Stacks of Bills vs. Stacks of Genes: The Economics of Planting Transgenic Seeds

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Transgenic Agriculture

- After about 10 years, transgenics are an established part of U.S. crop production
- 89% of U.S. soybean acres and 61% of corn acres were transgenic in 2006
  - In Wisconsin: 85% soybeans, 50% corn
- What have transgenics meant for farmers?
  - Higher yields (lower prices?)
  - Easier weed control (more low/no till?)
  - Higher seed costs due to tech fees
  - Weed and insect resistance management
  - Lots of traits, bundled in different combinations

Focus Today

- What do you get for your money?
  - Value of the different transgenic traits
- Resistance Management
  - What are its costs and benefits?
- Risk Management
  - How to protect your investment

Corn Gene Stacks

- 7 transgenic combinations available
- 3 Single Stacks: RR corn, Corn Borer (CB) Bt corn, Rootworm (RW) Bt corn
- 3 Double Stacks: CB Bt corn + RR, RW Bt corn + RR, CB + RW Bt corn
- 1 Triple Stack: CB + RW Bt corn + RR
- Many different conventional hybrids to put these traits into in all the different possible combinations

Total Tech Fee by Bundle

Based on Roundup Rewards Program refund rates for Monsanto traits

RR	CB Bt	RW Bt	Tech Fee
X			$26/bag
	X		$24/bag
X	X		$38/bag
		X	$45/bag
X		X	$55/bag
	X	X	$55/bag
X	X	X	$70/bag

Tech Fees by Trait Lower in Bundles

Trait	Alone	Bundled
Roundup Ready	$26/bag	$14 with CB Bt
		$10 with RW Bt
		$15 with CB+RW Bt
Corn Borer Bt	$24/bag	$12 with RR
		$10 with RW
		$15 with RW+RR
Rootworm Bt	$45/bag	$29 with RR
		$31 with CB Bt
		$32 with CB+RR

Companies want you to bundle

- Traits most expensive when bought as a single stack
- Traits least expensive when added onto a single stack (double stacks are best deal)
- Adding a trait onto a double stack costs $1-$5/bag more than adding it onto a single stack (expect this cost to fall)

