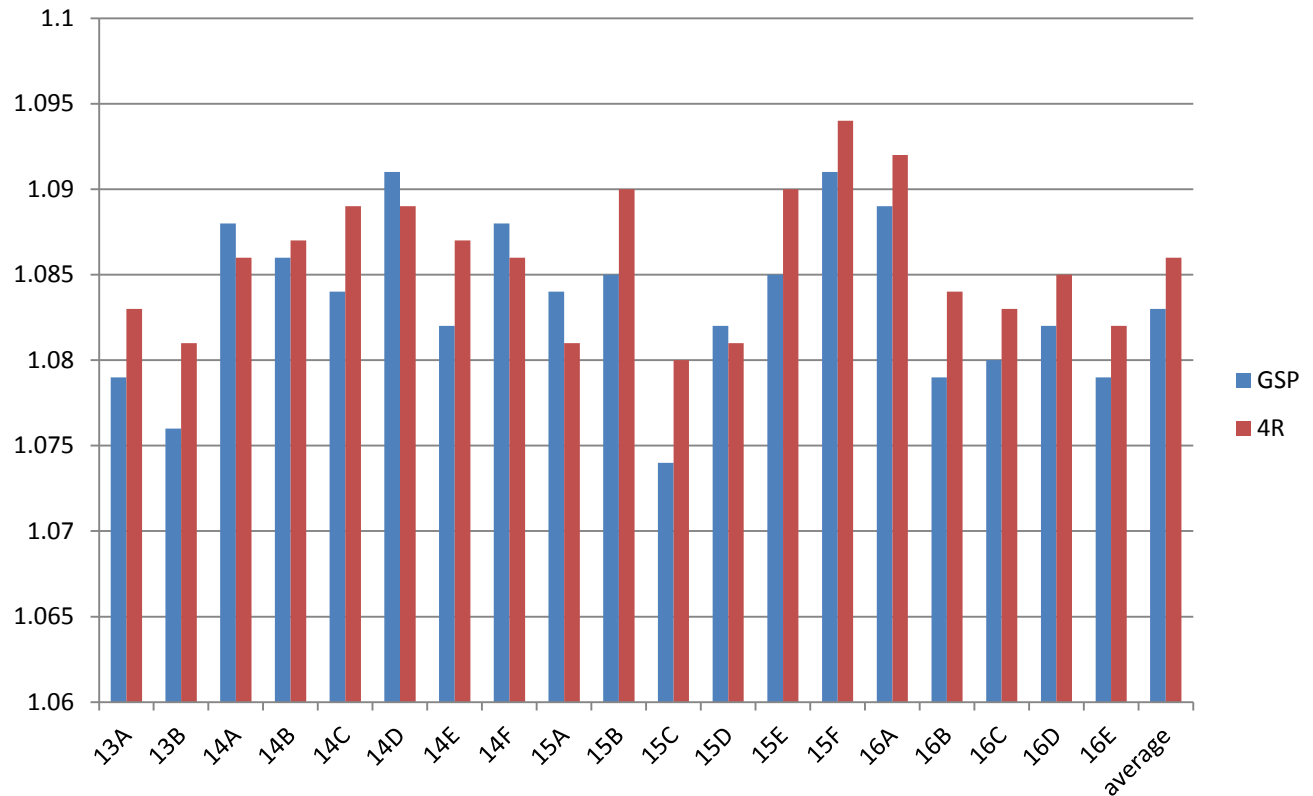
Average 4R \$3155

20 RB fields over 4 year period

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RESULTS *Tuber Specific Gravity*

