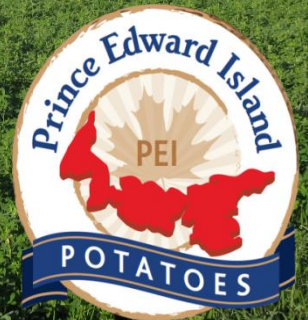


Tools for Soil Building in PEI



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Tools for Soil Building

- In my position, I get a lot of questions from growers about different rotation crops, best management practices for using them, and information on different tillage practices
- In this presentation, I hope to provide an overview for some of the tools available, including experiences direct from Island growers



Cover Crop Selection Tool

○ decision-tool.incovercrops.ca



LANGUAGE

English

LOCATION OPTIONS

Prince Edward Island

Queen

CASH CROP TYPES

Vegetable

Potato

COVER CROP PLANTING WINDOW



COVER CROP PERFORMANCE RATING



☐ Hide Crops that are not suitable for planting

Cover Crop

Soil

Goals / Benefits

For more info, click on cover crop name.

Broadleaf, non-legume

Buckwheat

Grass

Millet, Pearl

Sorghum-sudangrass

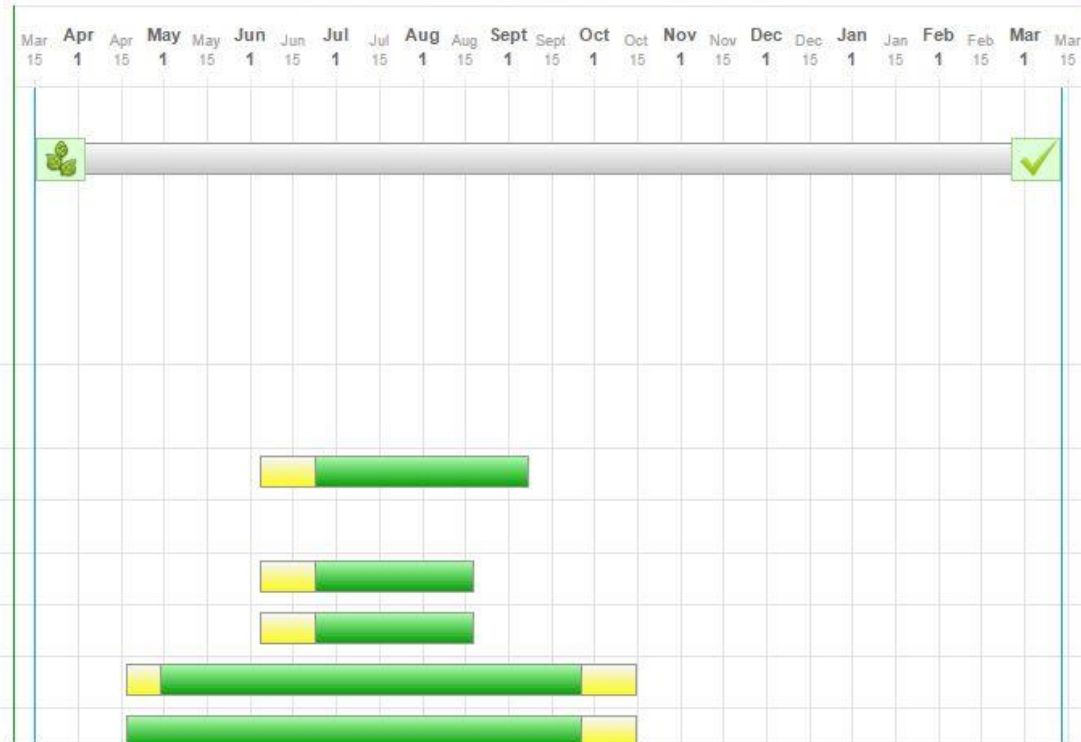
Oats

Barley, Spring

Plant date

Harvest

Main crop seeding dates with cover crop opportunities



Cover Crop Selection Tool

- ***Detailed information on each species for management!***

Information Sheet - Mustard, Oriental in Prince Edward Island Vegetable Crops

Eastern Canada cover crop selector tool

<http://decision-tool.incovercrops.ca/>

Planting Information

Drilled Seeding Depth ¼-¾ lb/ac [0.6 - 2 cm]

Drilled Seeding Rate 4-8 lb/ac [4.5- 9 kg/ha]
Broadcast and incorporated rate should be 10 - 20% higher than drilled rate. Increase seeding rate in late fall.

