P, Zn and N Fertilization for Corn

John Heard and Magda Rogalsky

Phosphorus and Zinc Fertilization Beneficial Management Practices for Corn in Manitoba

Crop Rotation and Strip-Tillage Preliminary Results

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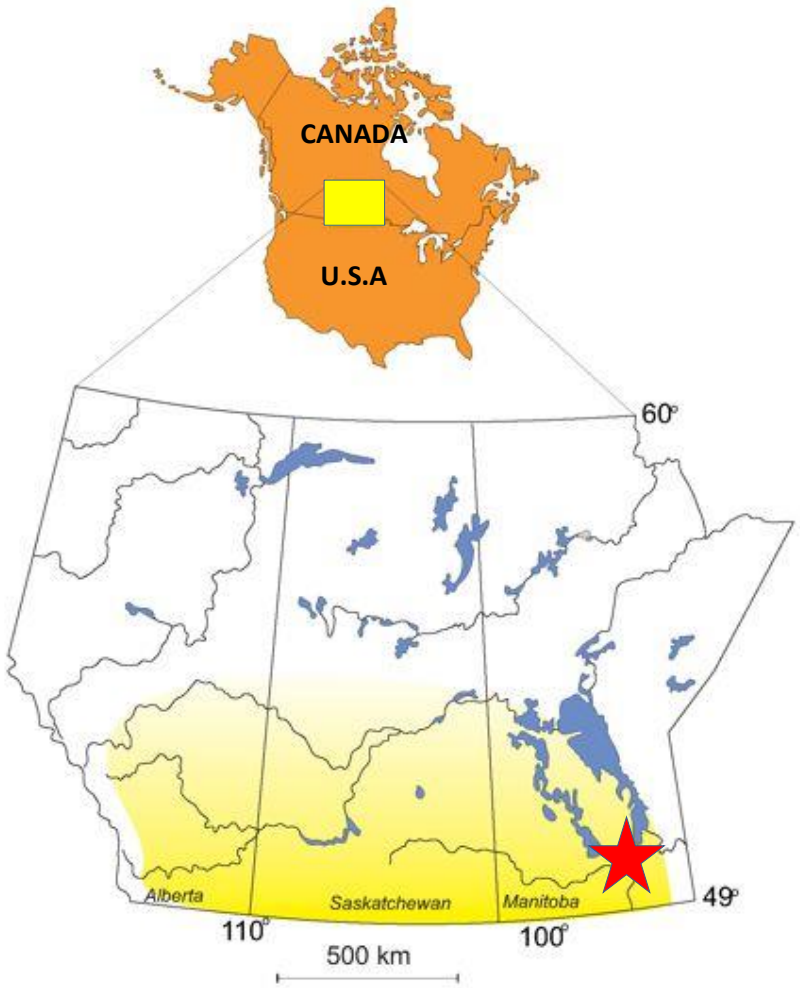
Background

Corn Production in Manitoba, Canada

- Grain corn acreage steadily increasing
- In 2015 grain corn was ranked 7th among "Top 10 acreage crops in MB" (Yield Manitoba, 2016)
- Northern fringes of the Northern Great Plains, short growing season and cold soils at planting



http://home.cc.umanitoba.ca/~mlast/lakelevel/page3/assets/1593.jpg

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Crop Rotation Study

Fertilization strategies for corn grown after canola vs. soybeans

P?

Zn?

Rotation Study: Background

- Canola is non-mycorrhizal, so AMF population drops
- Corn is highly dependent on mycorrhizal fungi (AMF)
- Therefore, corn on canola stubble is prone to P perhaps Zn deficiency (Ontario & BC studies)
- Starter fertilizer P and Zn may help to offset this problem

MAP 27 lb P_2O_5 ac^{-1} | No P Check | P deficiency symptoms at V3

Rotation Study: Site Information

	Planting Date	Harvest Date	Olsen-P (ppm)	DTPA-Zn (ppm)
2015 Sites				
Carman, MB	May 25	Oct. 15	19	1.50
Stephenfield, MB	May 26	Oct. 14	6	0.82
2016 Sites				
Carman, MB	May 12	Oct. 05*	9	1.91
Portage la Prairie, MB	May 16	Oct. 06	12	1.81

* Carman 2016 site was hand harvested due to wind damage and green snap.

Corn Hybrid: DKC 26-28RIB (2150 CHU)

Rotation Study: 2 Previous Crops Treatments

Canola

Soybean

Rotation Study: 5 Fertilizer Treatments

(lb/ac, sidebanded 2” by 1” at planting)

CONTROL

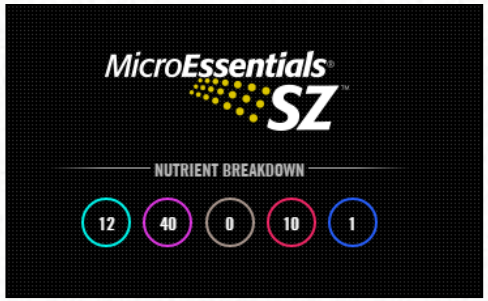
1. No P Check

MAP (11-52-0) + AS (21-0-0-24)

2.	27 P_2O_5	0 Zn	6.8 S
3.	54 P_2O_5	0 Zn	13.5 S

MicroEssentials SZ (12-40-0-10S-1Zn)

