

# **Phosphorus and Zinc Fertilization Beneficial Management Practices for Corn in Manitoba**

## *Crop Rotation and Strip-Tillage Preliminary Results*

**Magda Rogalsky\*, Don Flaten, Yvonne Lawley, Mario Tenuta, John Heard**

March 06, 2017

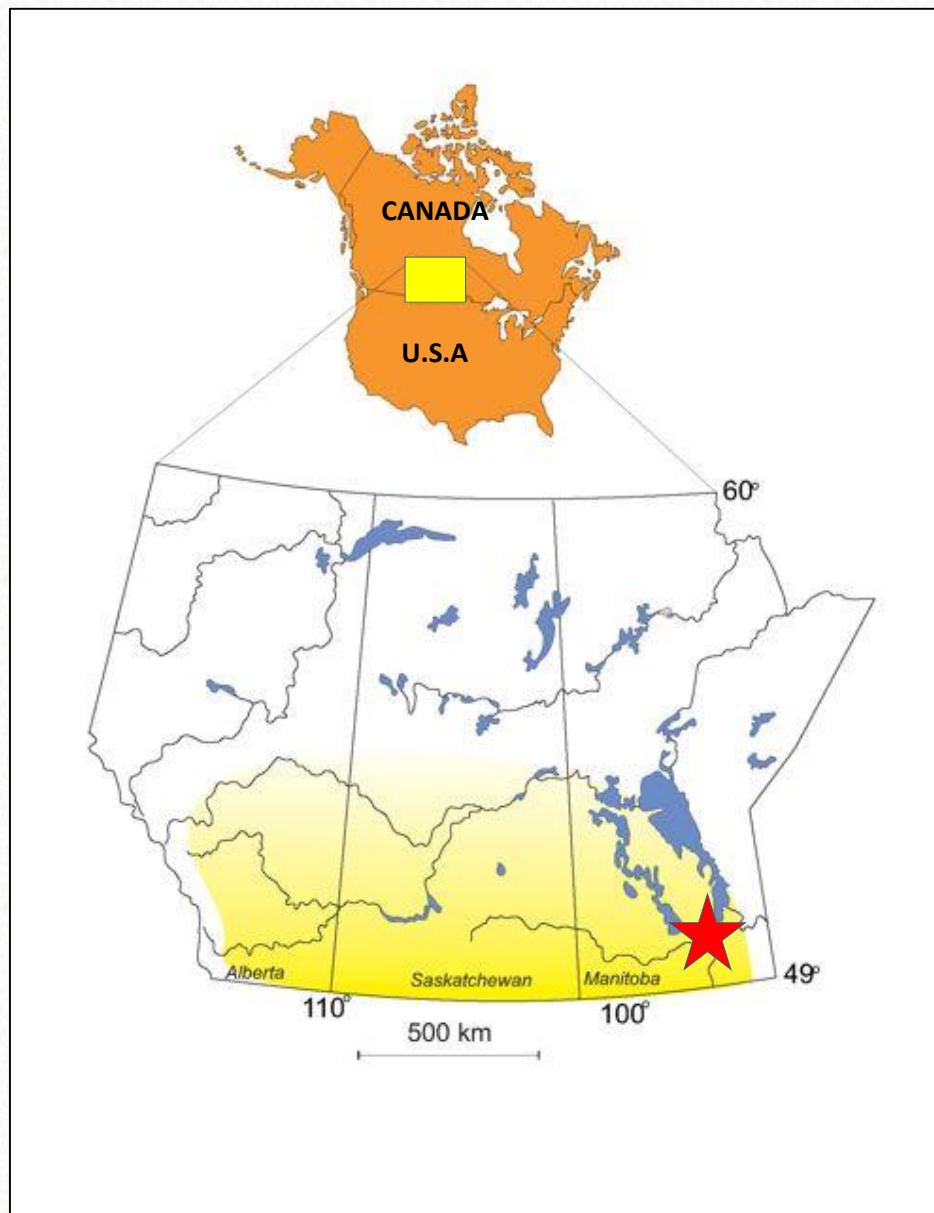
Soils and Crops 2017 SK  
Flaten & Rogalsky: Preliminary Results



UNIVERSITY  
OF MANITOBA

# Background Corn Production in Manitoba, Canada

- Grain corn acreage steadily increasing
- In 2015 grain corn was ranked 7<sup>th</sup> 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





# Crop Rotation Study

Fertilization strategies for corn grown after  
canola vs. soybeans



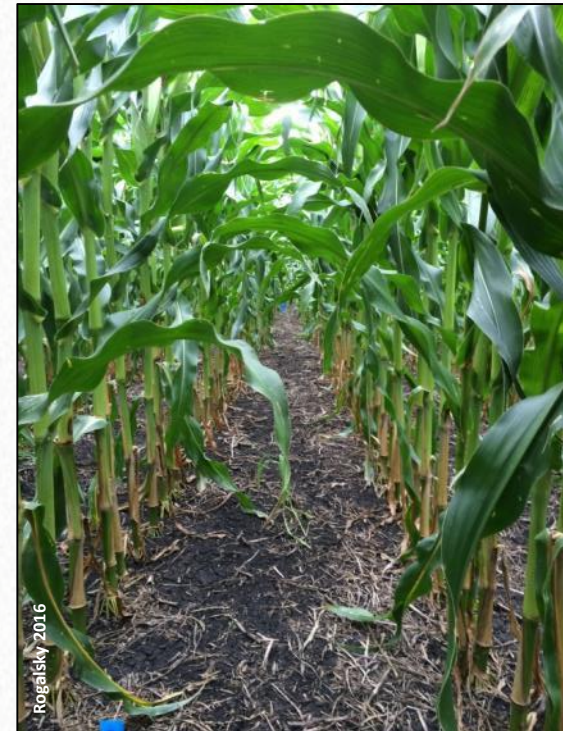
Rogalsky 2015



Rogalsky 2015



P?  
Zn?