Aerial seeding rate Recommended at least 25% higher than drilled rate.

Seeds per lb 180000 (metric: 397000)

Frost Seed No

Comments Avoid planting in hot weather because plants will bolt quickly. Sept 1 planting may be too late for biofumigation effects. May be planted as early as Apr. 1. If planted in the middle of summer, temperature may induce flowering before sufficient biomass has been put on to achieve cover crop objectives such as biofumigation.

Termination Information

Termination Methods Freeze, Tillage, Mow, Herbicide

Termination Comments Don't let go to seed. Readily winter-kills once it bolts.

Cover Crop Selection Tool

- Includes stand-alone crops as well as a series of mixes. Can select province, county, crop type.
- Each crop profile includes:
 - Planting info
 - Termination info
 - Performance roles
 - Cultural traits
 - Potential Advantages
 - Potential Disadvantages



Red Clover presents issues

- Has been a standard rotation crop in potato production in PEI for decades
- Produces significant biomass, establishes easily, great underseed in grain crops...well adapted to Maritime climate
- However...
 - Preferred host for Verticillium, root lesion nematode
 - Preferred egg laying crop for click beetles (wireworm)



Rotational Crops

- Brown/Caliente Mustard
- Buckwheat
- Sorghum Sudangrass
- Pearl Millet
- Tillage Radish
- Alfalfa
- Other Forage Mixes



Brown/Caliente Mustard

- A number of studies in PEI have show effectiveness of mustard in decreasing wireworm damage
- Significant literature references to effect on:
 - Verticillium
 - Rhizoctonia
 - Common scab
 - Weed reduction



Brown/Caliente Mustard

- Can have an effect on nematodes if incorporated and biofumigant properties are activated. If left as a cover crop, there is some evidence that it could be a host for some nematode species.
- Establishes quickly in warmer temperatures, and can be incorporated in 45-60 days, before glucosinolates move to the seed.
- Can double-crop in one growing season if disease pressure is sufficiently high.



Brown/Caliente Mustard

- Growers are reporting generally better marketable yields after mustard crops.
- Several growers have indicated that the tilth of the soil is better, easier to dig in the fall with fewer clumps.
- Requires adequate fertility to grow sufficient biomass.
- Recommended at 6:1 ratio of N:S in fertilizer blend. Mustard needs Sulphur to produce glucosinolates
- Don't skimp on the fertilizer for the mustard, or it may result in a poor mustard crop, and a tie up of nutrients in the potato year of rotation.



Brown/Caliente Mustard



Brown/Caliente Mustard



Brown/Caliente Mustard

- Mow with a flail mower to chop finely, then incorporate immediately.
- Need to incorporate in moist soil
- Leave for about 2 weeks, and then a cover crop can be seeded (drill, broadcast) to cover soil if not double cropping
- Can be mowed through the growing season, incorporated in the fall...will regrow if mowed high enough
- Not frost tolerant
- Timing of incorporation will depend on what you are trying to combat most (wireworm vs. others), schedule of crop activities.



Effect on Controlling Wireworm

Research by Dr. Noronha (2007-2010)

Crop Preceding Potatoes	Total Yield cwt/acre	Marketable Yield cwt/acre
Barley	417	265
Brown Mustard	402	397
Buckwheat	405	379

