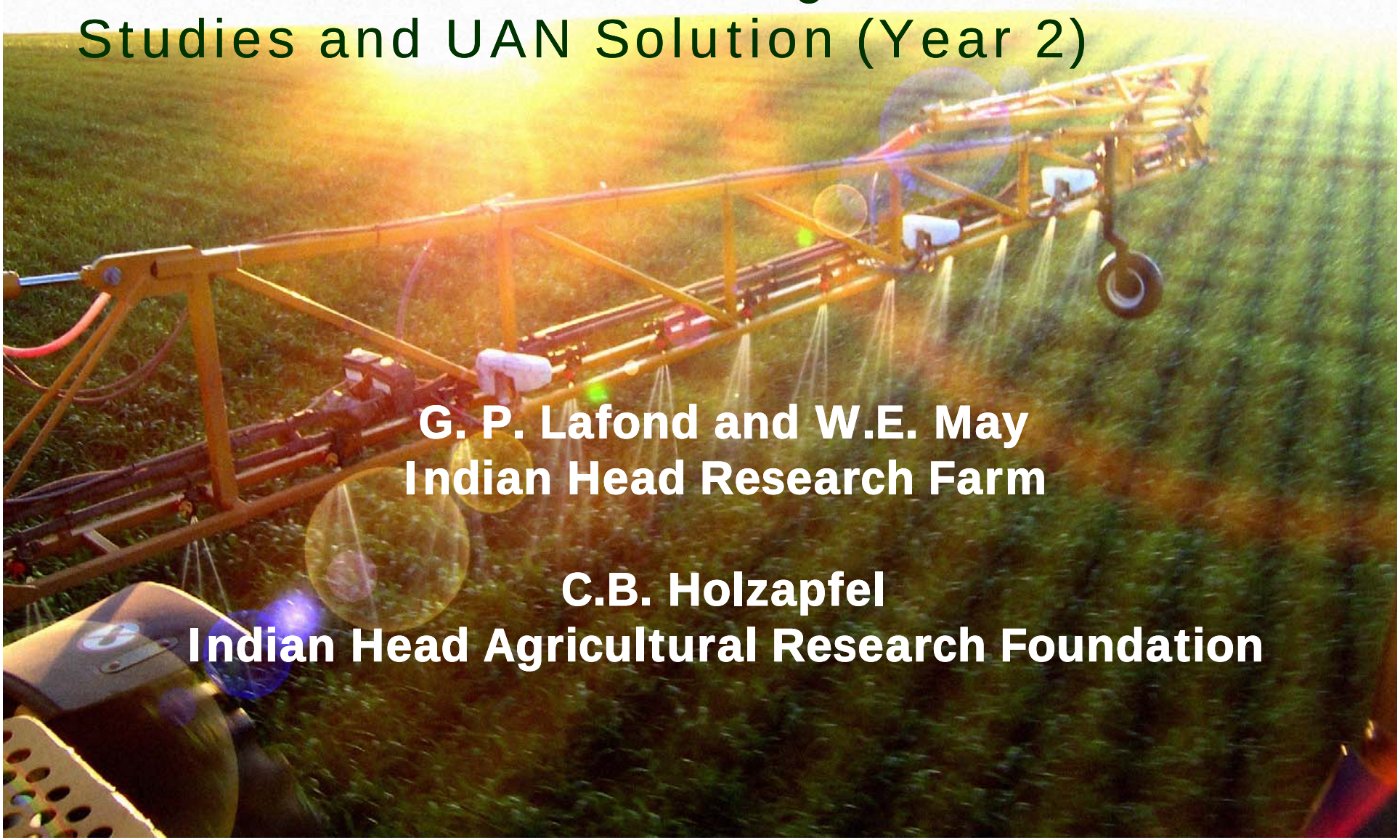
Validating Post-Emergent N Applications for the GreenSeeker^{tm} Optical Sensor in Cereals and Canola using Small Plot Studies and UAN Solution (Year 2)