Rogalsky 2016



# 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 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>

No P Check

P deficiency symptoms at V3

# Rotation Study: Site Information

	Planting Date	Harvest Date	Olsen-P (ppm)	DTPA-Zn (ppm)
<b>2015 Sites</b>				
Carman, MB	May 25	Oct. 15	19	1.50
Stephenfield, MB	May 26	Oct. 14	6	0.82
<b>2016 Sites</b>				
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

(kg ha<sup>-1</sup>, sidebanded 5 cm by 2.5 cm at planting)

## CONTROL

### 1. No P Check

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

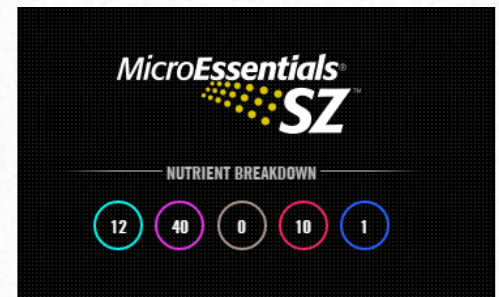
2. 30 P<sub>2</sub>O<sub>5</sub>                      0 Zn                      7.5 S

3. 60 P<sub>2</sub>O<sub>5</sub>                      0 Zn                      15 S

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

4. 30 P<sub>2</sub>O<sub>5</sub>                      0.75 Zn                      7.5 S

5. 60 P<sub>2</sub>O<sub>5</sub>                      1.50 Zn                      15 S