4.	27 P_2O_5	0.68 Zn	6.8 S
5.	54 P_2O_5	1.35 Zn	13.5 S



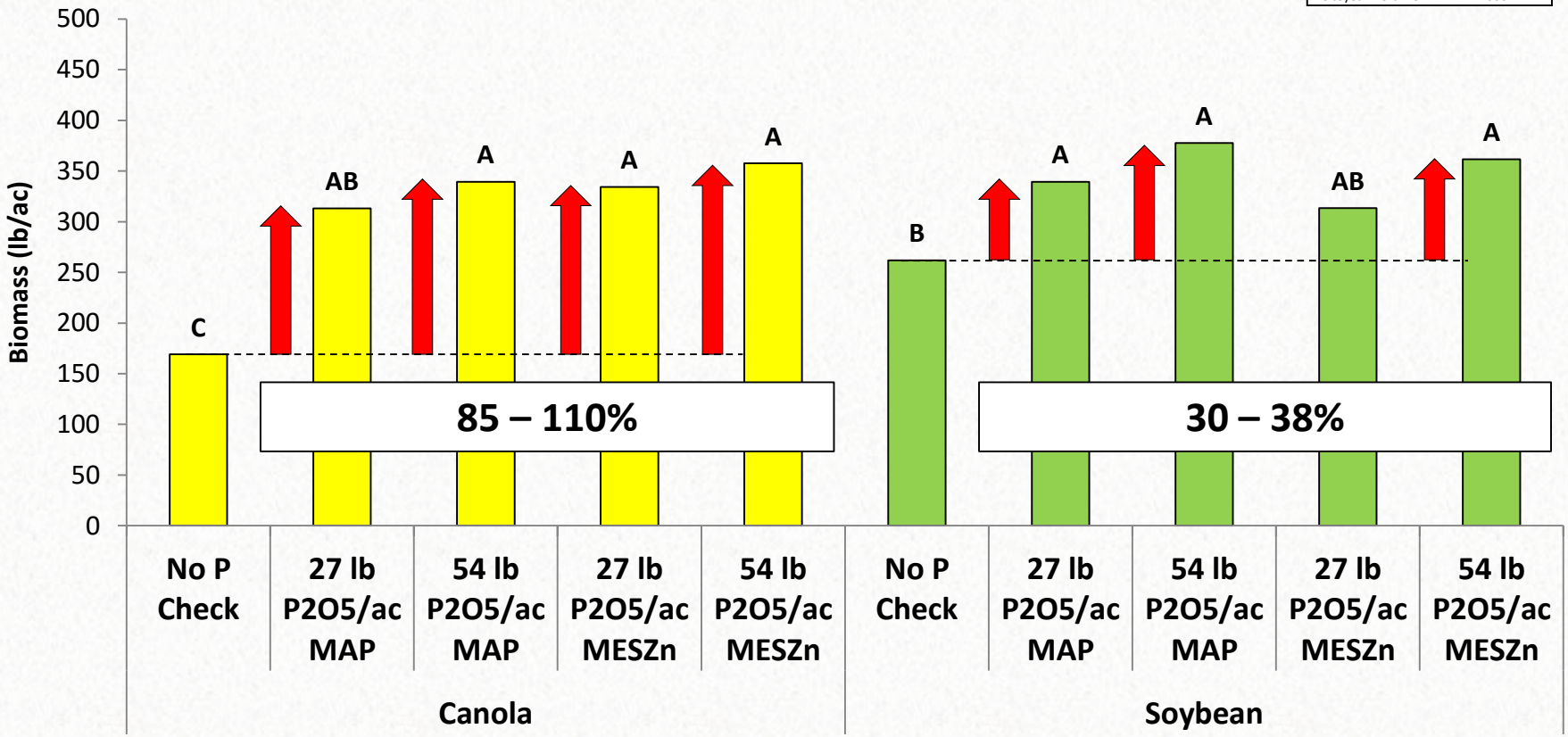
MicroEssentials (December 14, 2015) http://www.microessentials.com/#fusion-process

Rotation Study: Preliminary Results

Collected at V4

Corn Early Season Biomass (V4)
2015 - 2016

Alpha = 0.05	
Effect	Pr > F
fertilizer	<.0001
crop	0.0383
crop*fertilizer	**0.0025**
site-year	<.0001
siteyear*fertilizer	<.0001