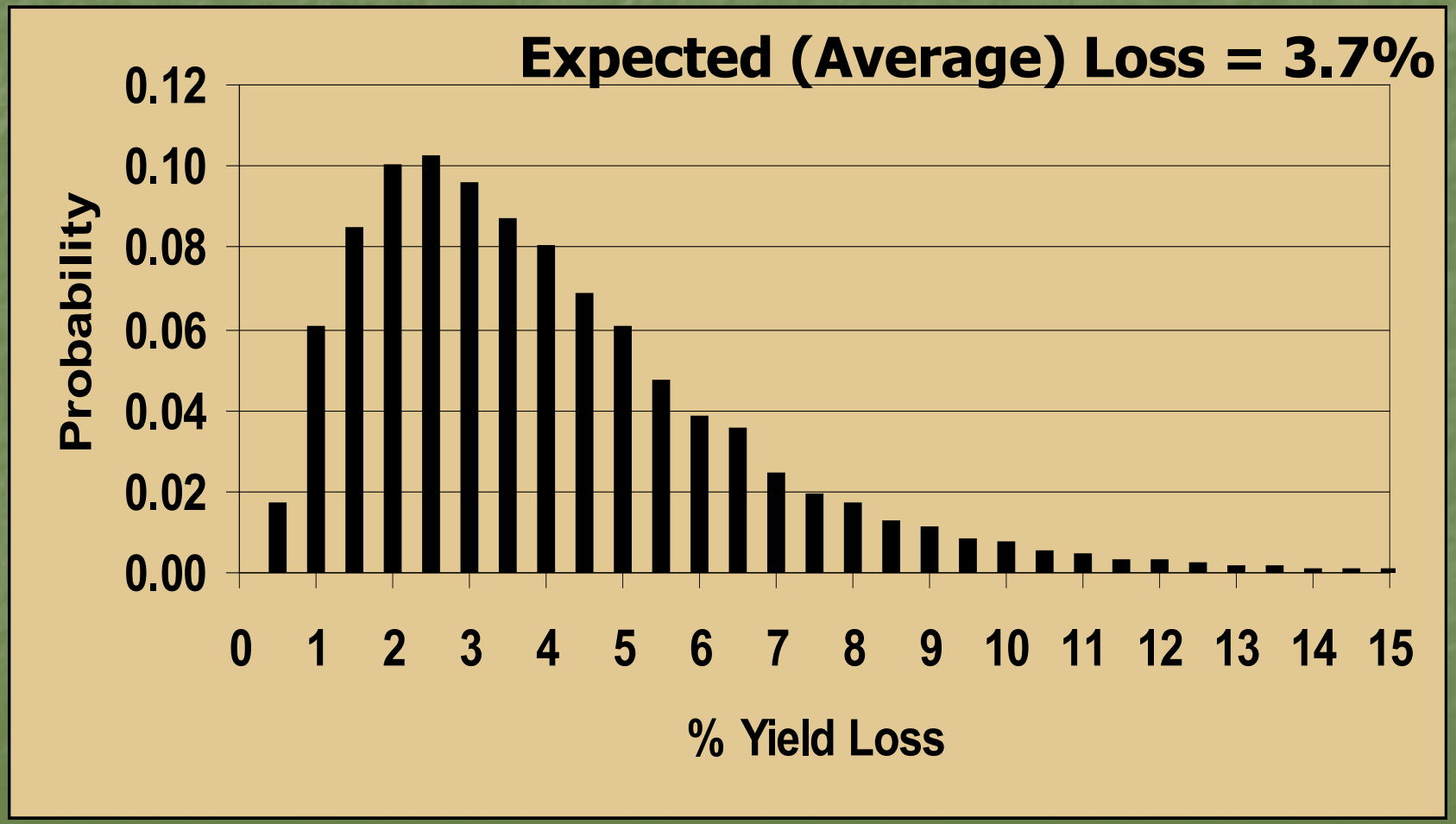
Trait Valuation

- What is the Expected Value, before you plant or know how the season develops?
- First look at Corn Borer Bt corn
- Next Look at Rootworm Bt corn
- Last: look at Roundup Ready corn

Value of Corn Borer Bt Corn

- Depends on European Corn Borer (ECB) population, which is random
- Estimate ECB population distribution using DATCP population data collected since 1940's
- Estimate distribution of stalk tunneling given ECB population (Mitchell et al. 2002)
- Estimate distribution of % yield loss given stalk tunneling (Hurley, Mitchell, and Rice 2004)
- Final Result: Distribution of % Yield Loss from ECB for each WI crop reporting district

Distribution of % Yield Loss in East Central Wisconsin



Spreadsheet Decision Aid

Farmer Enters

- Expected Yield (bu/ac)
- Expected Price ($/bu)
- Tech Fee ($/bag)
- Planting Density (seeds/acre)

Decision Aid Estimates

- Expected Net Benefit of Bt Corn ($/ac)
- Break-Even Probability (%)

Expected (Average) Net Benefit

- Expected net return ($/ac) to CB Bt corn based on random ECB population, tunneling, and % yield loss
- Long run average if planted CB Bt corn over many years
- = Price x Yield x % Yield Loss Prevented
  - Tech Fee
- Depends on assumed price, yield, tech fee and region

Break-Even Probability

- Because ECB population, tunneling, and % yield loss are random, Net Returns to CB Bt corn are random
- If the average net benefit is $5/ac does not mean the actual net benefit will always be $5/ac
- Break-Even Probability: Probability that the value of the yield saved by Bt corn will equal or exceed the extra cost of Bt corn

Summary: East Central Wisconsin

- Expected loss from ECB: 3.7%
- Assume a $10/ac tech fee
  - $24/bag, 33,333 planting density
- At current high corn prices, low expected corn yields still make CB Bt corn worth buying
- Table: Expected yield needed at each price to justify cost
- **Main Point: Buy CB Bt corn**

Price	Expected Yield
3.00	90.1
3.25	83.2
3.50	77.2
3.75	72.1
4.00	67.6
4.25	63.6
4.50	60.1