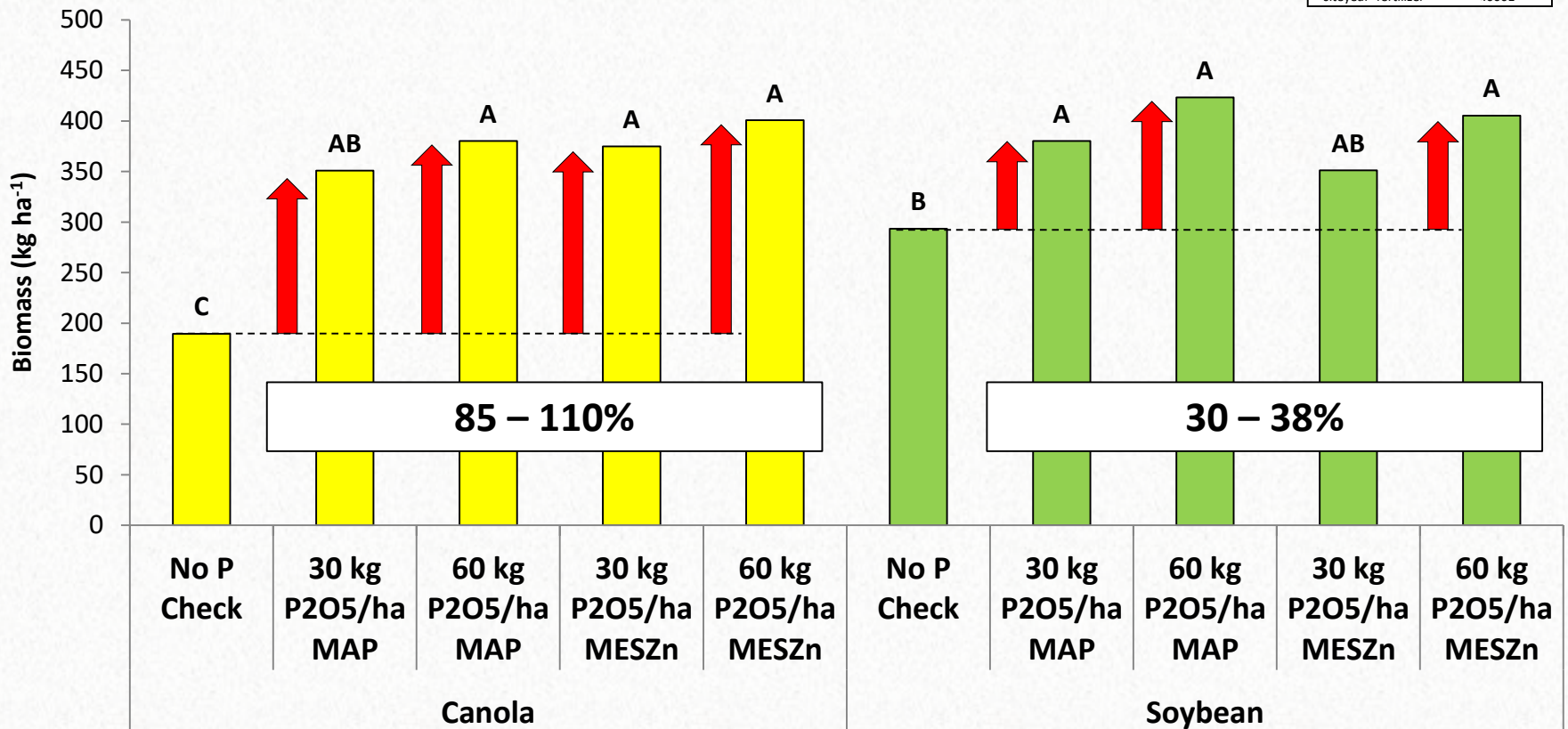


# Rotation Study: Preliminary Results

Collected at V4

## Corn Early Season Biomass 2015 - 2016

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



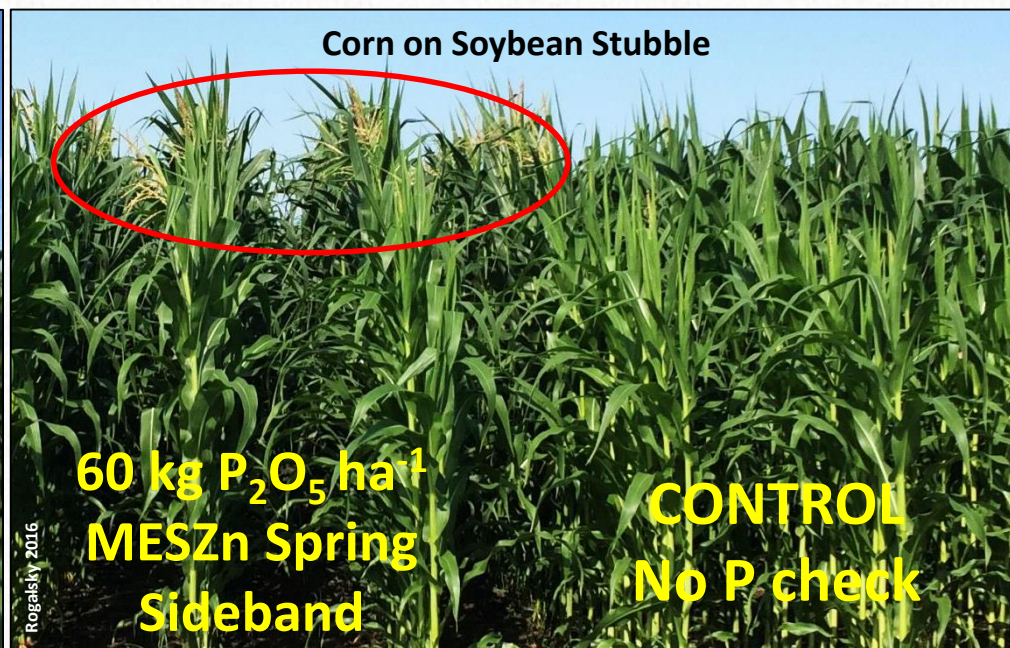
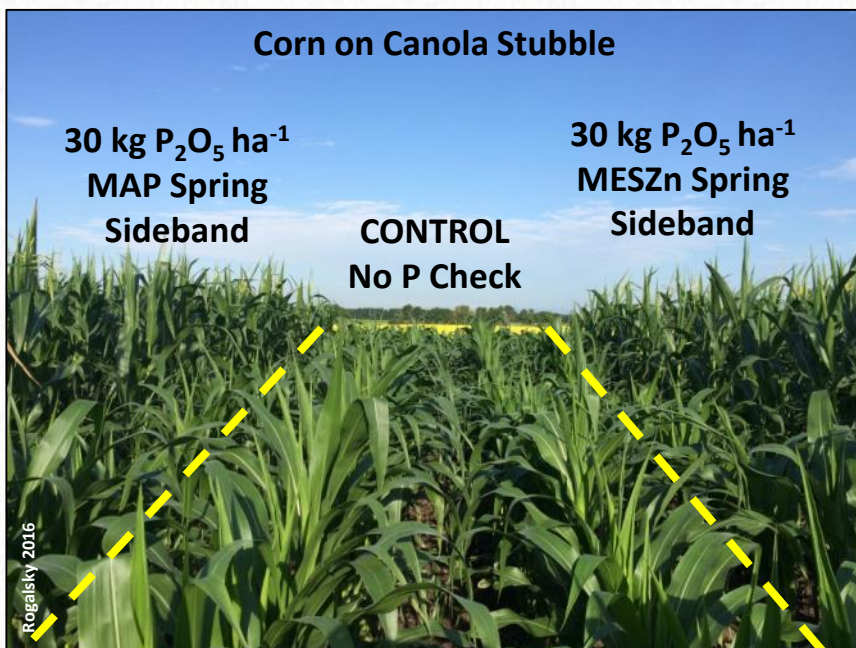