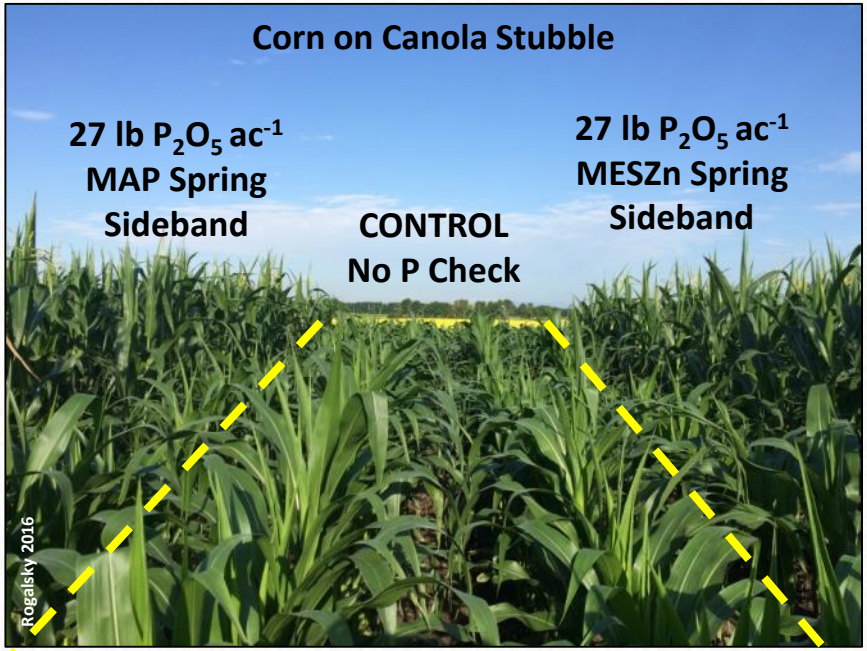


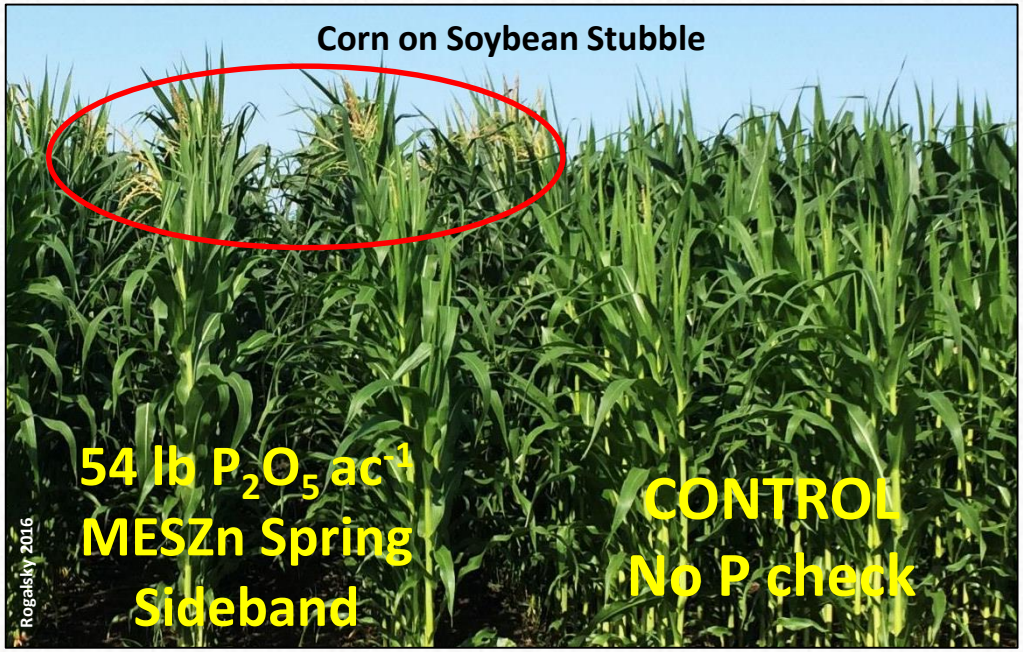
Rotation Study: Preliminary Results

Silking differences as compared to control plots

Alpha=0.05	
Effect	Pr > F
fertilizer	<.0001
crop	0.0003
crop*fertilizer	<.0001
siteyr	<.0001
siteyr*fertilizer	<.0001
siteyr*crop	0.0217
siteyr*crop*fertilizer	0.0015

Site-year	Maturity Advance (days)	Fertilizer and Crop
Carman 2015	+2 to 3	All fertilizer treatments, corn on canola
Stephenfield 2015	ns	ns
Carman 2016	+2 to 7	All fertilizer treatments, regardless of crop



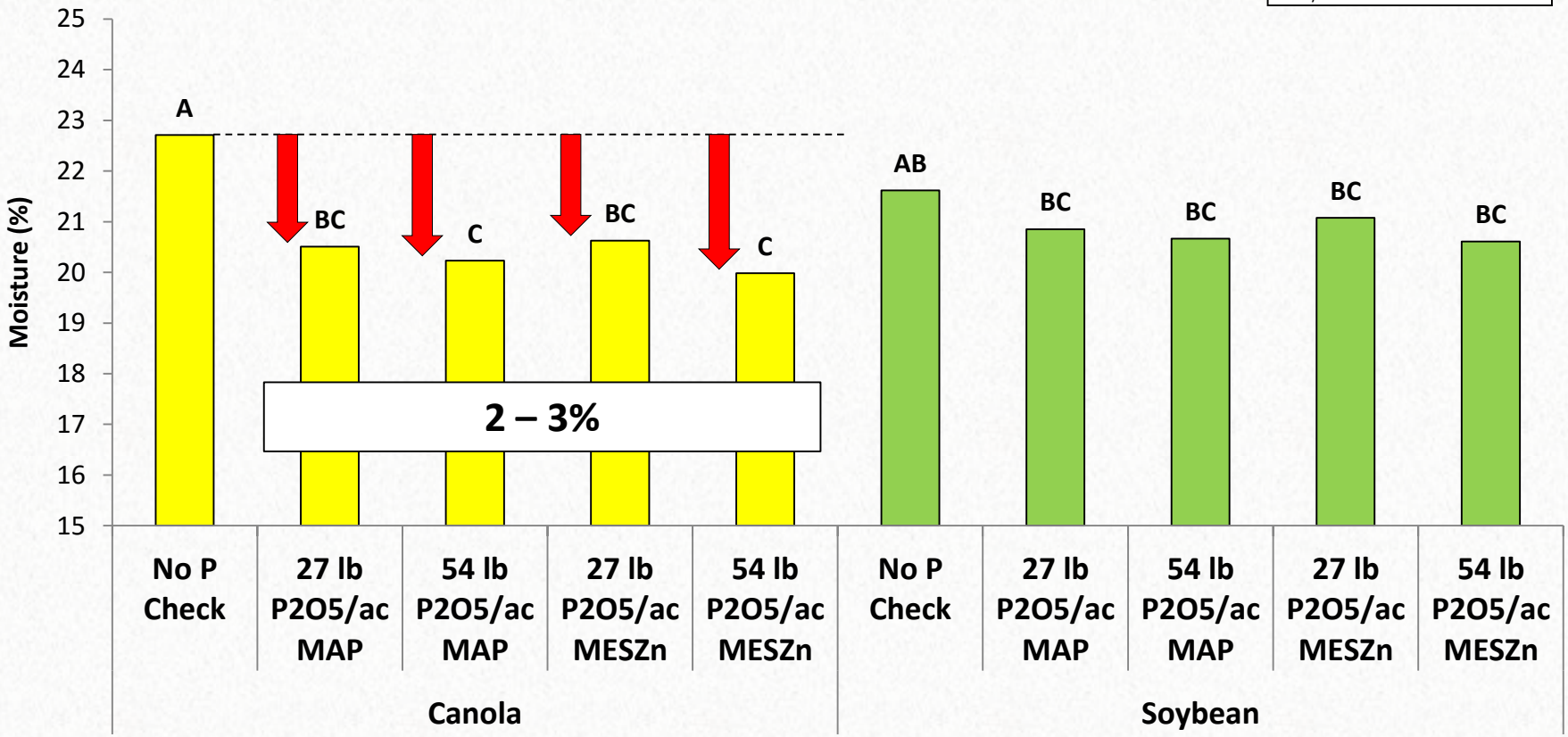


Rotation Study: Preliminary Results

Recorded at harvest

Grain Moisture at Harvest
2015 - 2016

Alpha = 0.05	
Effect	Pr > F
fertilizer	<.0001
crop*fertilizer	0.0002
siteyear	<.0001
siteyear*fertilizer	0.0001