Tuber Specific Gravity

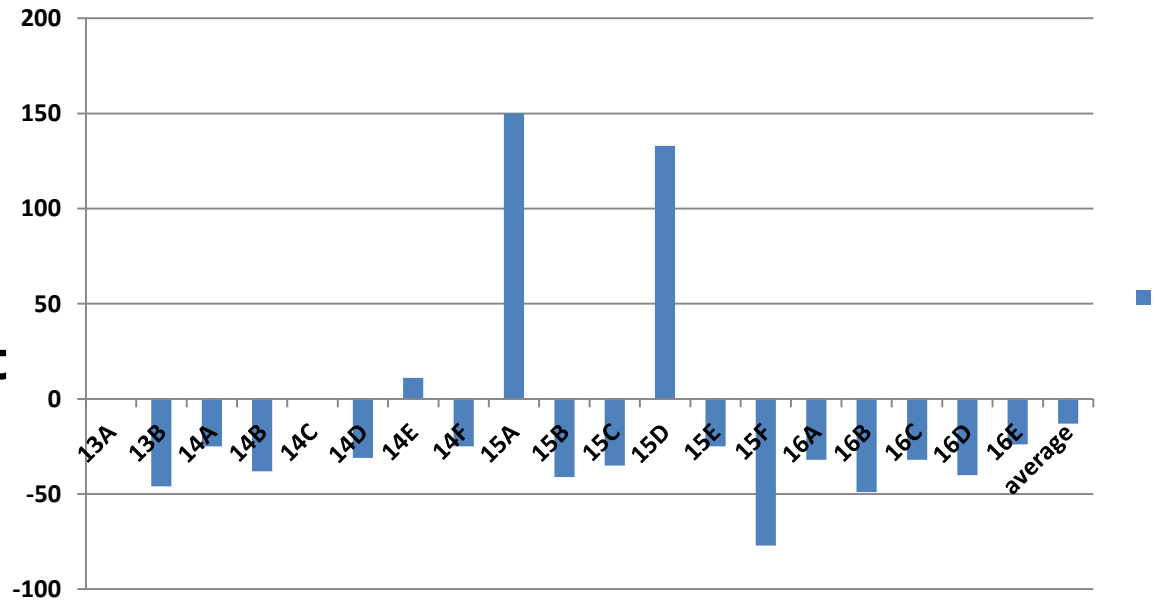


Average GSP 1.083

Average 4R 1.086

RESULTS *Residual NO3-N*

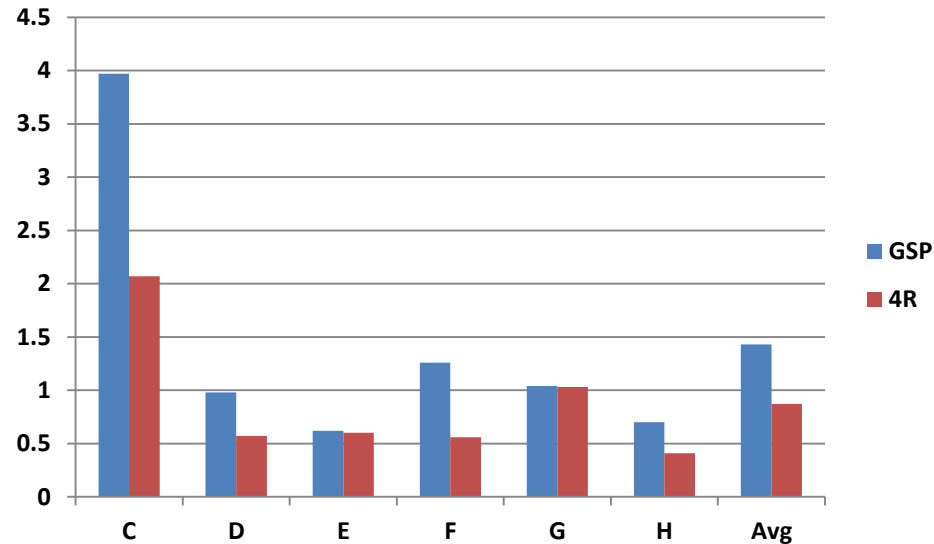
**% Change – Post Harvest
Residual Soil NO3-N
4R vs GSP 0-45cm**



**4R plots had on average, 13% less
residual NO3-N measured 10-15 days
after harvest!**

RESULTS *Green House Gas Emissions*

**Cumulative N₂O
Emissions Kg N/ha**



**4R plots had less GHG emissions
than GSP at all sites**

**2016 data- 4 RB fields, 1 Ranger Russet,
1 Superior**

WHY BE CONCERNED ABOUT GHG EMISSIONS?



Genesis Crop Systems

CONCLUSIONS.....

- **4R approaches look promising**
- **Better profitability, better quality, better footprint, better image**
- **Growers are talking and acting**
- **Ongoing identification of better ways to do the job – What we're doing now may not be where we are in 10 years?**





'He's got his father's eyes.'

A GROWER'S PERSPECTIVE

JONATHAN MACLENNAN *MacLennan Properties*





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