# Rotation Study: Preliminary Results

## 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

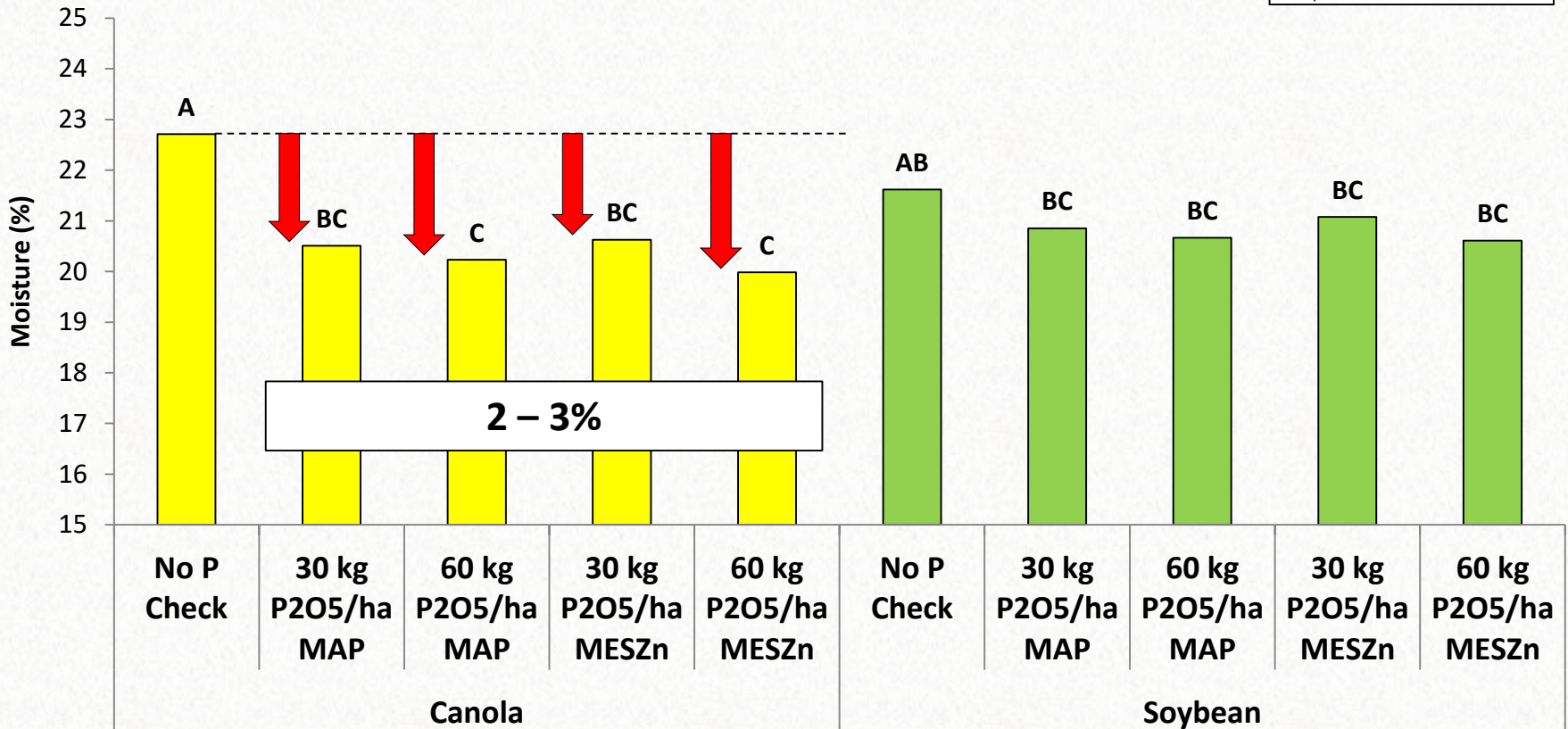


# Rotation Study: Preliminary Results

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



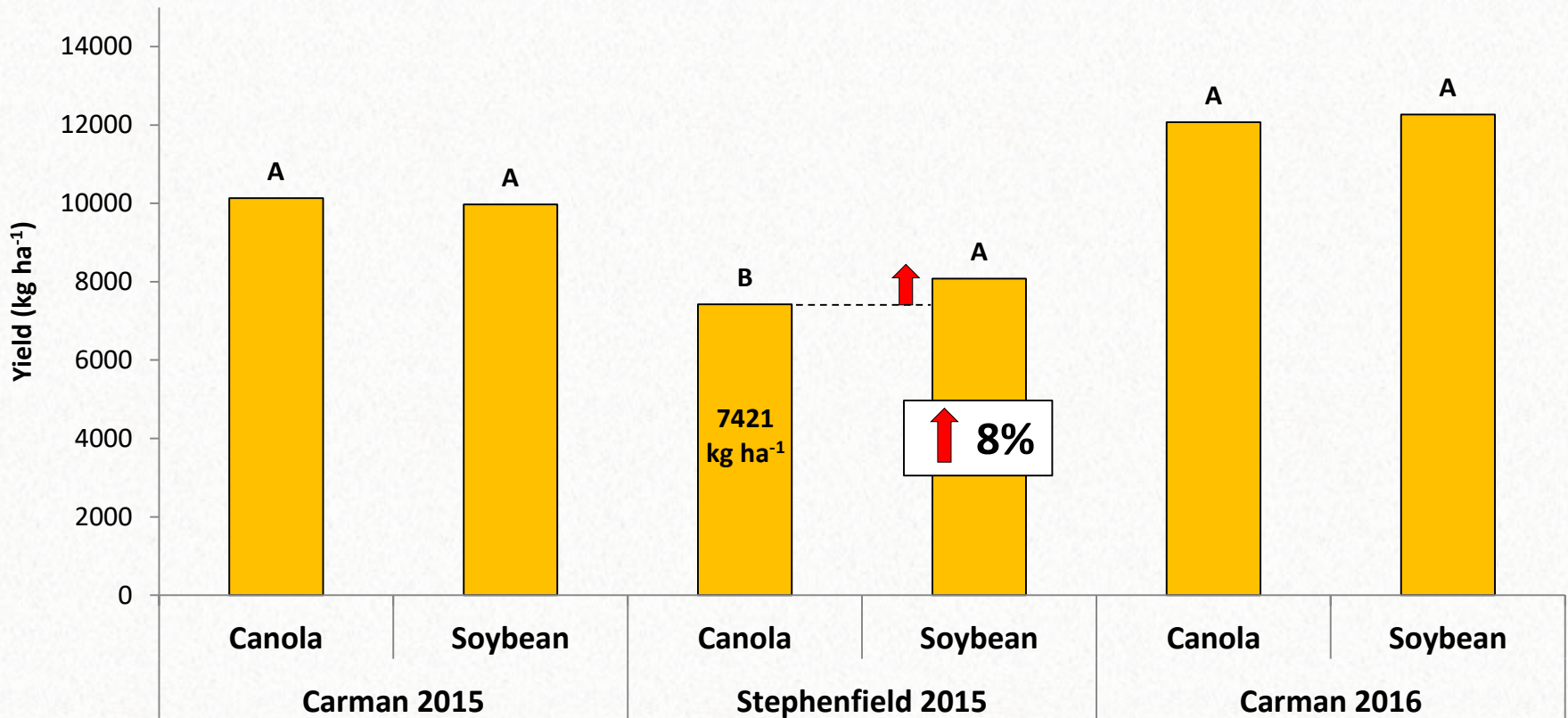


# Rotation Study: Preliminary Results

Adjusted to 15.5%

## Corn Grain Yield Response to Previous Crop 2015 - 2016

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

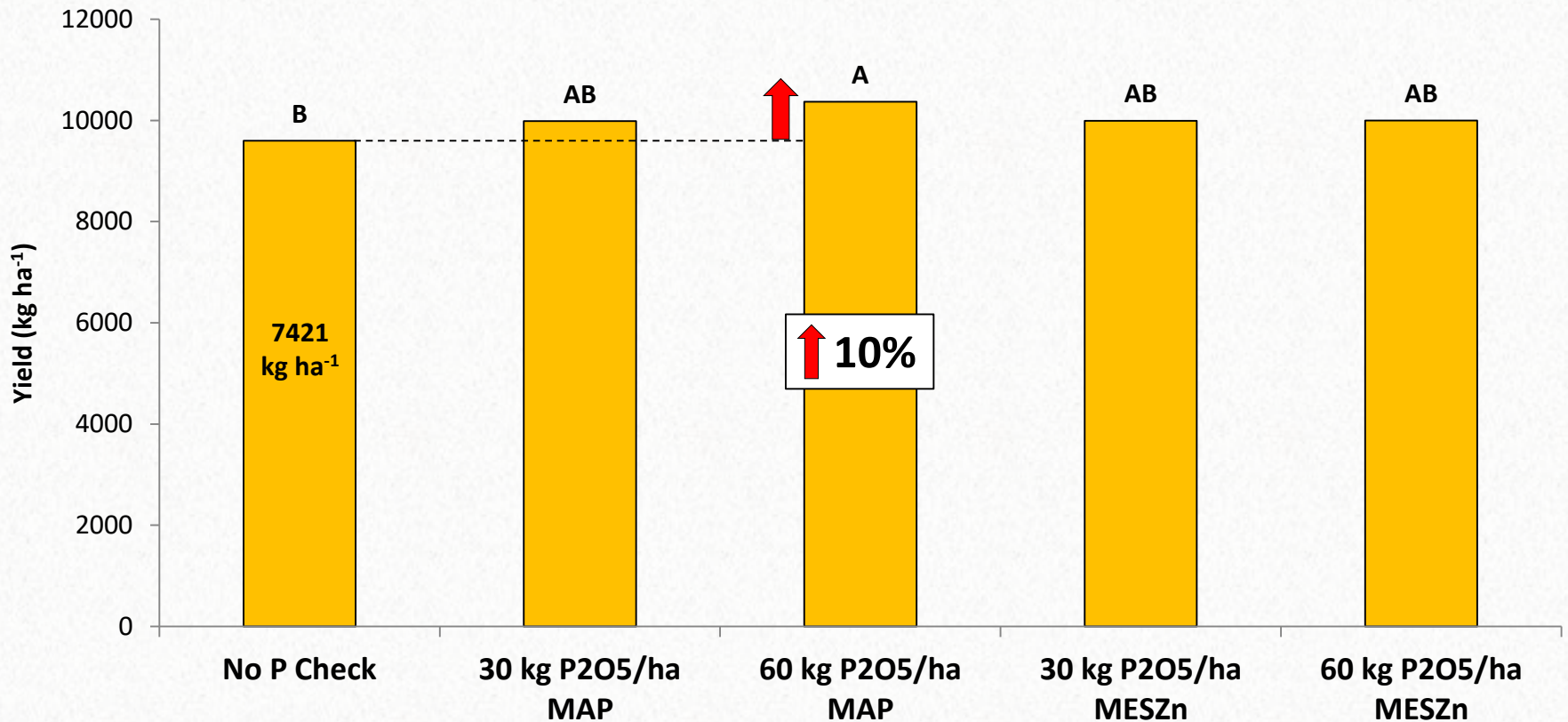


# Rotation Study: Preliminary Results

Adjusted to 15.5%

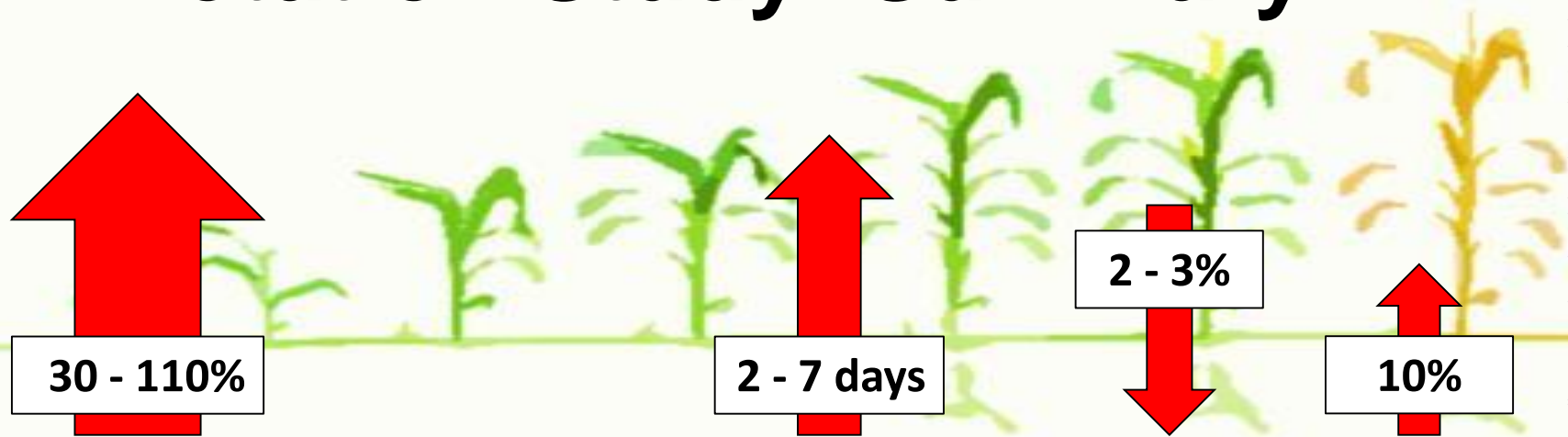
## Corn Grain Yield Response to Starter Fertilizer 2015 - 2016

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





# Rotation Study: Summary



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

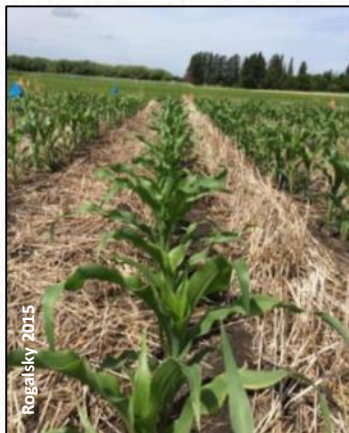
**Maturity** at 2 out of 3 site-years we saw advanced maturity for starter compared to control, greater maturity response in corn on canola

**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

# 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



60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> 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



Rogalsky 2015

March 06, 2017

Soils and Crops 2017 SK  
Flaten & Rogalsky: Preliminary Results



UNIVERSITY  
OF MANITOBA



# Tillage Study: 5 Fertilizer Treatments

(kg ha<sup>-1</sup>, spring (5 cm by 2.5 cm) and fall application (10 -13 cm))