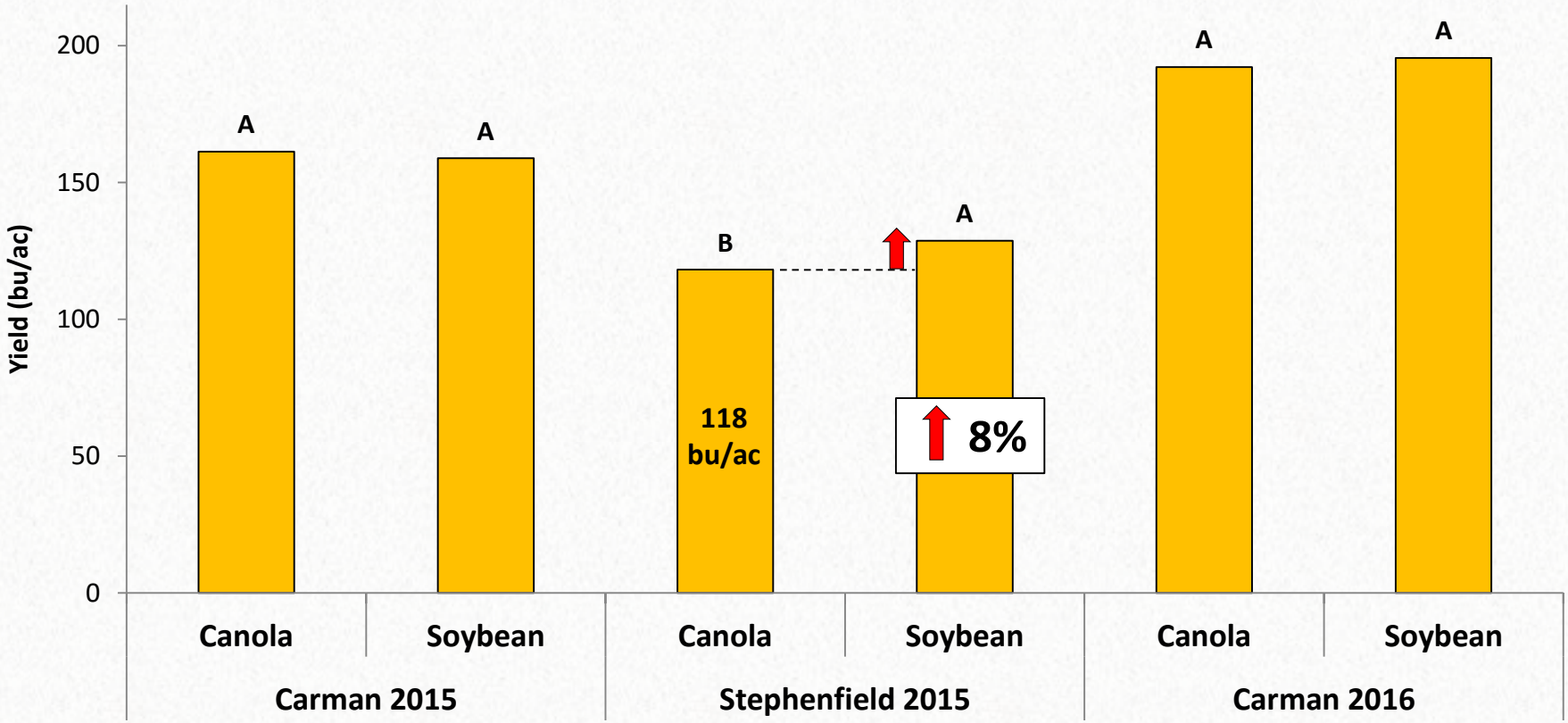


Rotation Study: Preliminary Results

Adjusted to 15.5%

Alpha = 0.05	
Effect	Pr > F
fertilizer	0.0017
crop	0.0415
siteyear	<.0001
siteyear*crop	0.0139