No insecticide used

Marketable Yield for Processing used as standard

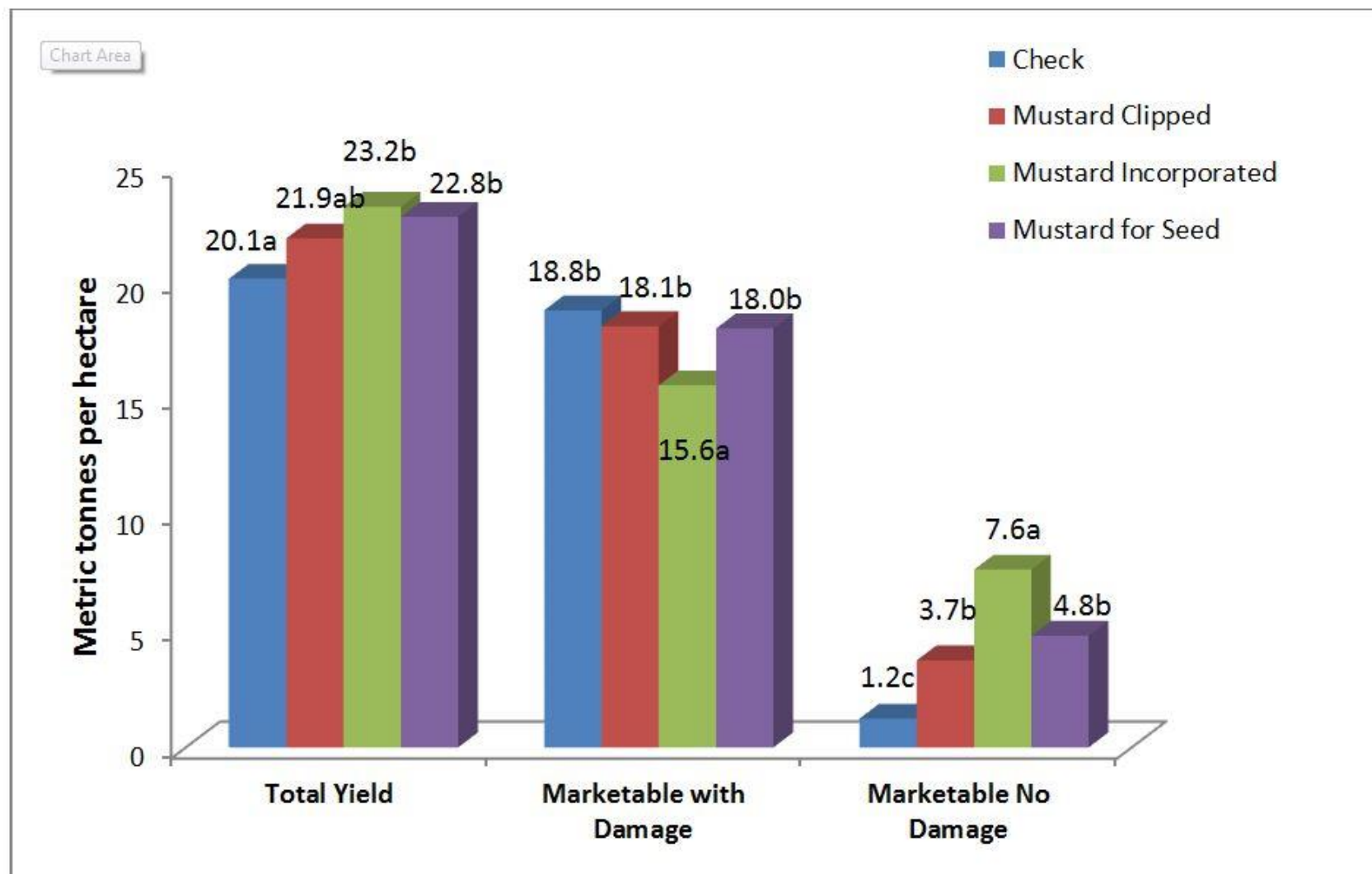
Double Crop of Mustard/Buckwheat for two years in this study

No Sig. Diff. for Total Yield

Sig. Diff for Marketable Yield for Processing



Grower Experience: Klondike Farms



Effect on Total Yield

Research by Dr. Ganga – Cavendish Farms (2013)

Crop Preceding Potatoes	Total Yield cwt/acre
Barley	256
Treated Wheat	277
Untreated Wheat	319
Mustard (Caliente 199)	340
Mustard + Nemat	351
Buckwheat	386

Study showed **significant reductions in holes/tuber and in the percentage of non-marketable tubers** in the plots when Mustard and Buckwheat were grown before potatoes.