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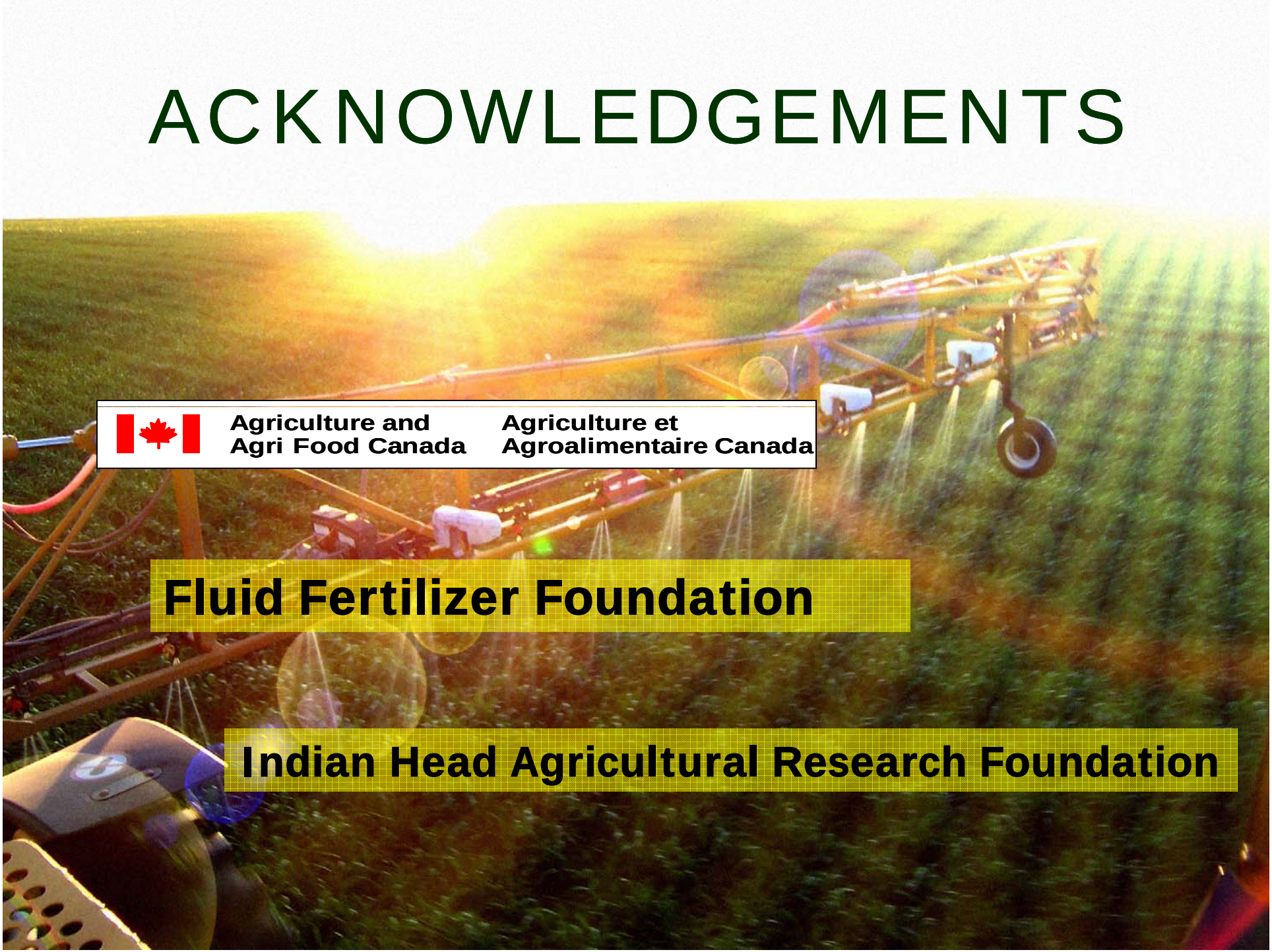
ACKNOWLEDGEMENTS