Corn Grain Yield Response to Previous Crop
2015 - 2016

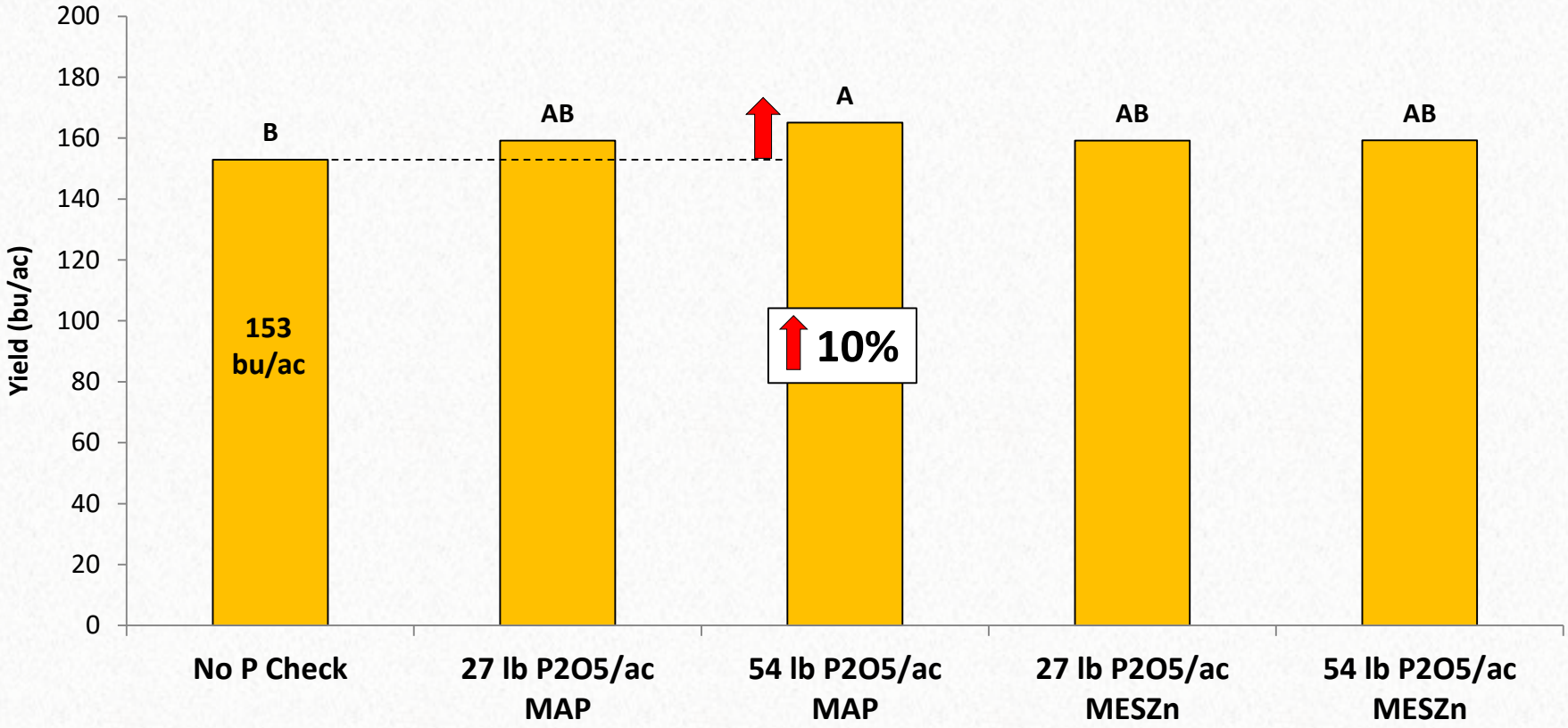


Rotation Study: Preliminary Results

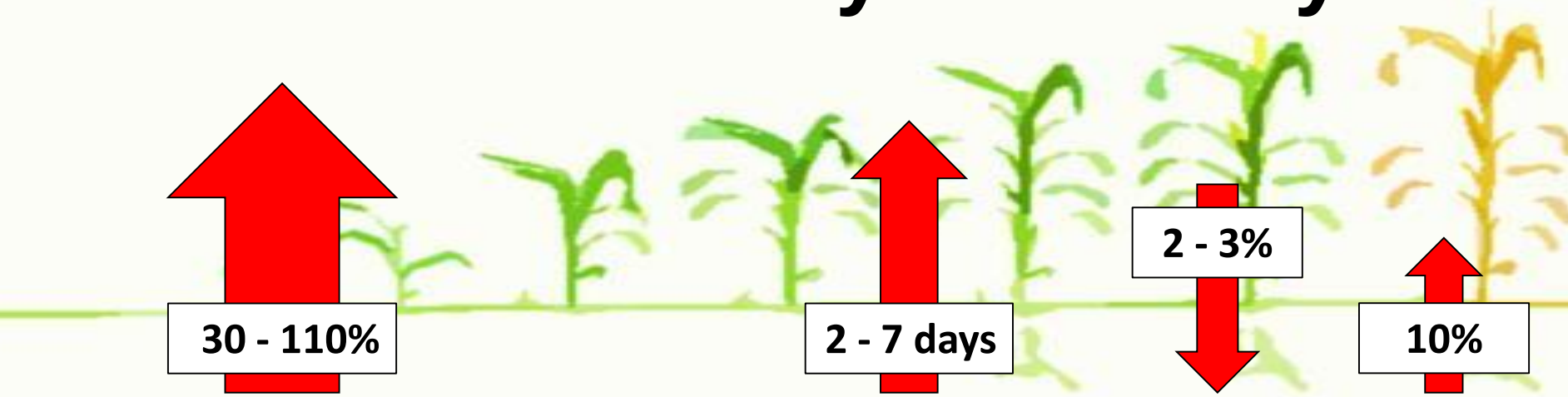
Adjusted to 15.5%

Alpha = 0.05	
Effect	Pr > F
fertilizer	0.0017
crop	0.0415
siteyear	<.0001
siteyear*crop	0.0139

Corn Grain Yield Response to Starter Fertilizer 2015 - 2016



Rotation Study: Summary



Early season significant increase in early season biomass with all starter P treatments especially in corn following canola

Maturity at 2 out of 3 site-years we saw advanced maturity for starter compared to control, greater maturity response in corn on canola

Dry Down all starter P treatments significantly reduced kernel moisture at harvest by 2 – 3% in corn on canola only

Grain yield 10% increase in yield with high rate of MAP only compared to the control, regardless of preceding crop

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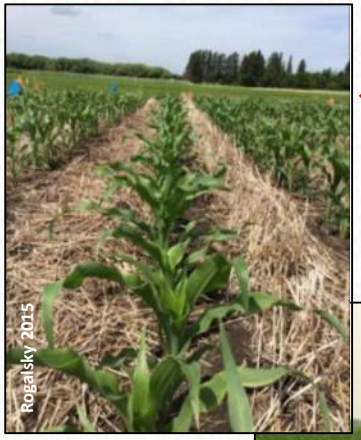
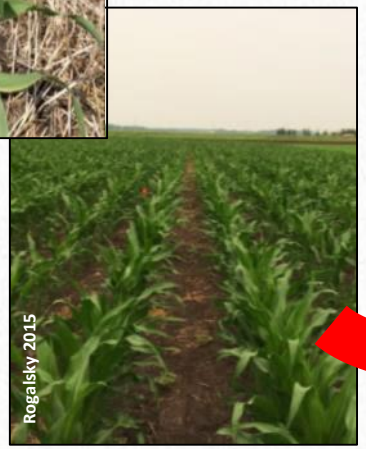
Tillage Study

Fertilization strategies for corn planted in strip tillage vs. conventional tillage





P?

Tillage Study: Background

Strip till:

- reduces risk of erosion
- provides opportunity to preplant band P
- may provide a warmer or cooler seed bed zone vs. conventional tillage
- cool soil may aggravate P deficiencies

Application of starter P may:

- accelerate early-season crop development
- decrease grain moisture
- increase grain yield

P deficiency symptoms at V3 in striptill

54 lb P_2O_5 ac^{-1} MAP
Spring Sideband

No P Check

Tillage Study: Site Information

	Planting Date	Harvest Date	Olsen-P (ppm)	Residue
2015 Sites				
Carman, MB	May 25	Oct. 16	8	Wheat
Portage la Prairie, MB	May 26	Oct. 19	11	Barley
2016 Sites				
Carman, MB	May 12	Oct. 5*	5	Wheat
Portage la Prairie, MB	May 16	Oct. 6*	14	Wheat

*Carman 2016 site was hand harvested due to wind damage and green snap.
*Portage 2016 sites was hand harvested due to hail and black bird damage.

Corn Hybrid: DKC 26-28RIB (2150 CHU)

Tillage Study: 2 Previous Tillage Treatments

Tillage Study: 5 Fertilizer Treatments

(lb/ac, spring sideband (2” by 1”) and fall application (4-5”))