Mustard: Grower Experience

Presented by Dr. Gefu Wang-Pruski at 2016 PEI Potato Expo, work with Cavendish Farms

Soil analysis for *Verticillium dahlia* detection and quantification in 2014

Field	Crop 2013	Crop 2014	Number of Vd cells /g soil	
			June 24	Sept. 5
IRF Heckbert Field Northeast Corner	Potatoes	Mustard/Mustard	178.5	11.3
IRF Heckbert Field Center	Potatoes	Barley under seeded	370.0	41.3
IRF Hickey Field FieldNorth side	Potatoes	Mustard	427.2	6.2
IRF Hickey Field Center	Potatoes	Barley under seeded	99.4	2.2
IRF Hickey Field South side	Potatoes	Buckwheat	224.7	23.9
Cavendish Farms	Potatoes	Corn	412.0	116.1
Cavendish Farms	Potatoes	Mustard blend (Caliente 199)	2140.3	0.0
Cavendish Farms	Potatoes	Mustard blend (Caliente/Nemat)	1063.1	-
Cavendish Farms	Potatoes	Mustard blend (Caliente61)	856.9	33.9
Cavendish Farms	Potatoes	Pearl Millet	1081.8	0.0
Cavendish Farms	Potatoes	Buckwheat	1719.8	299.4
Cavendish Farms	Potatoes	Sudan-sorghum hybrid	5660.3	0.0
Cavendish Farms	Potatoes	Triple Mix	9236.0	322.5

Buckwheat

- Has been shown in PEI to reduce wireworm damage in potatoes (single and double crop)
- Literature indicates that it is very favorable in combating Potato Early Dying (Verticillium/nematodes)
- Also has been shown to be good at suppressing weeds.
- Known as a P scavenger, making P more available to subsequent crops
- **DO NOT LET IT GO TO SEED**
... can become a weed.



Buckwheat

- Requires warmer soil to germinate than mustard
- Not frost tolerant at all...will decompose quickly after frost
- Fast growing in the summer, can be established and incorporated quickly.
- Some risk of white mold



Sorghum Sudangrass

- High biomass crop for building soil OM
- Has been shown to control root lesion nematodes
- Cited for weed suppression
- Can be used for cattle feed



Sorghum Sudangrass

- Mid-season mowing at greater than 6 inches dramatically increase root mass and depth.
- Requires warm soil for germination and establishment. Not frost tolerant
- When frosted, can cause prussic acid poisoning if fed to livestock
- Biomass can take longer to break down, can tie up some N in resultant year, especially if not chopped/flailed.



Pearl Millet

- According to OMAFRA, best known crop for reduction of root lesion nematodes
- Good production of biomass for soil OM
- Weed suppression and compaction reduction



Pearl Millet

- Requires warm soil to establish (like sudangrass)
- Slower to establish than sudangrass
- Vegetative growth will decompose much better than mature growth, so better to mow more often and at a lower height for maximum effect
- May tie up some soil N in next year if allowed to get mature. DO NOT LET GO TO SEED



Tillage Radish

- Assists in breaking up soil, creating holes for water infiltration.
- Good for N scavenging and weed control.
Releases N rapidly.
- Can be established early



Tillage Radish

- Can be planted in mixture with other species
- Don't grow in rotation with other brassica species (canola, mustard) due to white mold, clubroot
- Plant before Sept 1 if wanting a deep taproot.



Alfalfa

- Deep taproots/root mass help with soil compaction and building soil OM
- Can be economic forage crop if in rotation with cattle farms
- Can be mixed easily with other suitable grass species (orchardgrass, timothy, brome grass)



Alfalfa

- Can be direct seeded in spring, but establishes best as under seed with grain crop
- Sensitive to acidic soil, ideally pH 6.3 or more
- Requires additional application of K
- Inoculation to foster N fixation, can contribute significant amount of N when incorporated
- Plant a variety resistant to *Verticillium*



Other Forage Mixes

- Oats/Peas
- Oats/Peas/Hairy Vetch
- Grasses/White Clover or Crimson Clover
- Kale
- ???



Organic Amendments

- Not always easy to access manure or compost, but quick way to improve soil OM and nutrients.
- Important to do manure sample tests to assess nutrient value of manure before application
- Time/incorporation of manure important ...don't want to lose all of the N!