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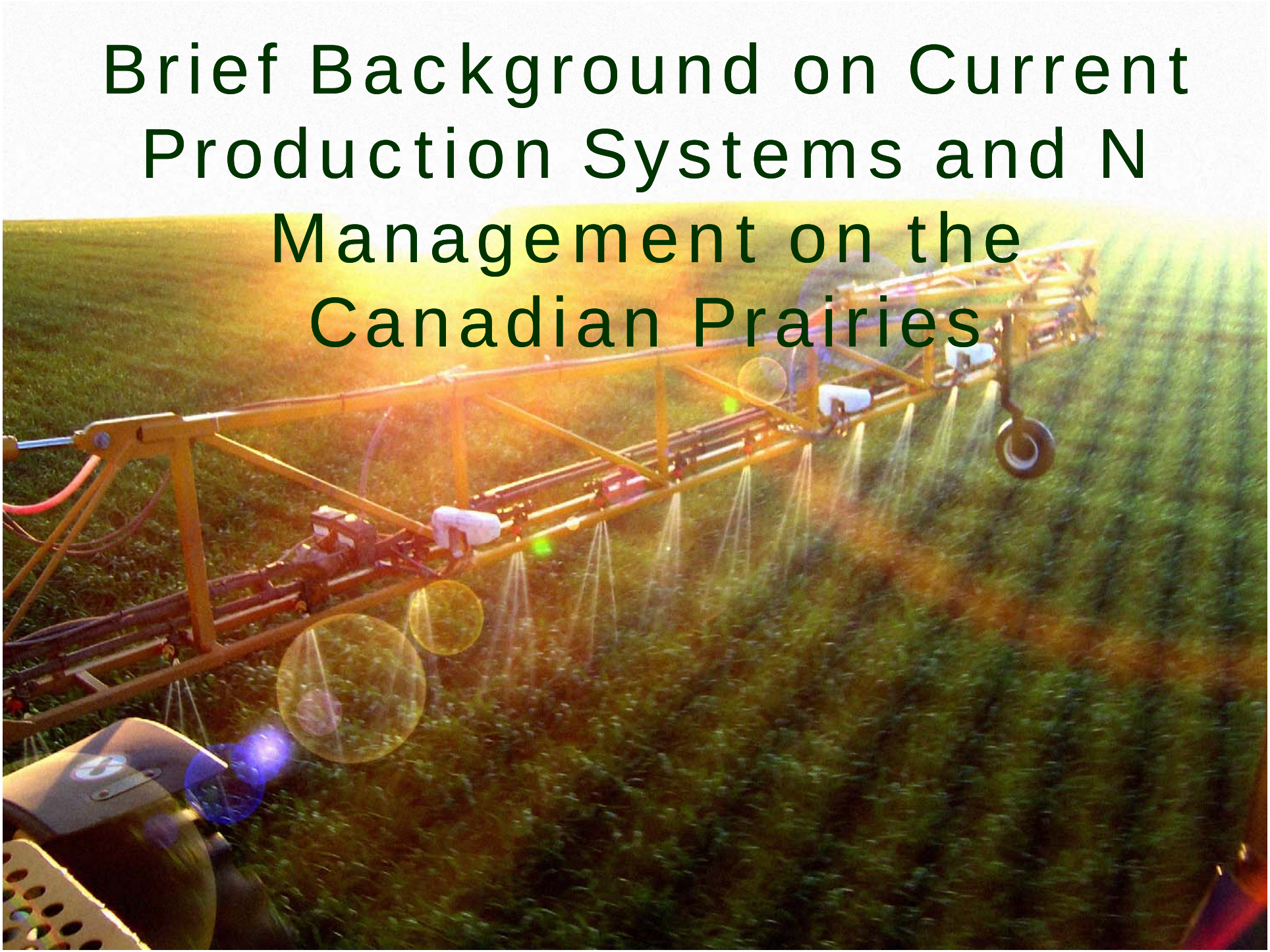