## CONTROL

### 1. No P Check

## MAP (11-52-0) Only

2. 30 P<sub>2</sub>O<sub>5</sub> SPRING SB

3. 60 P<sub>2</sub>O<sub>5</sub> SPRING SB

4. 30 P<sub>2</sub>O<sub>5</sub> FALL DB

5. 60 P<sub>2</sub>O<sub>5</sub> FALL DB

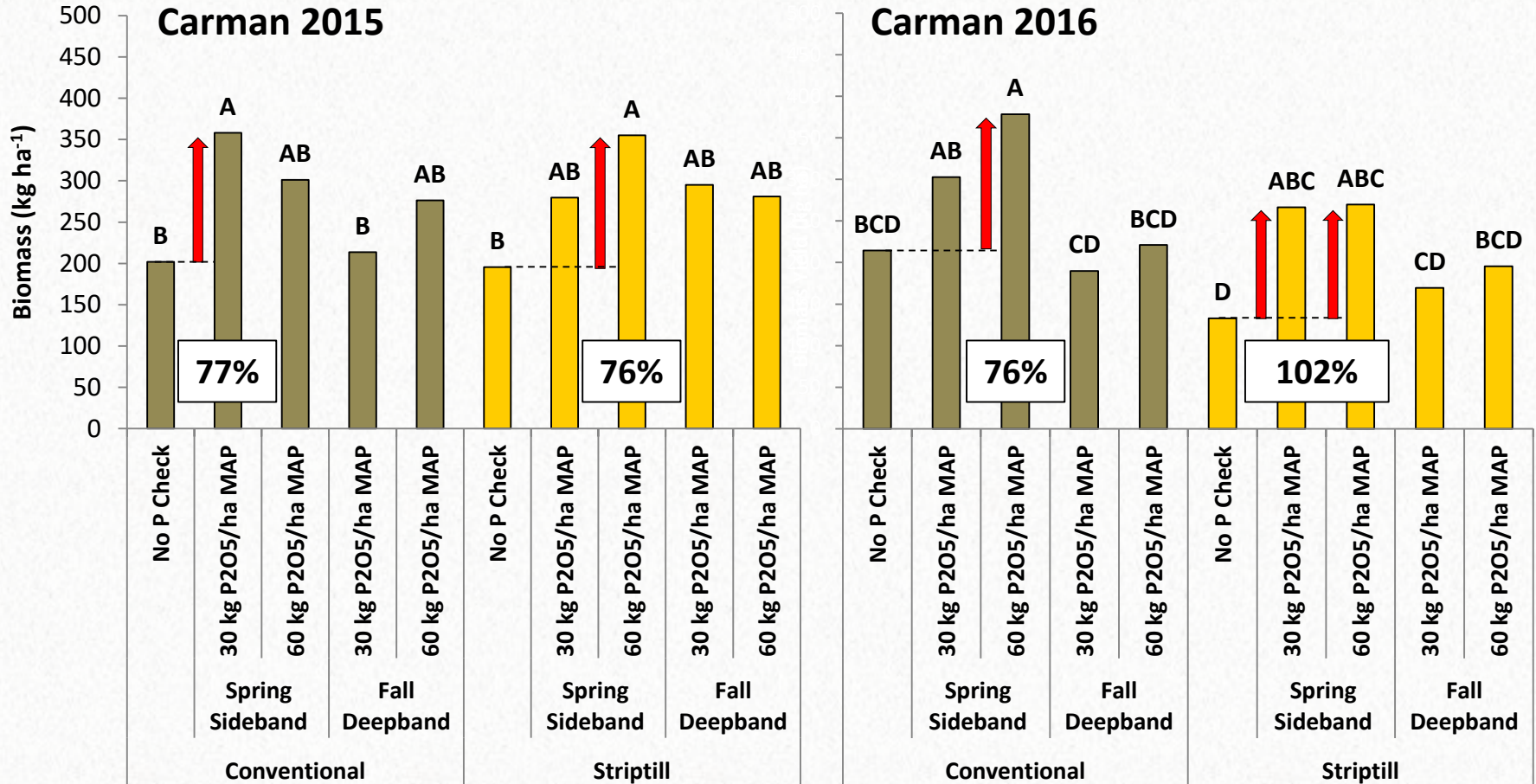


# Tillage Study: Preliminary Results

Collected at V4

Corn Early Season Biomass (V4) 2015 - 2016

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



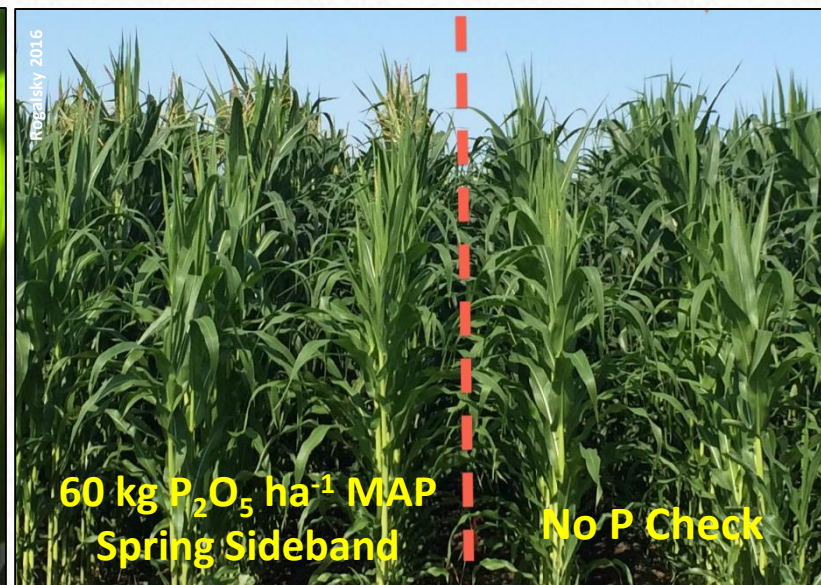


# Tillage Study: Preliminary Results

## 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

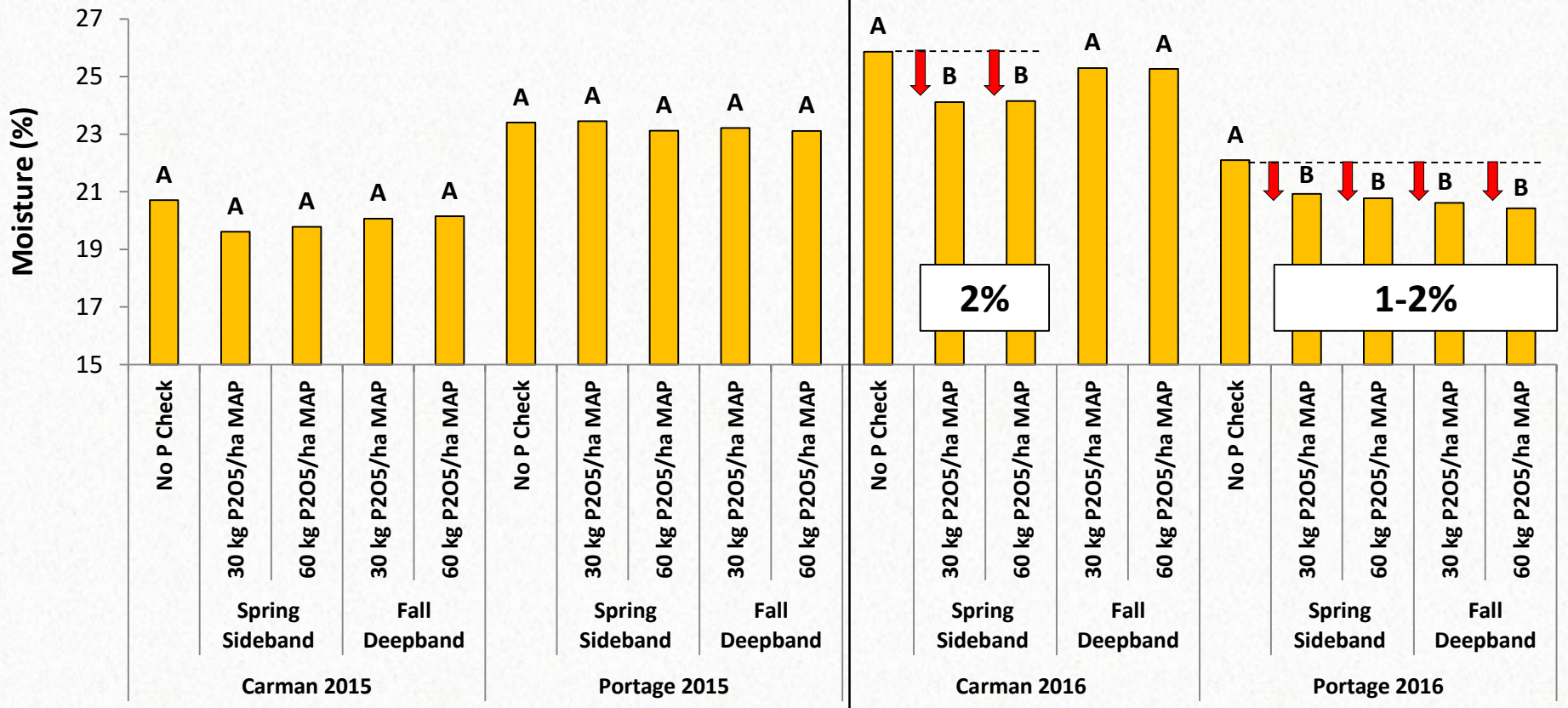