Organic Amendments

- Can be high cost to organic amendments if not readily available close by, or if they aren't a concentrated product. However, can help build soil health and soil OM faster than crop rotation alone.
- Working with local livestock farmers to assess manure availability, trading for straw/hay
- Investigate alternative organic amendment sources

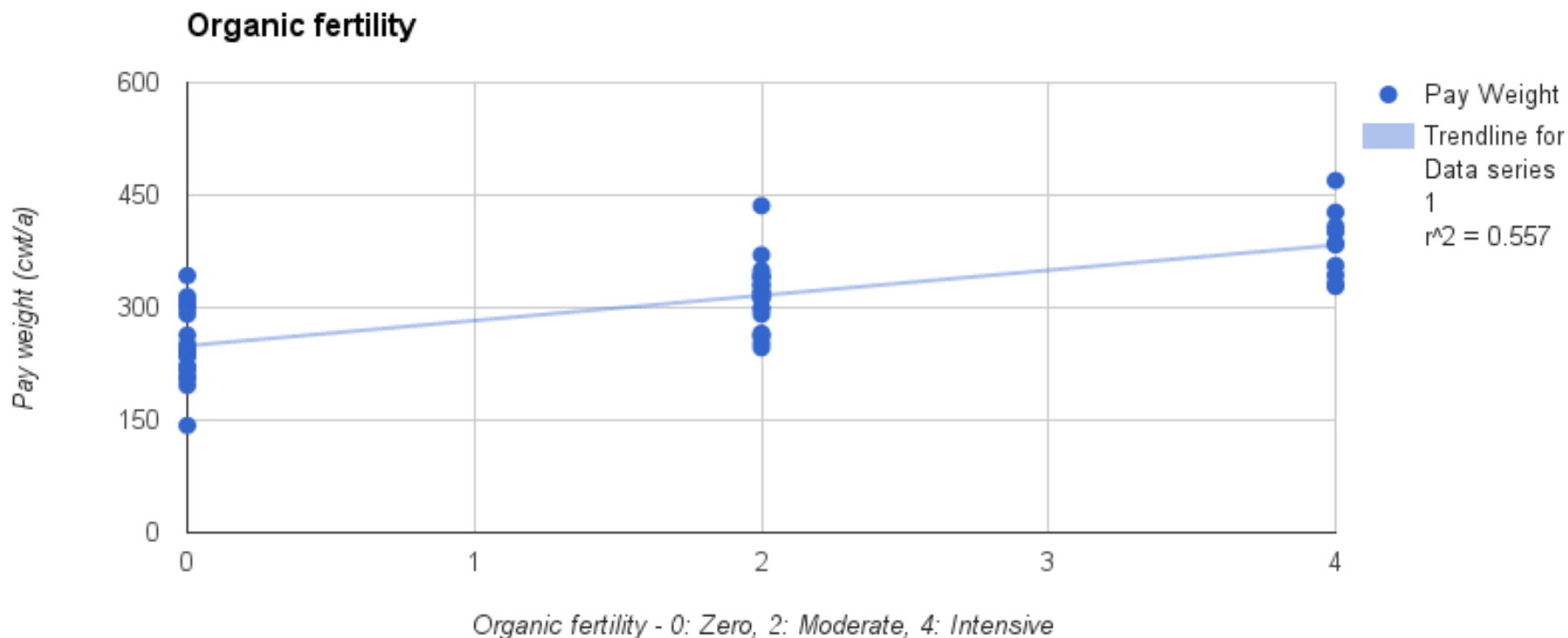


Organic Amendments

- Nutriwave:
 - 4-1-2 chicken manure
 - 3% calcium, 0.7% magnesium
 - Dehydrated pellets



Organic Amendments



Oyster Cove Farm: Investigating impact of organic amendments on pay weight from 2014-2016.



Residue Tillage

- Currently working with multiple researchers and agronomists in PEI to put together multiple years of data on use of residue tillage and it's effect on marketable yield and soil characteristics.