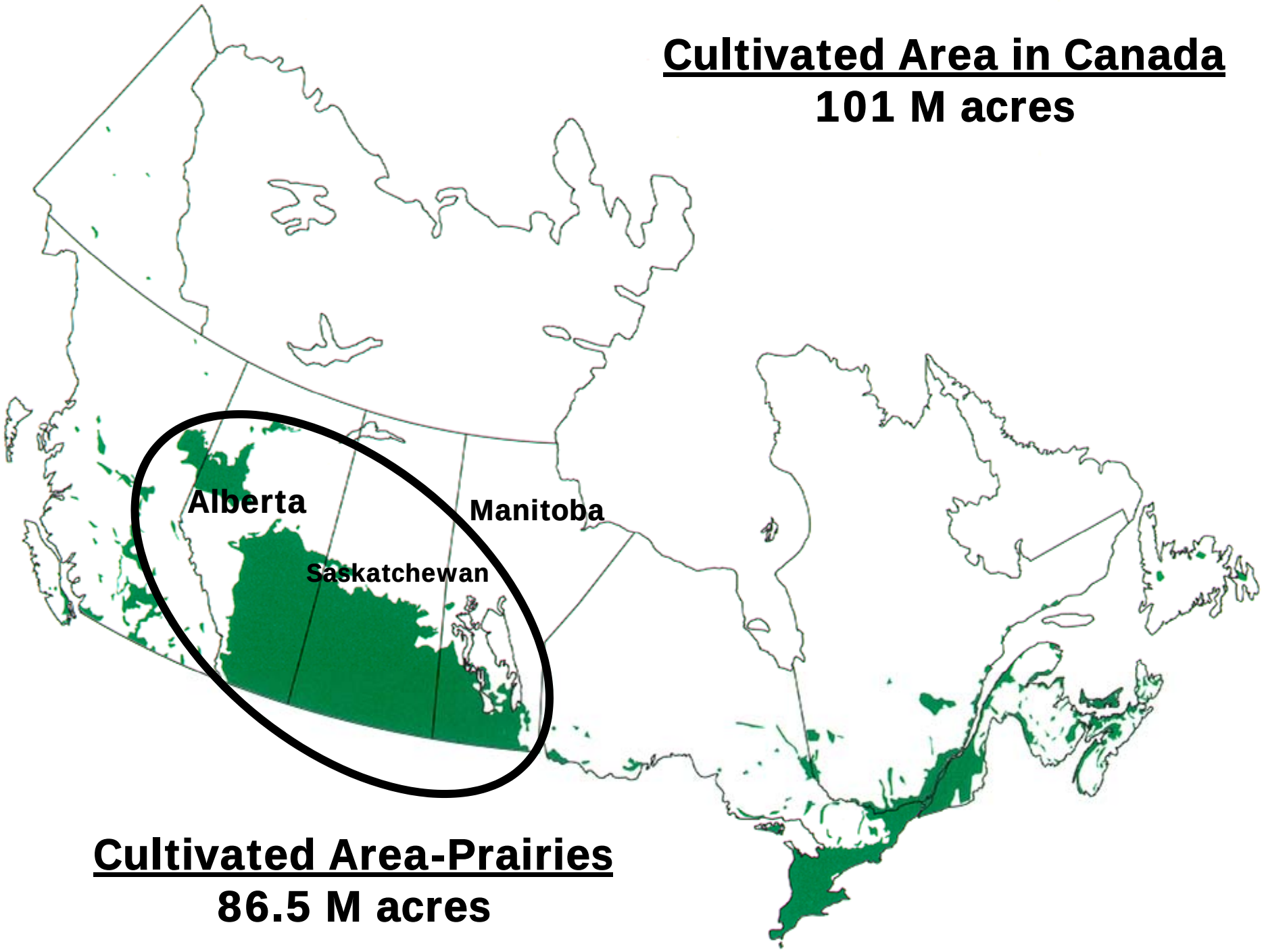
Fluid Fertilizer Foundation