Value of Rootworm Bt Corn

- Do not have the data to develop a system for RW Bt corn like I have for CB Bt corn
- Recommendations based on my published work and research experience
- **No Rootworm problems in Rotated Corn**
  - No need for rootworm control in rotated corn
  - No problems with soybean variant WCR or NCR extended diapause in this part of state
- **Main Point: Rotate corn to control RW**

RW Bt corn in Corn after Corn

- Available RW Control Options
  - RW Bt corn, Soil Insecticides, Seed Treatments
  - **None** provides complete control
  - All three control other seed/root pests
- RW Bt corn as good as or better than Soil Insecticides and Seed Treatments for RW
- Seed Treatments generally least effective
- **Which is the most economical?**

Cost of RW Control

- RW Bt corn tech fee about $18-$20/ac alone, $12-$13/ac as double stack
- Soil Insecticides also $18-$20/ac
- Seed Treatments $15/bag, or about $6/ac
- How many bushels do you need to save to justify these costs?

Bushels Needed to Justify Cost

	Seed Treatment	RW Double Stack	RW Single Stack Soil Insecticide
Price	$6/ac	$12/ac	$18/ac
2.00	3.0	6.0	9.0
2.25	2.7	5.3	8.0
2.50	2.4	4.8	7.2
2.75	2.2	4.4	6.5
3.00	2.0	4.0	6.0
3.25	1.8	3.7	5.5
3.50	1.7	3.4	5.1
3.75	1.6	3.2	4.8
4.00	1.5	3.0	4.5
4.25	1.4	2.8	4.2
4.50	1.3	2.7	4.0

Main Point

- At current corn prices and costs, to justify these treatments, need to expect to save
  - 1.5-2 bu/ac for seed treatment
  - 3-4 bu/ac for RW in double stack
  - 4.5-6 bu/ac for RW single stack or soil insecticide
- Expected savings will depend on CRW pressure—how bad is it in your area?

RW pressure in East Central WI

- I do not have data on RW pressure in EC WI
- UW Corn Hybrid Performance Trials
  - Trials at Fon du Lac, Seymour, Valders
  - Compare RW Bt to hybrids without the gene
  - Compare and see bu difference and lodging over the last few years: is it worth it?
  - Work with county ag agent or dig through publication
- Work with UWEX to run your own trial
- Do you already treat for RW?
  - What have you found for performance?
  - What do you get for your money?
  - Leave some untreated rows to see
  - Ask neighbors what they do

Some things to think about

- RW Bt corn vs Soil Insecticide
  - As good as or better control
  - More consistent/dependable control
  - Safer to use for people and environment
  - More convenient to use: no insecticide boxes
- RW Bt corn vs Seed Treatments
  - Better control with RW Bt
  - Both convenient to use (but need refuge for Bt)
  - Both safer to use
- All three control more pests than just Rootworms

Main Point/Summary

- If you think you need some soil insect protection for corn after corn
  - Seed Treatment the cheapest, but worst control
  - **RW Bt Corn as double stack best deal—most protection at cheapest cost**
  - RW Bt Corn as single stack: comparable to a soil insecticide in cost
  - Soil insecticide good backup, especially if did not order, or buy RW Bt or Seed treatment
- None of these perfect: Refuge, Efficacy, Safety and Consistency

Roundup Ready Trait

- Cost for RR corn trait
  - $10-$11/ac if single stack
  - $4-$6/ac as a bundled stack trait
- Weed Resistance: Major problem arising due to over use of Roundup: several instances in U.S.
- Recommend: Do not rely solely/primarily on Roundup for weed control in Corn after RR Soybeans that use Roundup as primary weed control method

Value of RR corn

- Do not rely on RR trait for weed control, rather treat RR tech fee as the cost to buy the option for a weed rescue treatment if needed
- Rely on some standard, non-Roundup, weed control, then use Roundup only if you have a weed control failure or an escape
- Gives good weed control, plus preserves Roundup for your soybeans and the Roundup option for your corn, but costs more
- Fails as resistance management if you end up using Roundup on corn most/many years

Resistance Management
New Issue due to Transgenics

- Weed Resistance: rotate modes of action—do not keep using only Roundup year after year
- Insect Resistance for Bt Corn: 20% non-Bt refuge
  - Within ½ mile for CB Bt
  - Adjacent for RW Bt
- Use soil insecticide/seed treatment for RW refuge
- Choose the refuge configuration that works best for you