CONTROL

1. **No P Check**

MAP (11-52-0) *Only*

2. **27 P_2O_5 SPRING SB**
3. **54 P_2O_5 SPRING SB**

4. **27 P_2O_5 FALL DB**
5. **54 P_2O_5 FALL DB**

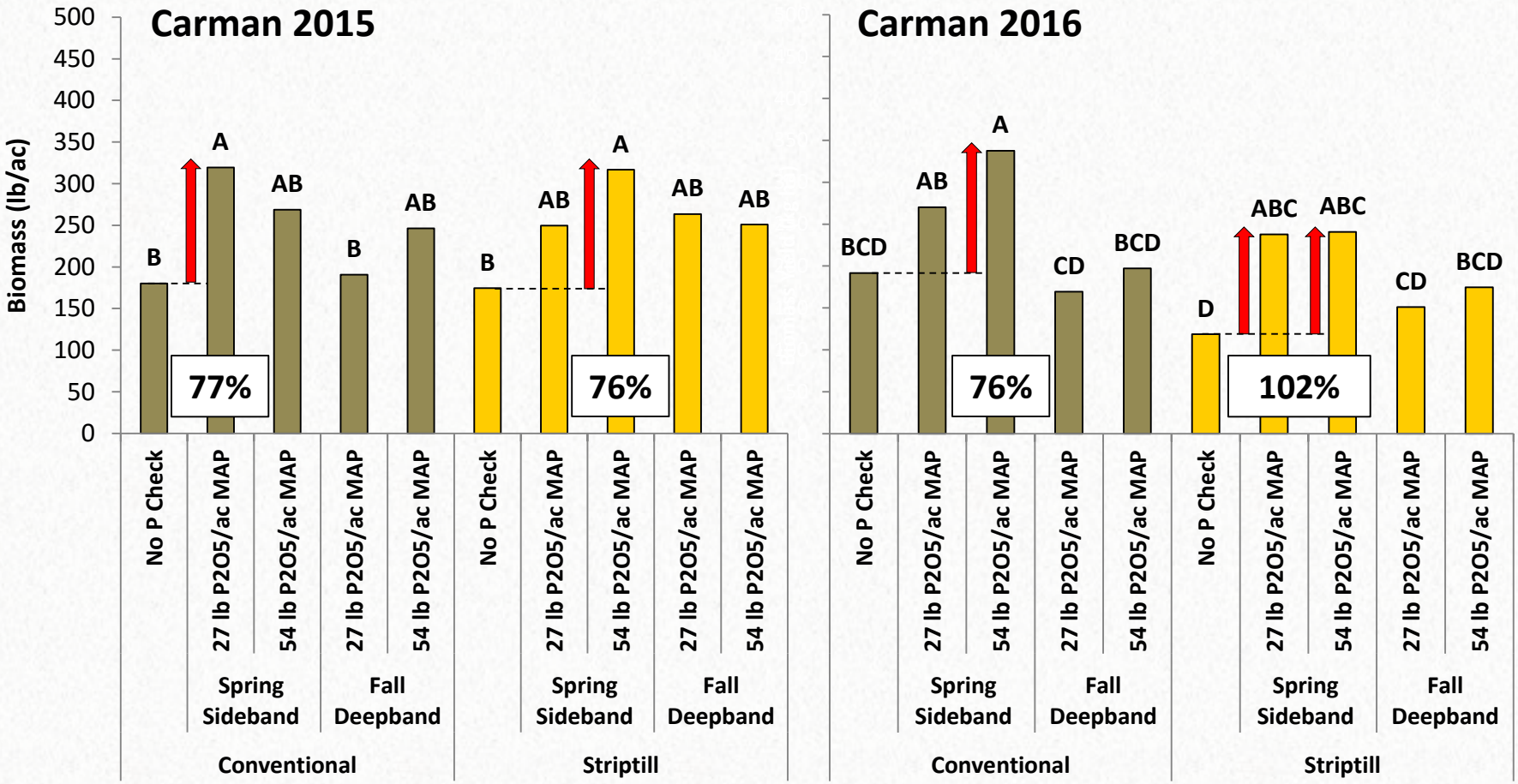
4-row, Yetter Strip Till Unit
8” (20 cm) wide strips on 30” (76 cm) centers with 4-5” deep band

Tillage Study: Preliminary Results

Collected at V4

Alpha = 0.05	
Effect	Pr > F
fertilizer	<.0001
siteyear	<.0001
siteyear*fertilizer	0.0005
siteyear*tillage	0.046
siteyear*tillage*fertilizer	0.0177

Corn Early Season Biomass (V4) 2015 - 2016

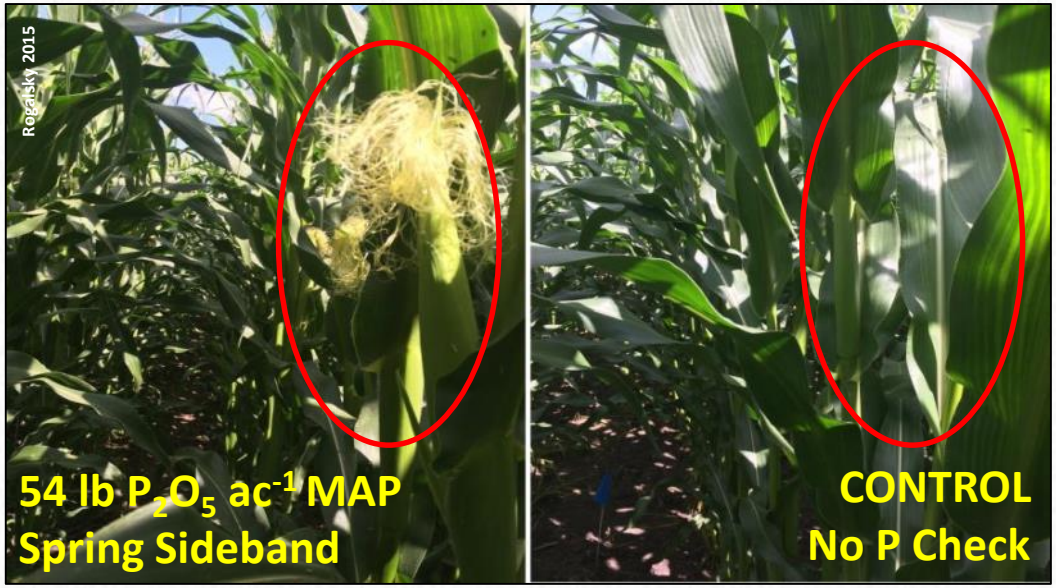


Tillage Study: Preliminary Results

Silking differences as compared to control plots

Alpha = 0.05	
Effect	Pr > F
fertilizer	<.0001
siteyear	<.0001
siteyear*fertilizer	<.0001

Site-year	Maturity Advance (days)	Fertilizer
Carman 2015	+2	All fertilizer treatments
Portage la Prairie 2015	ns	ns
Carman 2016	+3 to 4	Both rates of spring side-banded MAP
Portage la Prairie 2016	ns	ns