Indian Head Agricultural Research Foundation

Brief Background on Current Production Systems and N Management on the Canadian Prairies




Cultivated Area in Canada
101 M acres
Alberta
Manitoba
Saskatchewan
Cultivated Area-Prairies
86.5 M acres

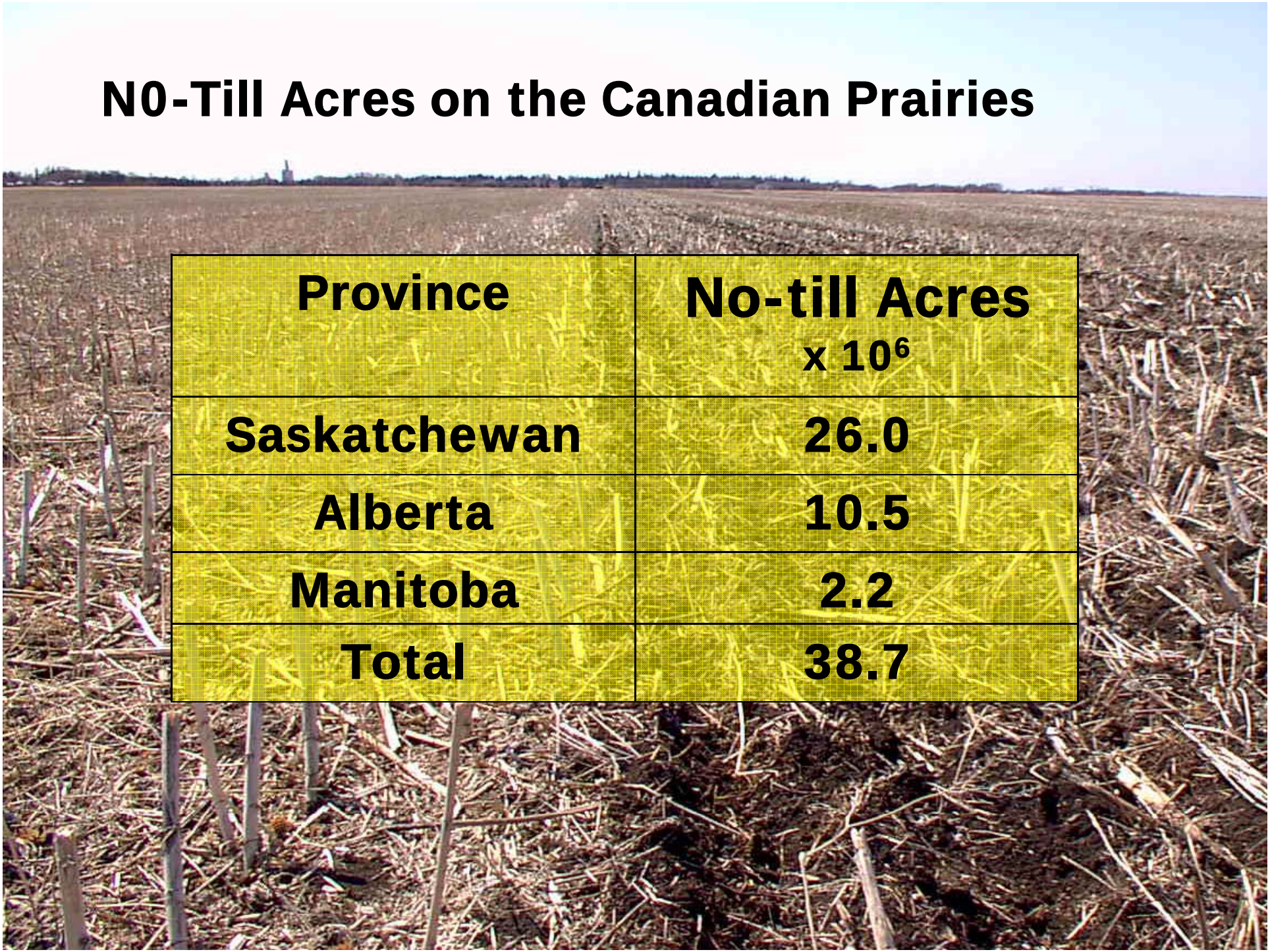
No-Till Area on the Canadian Prairies (% of cultivated acres)

Year	Saskatchewan	Alberta	Manitoba
1991			
1996			
2001			
2006			

NO-Till Area on the Canadian Prairies (% of cultivated acres)

Year	Saskatchewan	Alberta	Manitoba
1991	10	3	7
1996	19	10	15
2001	39	27	13
2006	60	48	21

N0-Till Acres on the Canadian Prairies



Province	No-till Acres x 10^6
Saskatchewan	26.0
Alberta	10.5
Manitoba	2.2
Total	38.7