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- Insect Resistance for Bt Corn:
  - 20% non-Bt refuge
  - Within ½ mile for CB Bt
  - Adjacent for RW Bt
- Can use a soil insecticide or seed treatment on RW refuge
- Choose the refuge configuration that works best for you: are many possibilities

Expected Cost of CB Refuge

- You give up ECB control in refuge, so expect to lose some yield—How much?
- Expected Cost of CB Refuge in terms of ECB damage, spread over whole field

  = price x yield x % refuge x % ECB loss
- Expected yield loss from ECB in East Central Wisconsin = 3.7%
- Refuge = 20%

Expected Cost $/ac for ECB Refuge Spread Over Whole Field

price \ yield	100	110	120	130	140	150	160
3.00	2.22	2.44	2.66	2.89	3.11	3.33	3.55
3.25	2.41	2.65	2.89	3.13	3.37	3.61	3.85
3.50	2.59	2.85	3.11	3.37	3.63	3.89	4.14
3.75	2.78	3.05	3.33	3.61	3.89	4.16	4.44
4.00	2.96	3.26	3.55	3.85	4.14	4.44	4.74
4.25	3.15	3.46	3.77	4.09	4.40	4.72	5.03
4.50	3.33	3.66	4.00	4.33	4.66	5.00	5.33

Main Point

- Expected cost of CB Bt corn refuge is about $3-$5/ac this year—not too much
- Expected cost of RW Bt corn refuge?
  - Low if use seed treatment or soil insecticide on your refuge
- Main point: refuge does cost money, but not too much, plus refuge has benefits

Benefits of Refuge

- Doing the right thing!
- Compliance Assurance Program (CAP) doing on farm inspections and imposing penalties for violations
- Valuable Data: compare yields between refuge and Bt and calculate the actual cost of refuge and the actual yield benefit
- Use data over years and fields to see your average (expected) benefit and costs, plus how your benefit and costs have changed

Risk Management

- High input costs means you are making a larger investment when you plant your crop
  - Seed costs from transgenic tech fees
  - Fertilizer and Fuel costs higher, Labor as well
- High corn prices means expected value of your crop is higher than in year past
- Use crop insurance to
  - Ensure recover some/all of your input costs
  - Reap benefits of high corn prices
- 2007 a year to consider crop insurance

Crop Insurance

- 4 types for corn and soybeans in Wisconsin
- Insure your yield—APH
- Insure your yield and market price—CRC
- Insure county yield—GRP
- Insure county yield and market price—GRIP
- Must decide by March 15th

Crop Insurance Hints for 2007

- Just completed 2 page Fact Sheet
- Yield/weather risk same as in other years
- Is price risk greater this year?
- Good year to consider revenue (price x yield) insurance: CRC or GRIP
- If prices drop, you'd like to have current high prices locked in for your crop
- If prices go higher, you'd like to be sure you have grain to sell or can buy grain for livestock
- CRC and GRIP meant for these risks