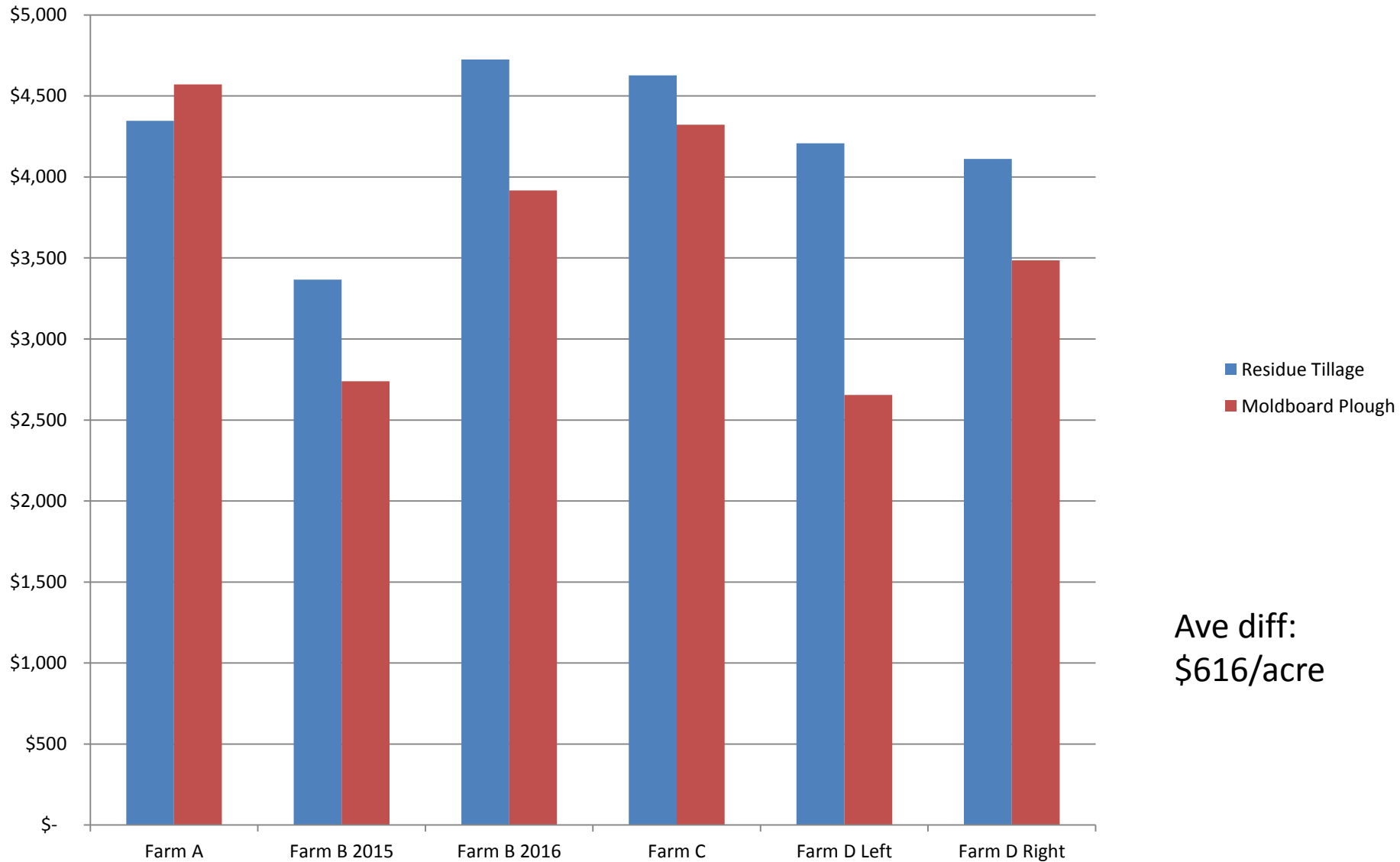


Residue/Reduced Tillage

- Plan is to put all of the data together to identify keep trends over multiple sites/years.
- Reduced tillage techniques have been shown to reduce soil compaction, improve water holding capacity of soil and water infiltration, destroy less soil OM, reduce soil erosion
- Also seeing a positive trend on marketable yield with use of reduced tillage equipment.



Residue Tillage versus Moldboard Plough



Looking at Changes?

- Identify a problem field
- What are the biggest limitations for that field?
- How could those limitations be addressed through rotation or through organic amendments?
- Leave a check strip to help assess impact
- Be prepared for differences to take more than one year to show up
- Measure yields and/or soil quality parameters directly!



Questions?

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