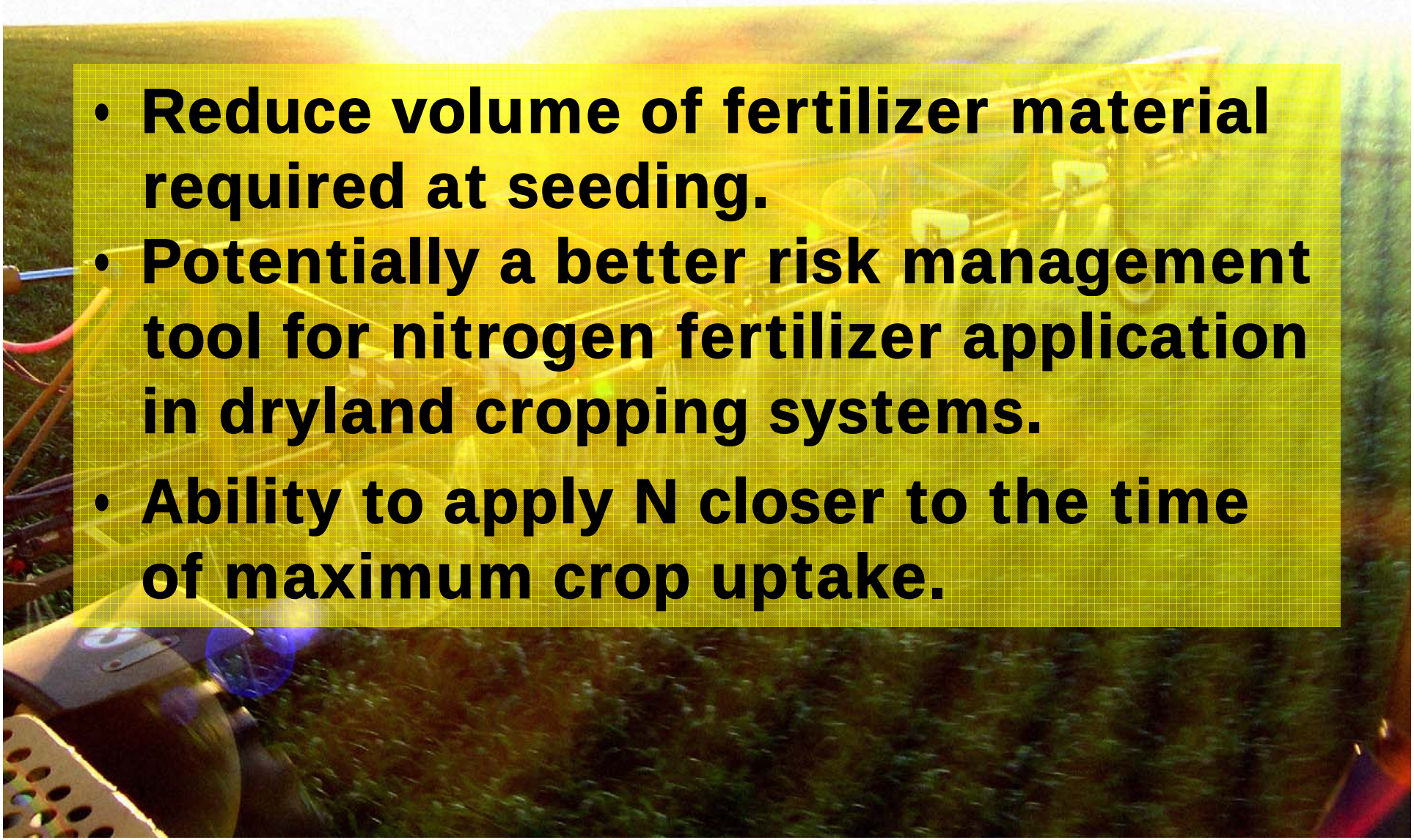
N Management under No-till on the Canadian Prairies

- Majority of N is applied in the soil at time of seeding using a one-pass seeding and fertilizing system

Challenge with Post-Emergent-N (PE-N) Management

It is very difficult to improve on the no-till one-pass seeding and fertilizing system because of its proven and recognized high efficiency.

Why the interest with Post Emergent N Applications in Western Canada?