CRC vs GRIP

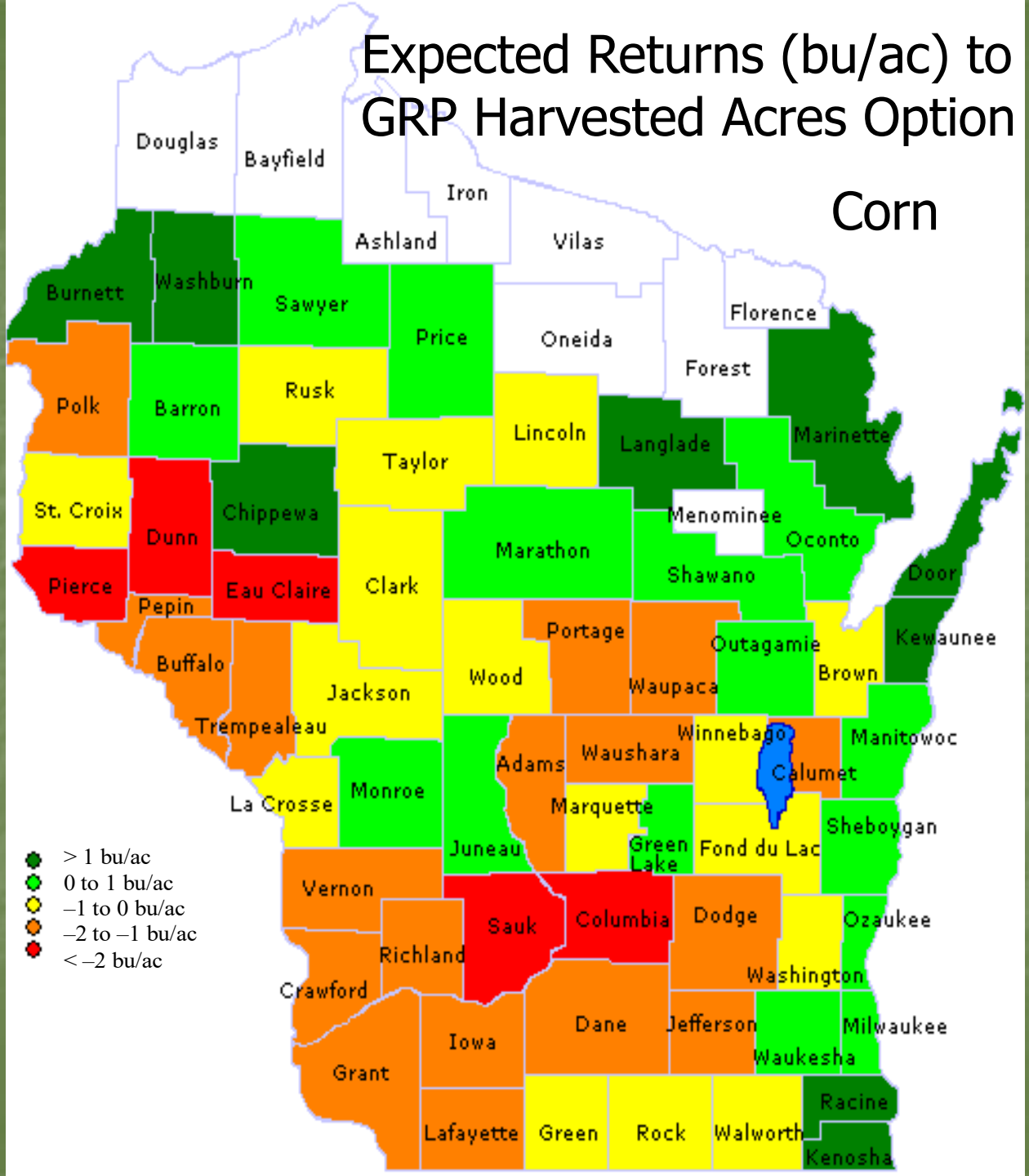
- CRC pays indemnities based on your yield and CBOT prices
  - Need established yield history
  - Pay more for individual based coverage
- GRIP pays based on county yield and CBOT prices
  - Do not need yield history
  - Generally cheaper than CRC
  - Good deal if your yield follows county yield

GRP/GRIP generally a good deal in this part of Wisconsin

- Just competed analysis of GRP for corn and soybeans for each Wisconsin county
- Color maps available on my web page
  www.aae.wisc.edu/mitchell/extension.htm
- These counties show on average, positive net return to GRP (and GRIP) for corn, especially with the Planted Acres Option
- GRP (or GRIP) not good deal for soybeans