# Tillage Study: Preliminary Results

Recorded at harvest

## Grain Moisture at Harvest 2015 - 2016

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

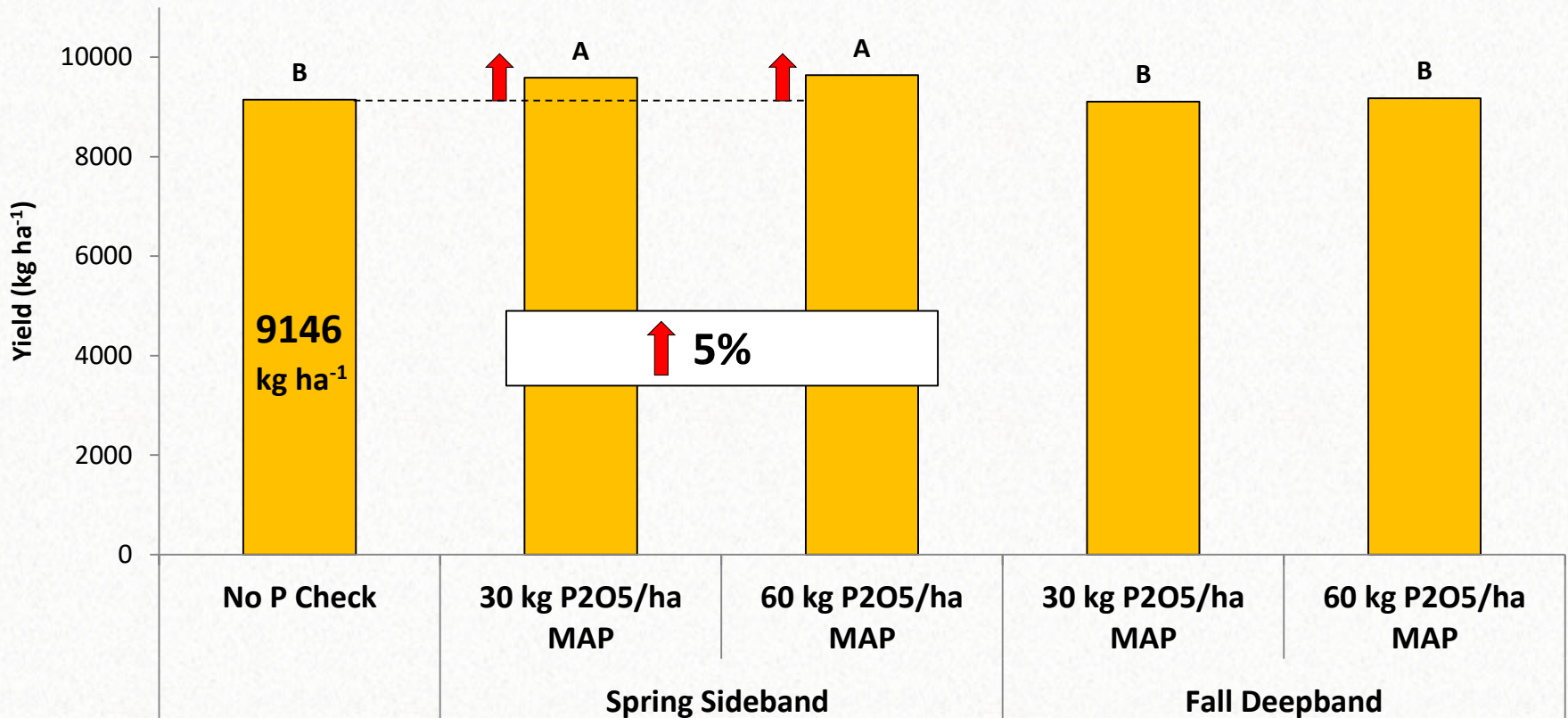


# Tillage Study: Preliminary Results

Adjusted to 15.5%

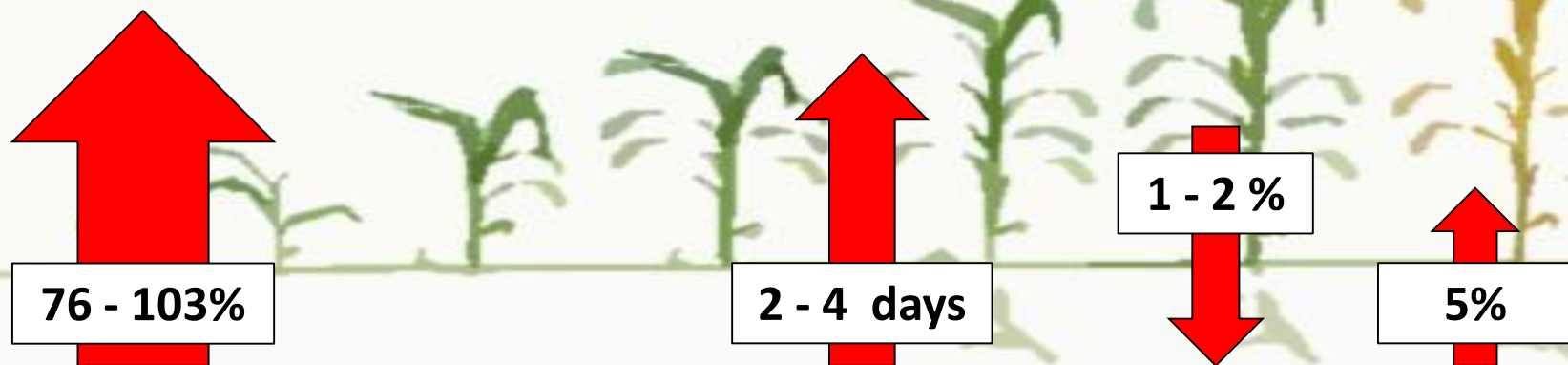
## Corn Grain Yield Response to P 2015 - 2016

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





# Tillage Study: Summary



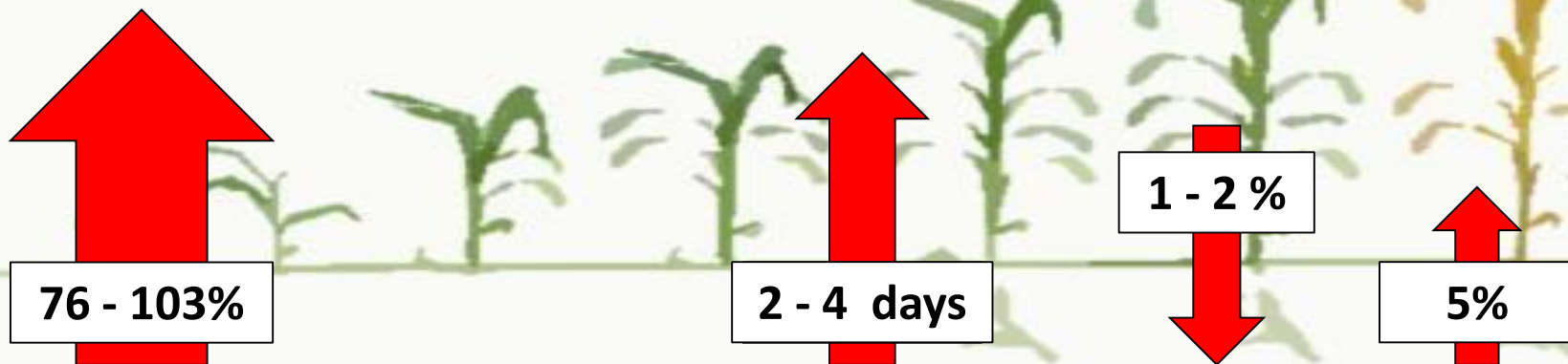
**Early season** at Carman in 2015 and 2016 spring side-banded MAP increased early season biomass, relative to the controls

**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



## Good News...

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



# Acknowledgments

**Manitoba Corn Growers Association**

**Canada-Manitoba GF2 Program**

**Western Grains Research Foundation**

**Agrium**

**Mosaic**

**MAFRD (J.Heard)**

**Canada-Manitoba CDC (C.Cavers)**

**Plateau Sands Farm (C.Dyck)**

**University of Manitoba (G.Bardella, I.Vaisman, E. Wallace, G.Bartley, A.Iverson, J.Dunn, F.Zvomuya)**

**Richardson Pioneer (B.Hellegards)**

**Western Economic Diversification Canada**

Thank  
you!



# Contact Information

Email: [magdalena.rogalsky@umanitoba.ca](mailto:magdalena.rogalsky@umanitoba.ca)

Twitter: @umrog