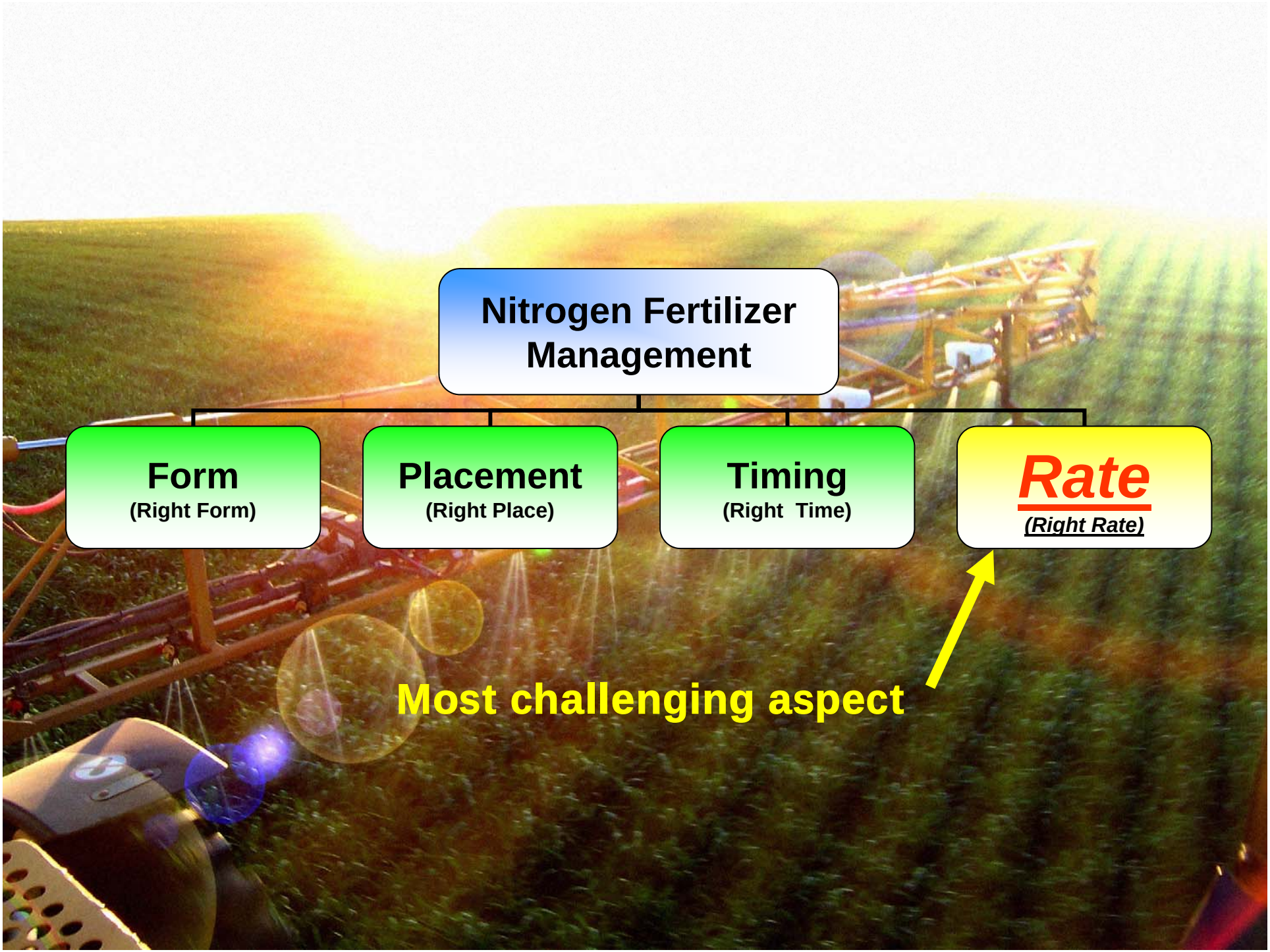
- **Reduce volume of fertilizer material required at seeding.**
- **Potentially a better risk management tool for nitrogen fertilizer application in dryland cropping systems.**
- **Ability to apply N closer to the time of maximum crop uptake.**

Where are we at with this concept-Part 1 (2001-03)?