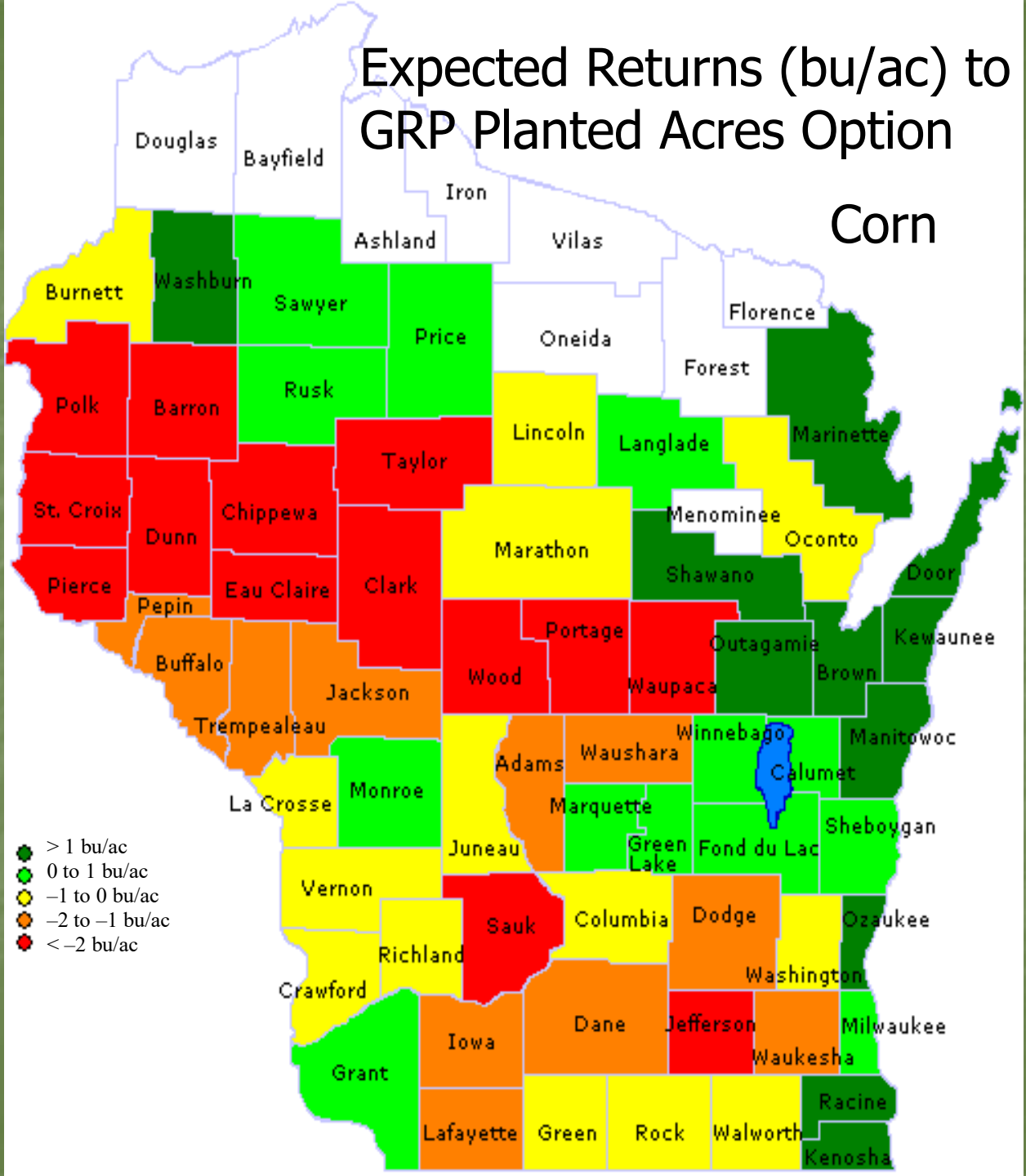
Expected Returns (bu/ac) to GRP Harvested Acres Option