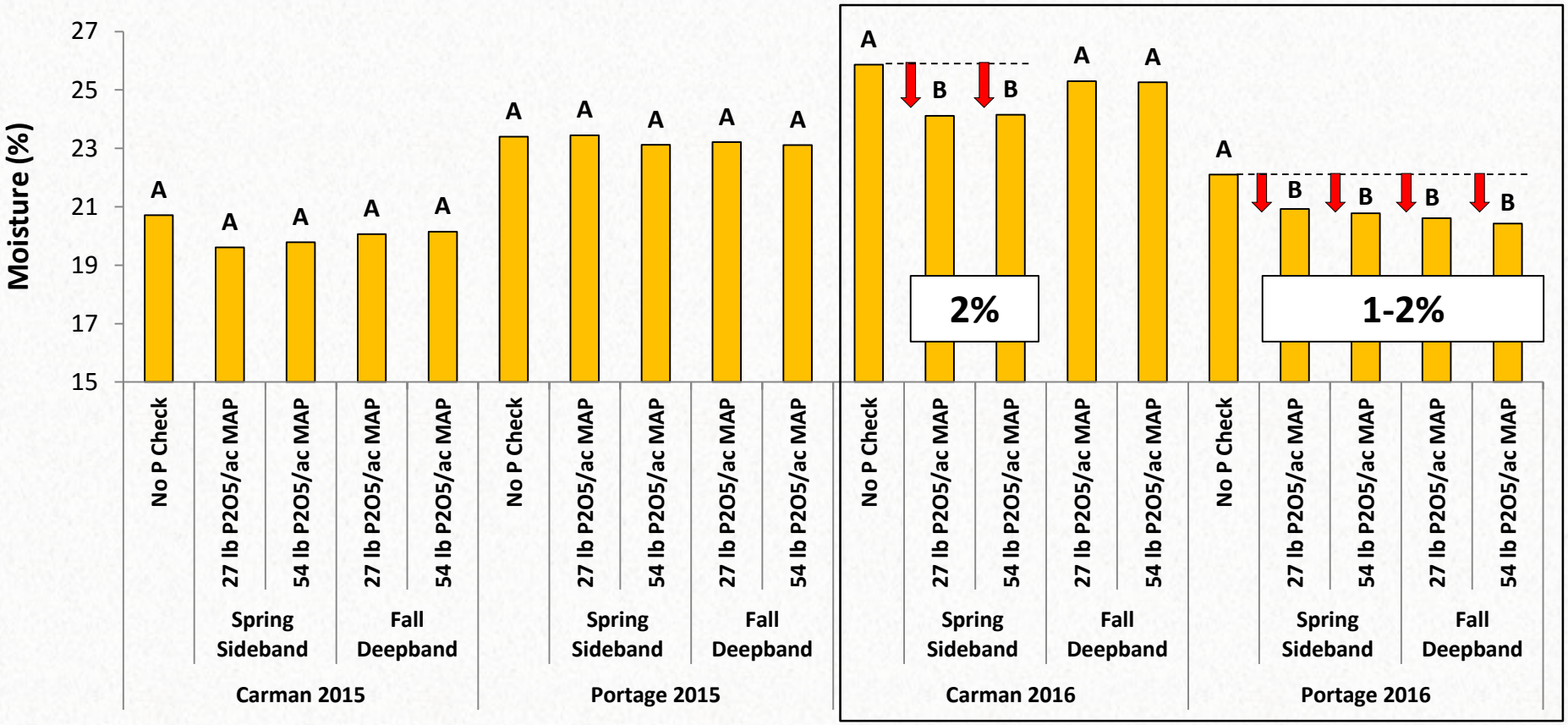


Tillage Study: Preliminary Results

Recorded at harvest

Kernel Moisture at Harvest
2015 - 2016

Alpha = 0.05	
Effect	Pr > F
fertilizer	<.0001
siteyear	<.0001
siteyear*fertilizer	0.0126