Corn

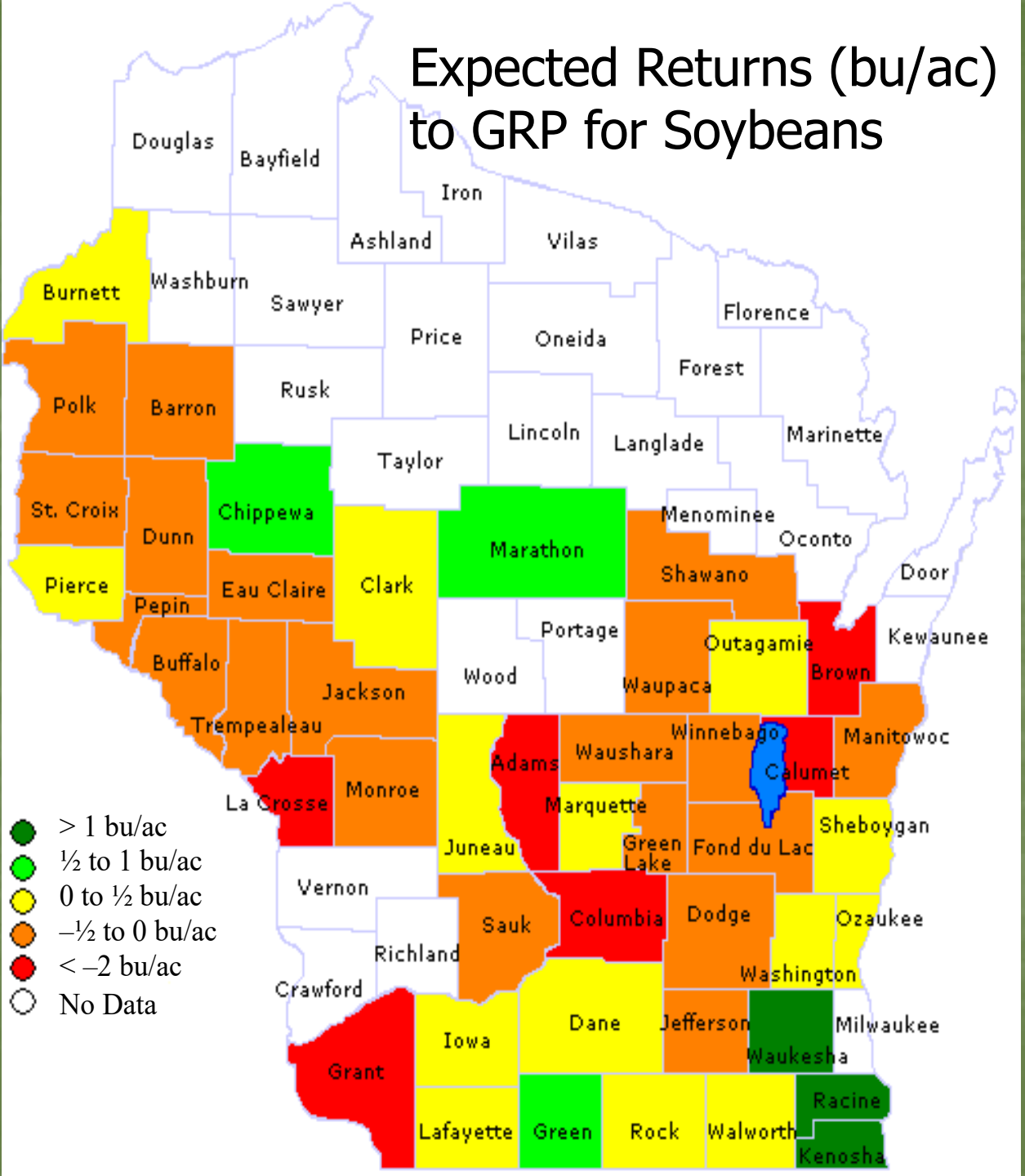


Expected Returns (bu/ac) to GRP Planted Acres Option

Corn



Expected Returns (bu/ac) to GRP for Soybeans



Other Quick Hints

- Coverage Level: Usually 70-75% for CRC or APH best deal, sometimes 65% or 80%
- Price Election: Take 100%/maximum
- Units: Get as many Optional Units as can
- Livestock/Dairy: use crop insurance so can buy grain if your yield fails
- Irrigation: Low yield risk, look at GRP/GRIP
- Low Yields: Use yield plug and floor, try GRP/GRIP
- Short/No Yield History: Use GRP/GRIP as establish history

Summary/Conclusion

- Transgenic Seed Cost: double stack best deal, single stack most expensive
- CB Bt corn: worth the cost in EC Wisconsin
- Plant RW Bt corn only after corn, and only if need RW control—you decide
- Plant CB Refuge: costs $3-$5/ac of corn
- Plant RW Refuge: treat with soil insecticide or seed treatment
- RR trait: Gives option to fix control failures or weed escapes, don't use as main control
- Consider crop insurance: CRC/GRIP

Questions?

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