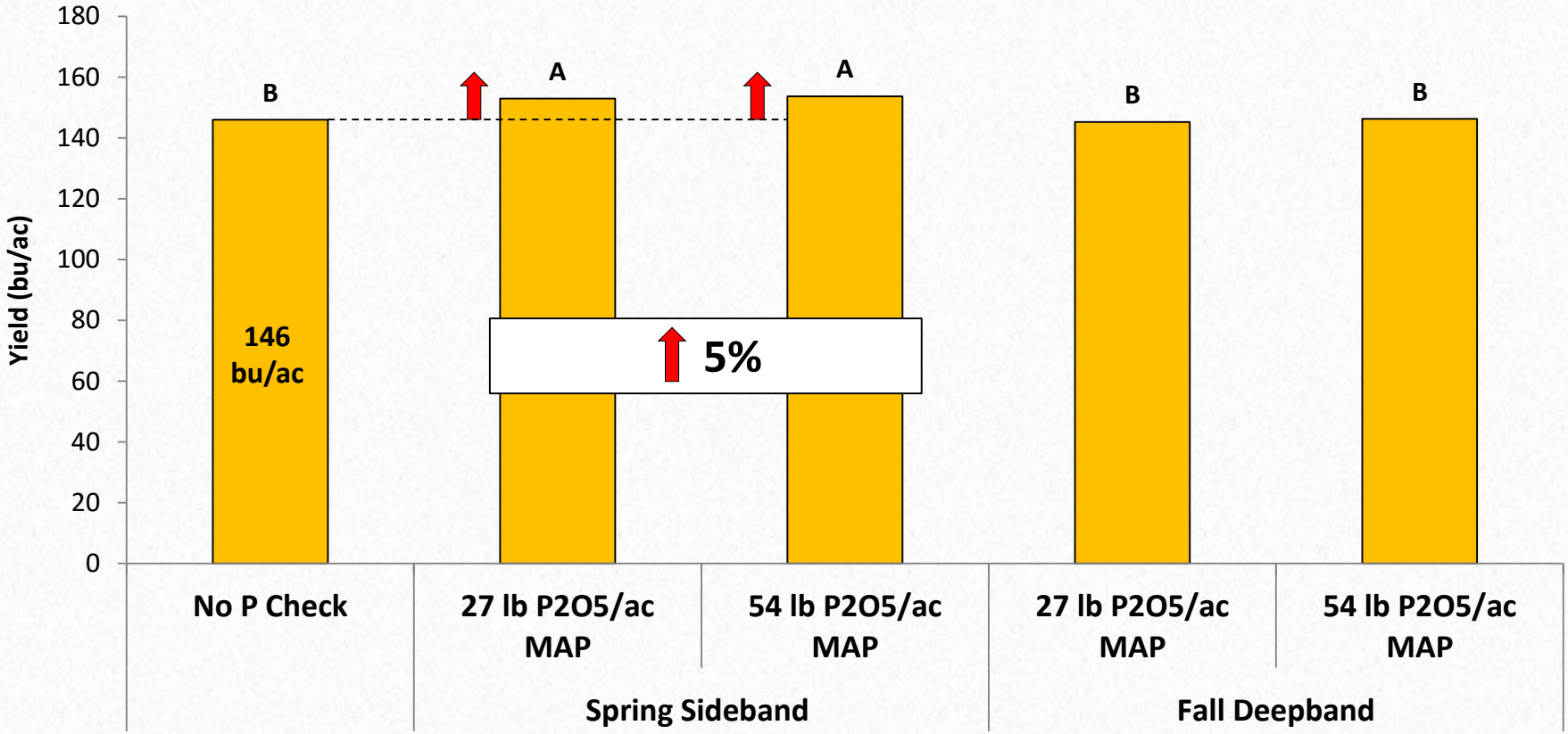


Tillage Study: Preliminary Results

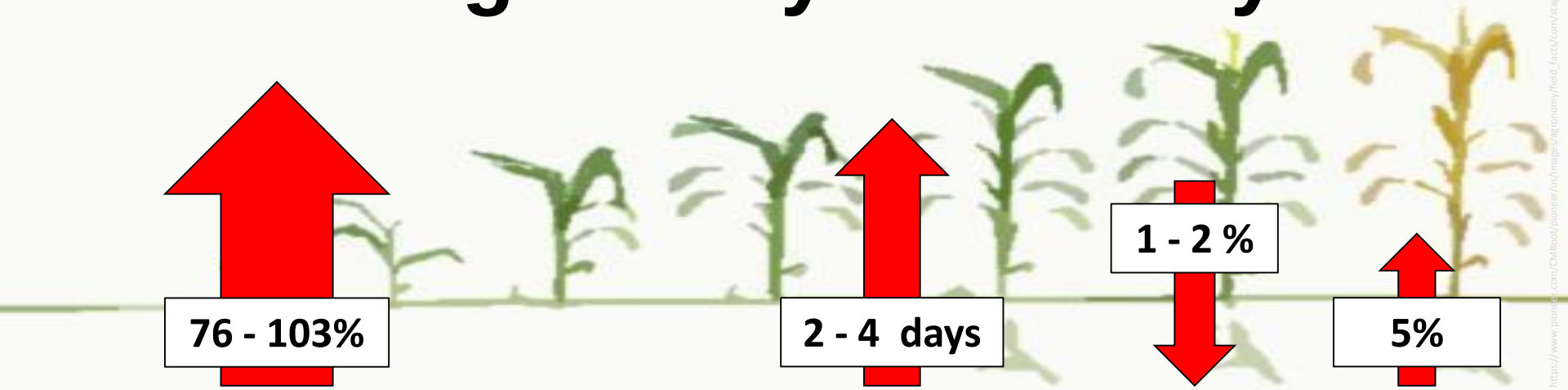
Adjusted to 15.5%

Alpha = 0.05	
Effect	Pr > F
fertilizer	0.0002
siteyear	<.0001

Corn Grain Yield Response to P
2015 - 2016



Tillage Study: Summary



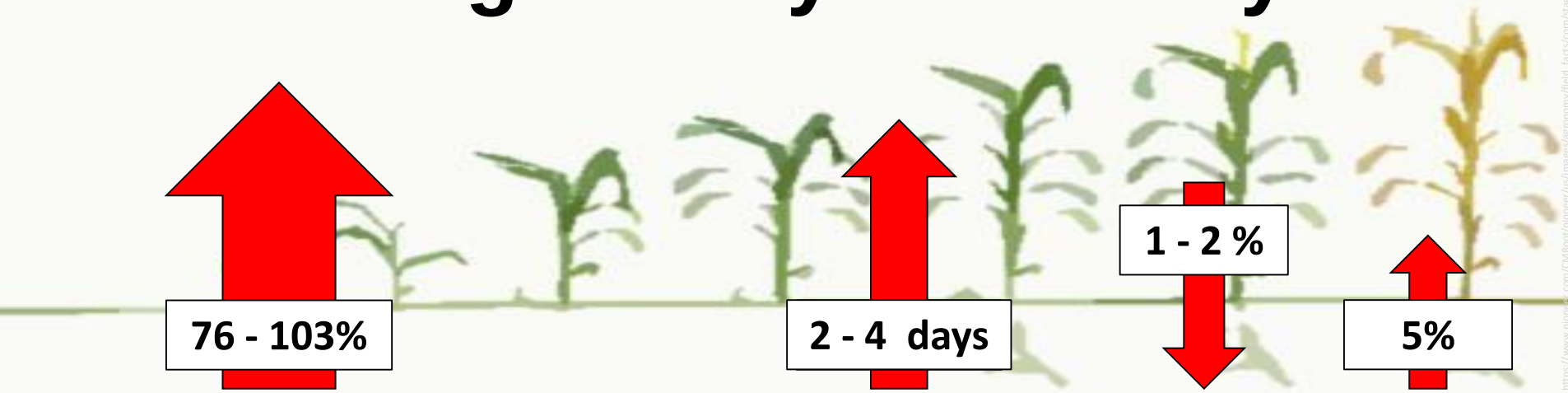
Early season at Carman in 2015 and 2016 spring side-banded MAP increased early season biomass, relative to the controls

Maturity advanced maturity at Carman in 2015 and 2016 with banded MAP compared to control, regardless of tillage system

Dry Down banded MAP significantly reduced kernel moisture at harvest by 1 – 2% at Carman and Portage in 2016

Grain yield 5% yield increase with spring side-banded MAP compared to the control and fall banded MAP, regardless of tillage

Tillage Study: Summary



https://www.pioneer.com/CMRoot/pioneer/us/images/agronomy/field_facts/corn/staging-corn-growth.jpg

Good News…

Corn planted in strip till yielded as well as corn planted in conventional till and had similar grain moisture.

https://cdn.vectorstock.com/i/composite/43,88/cartoon-happy-corn-giving-thumb-up-vector-5824388.jpg

Acknowledgments

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Richardson Pioneer (B.Hellegards)

Western Economic Diversification Canada

Thank you!

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