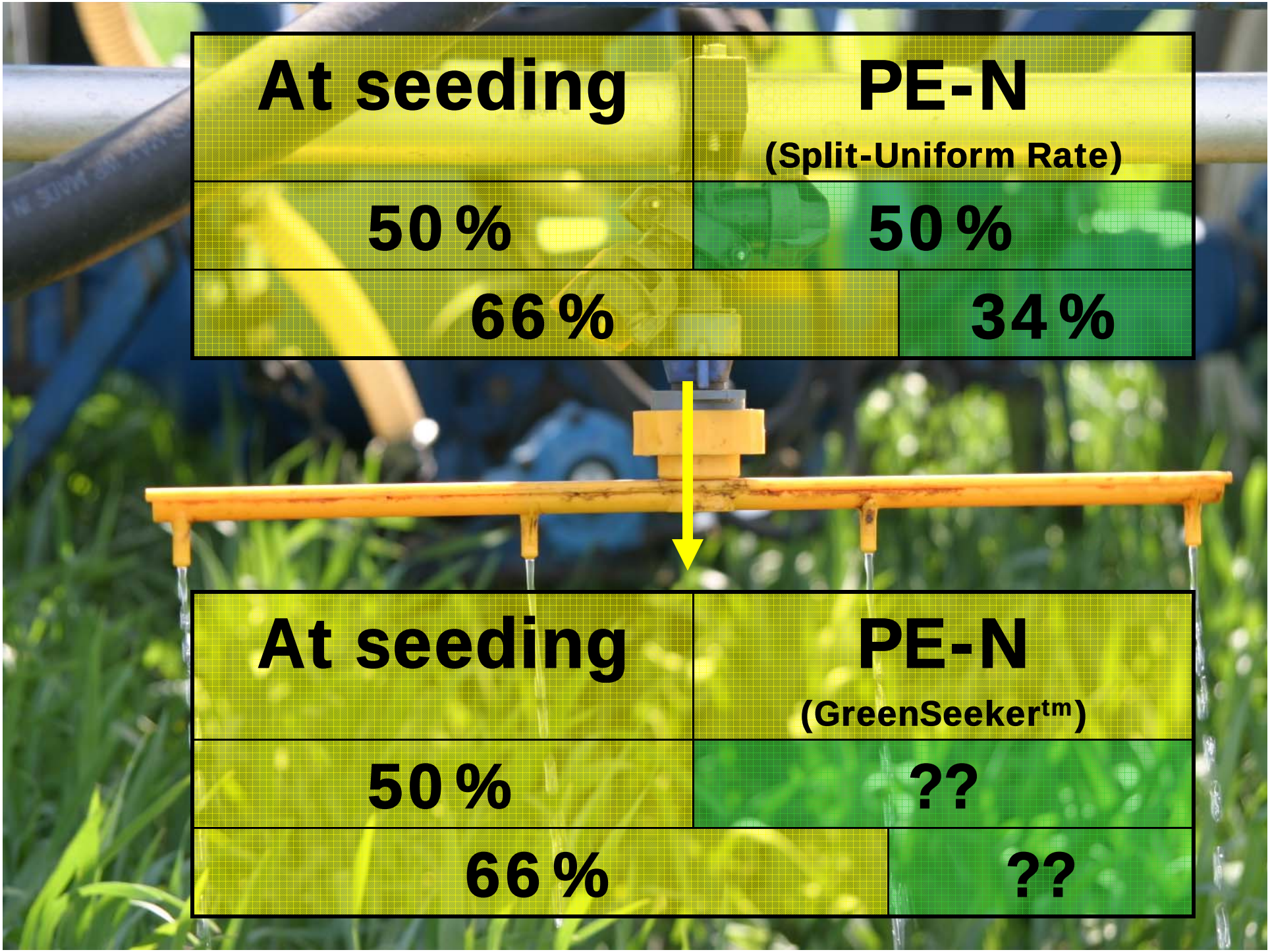
- **Test Crop: Spring wheat and canola**
- **PE-N application: 1, 10, 20 & 30 days after planting (UAN-surface dribble) vs all at planting**
- **Biggest risk is delay in receiving significant rainfall after application.**
- **Coulter injection reduces but does eliminate the risks associated with PE-N**
- **Need to consider some N at time of seeding as a way to control risks**

Where are we at with this concept-Part 2 (2004-06)?

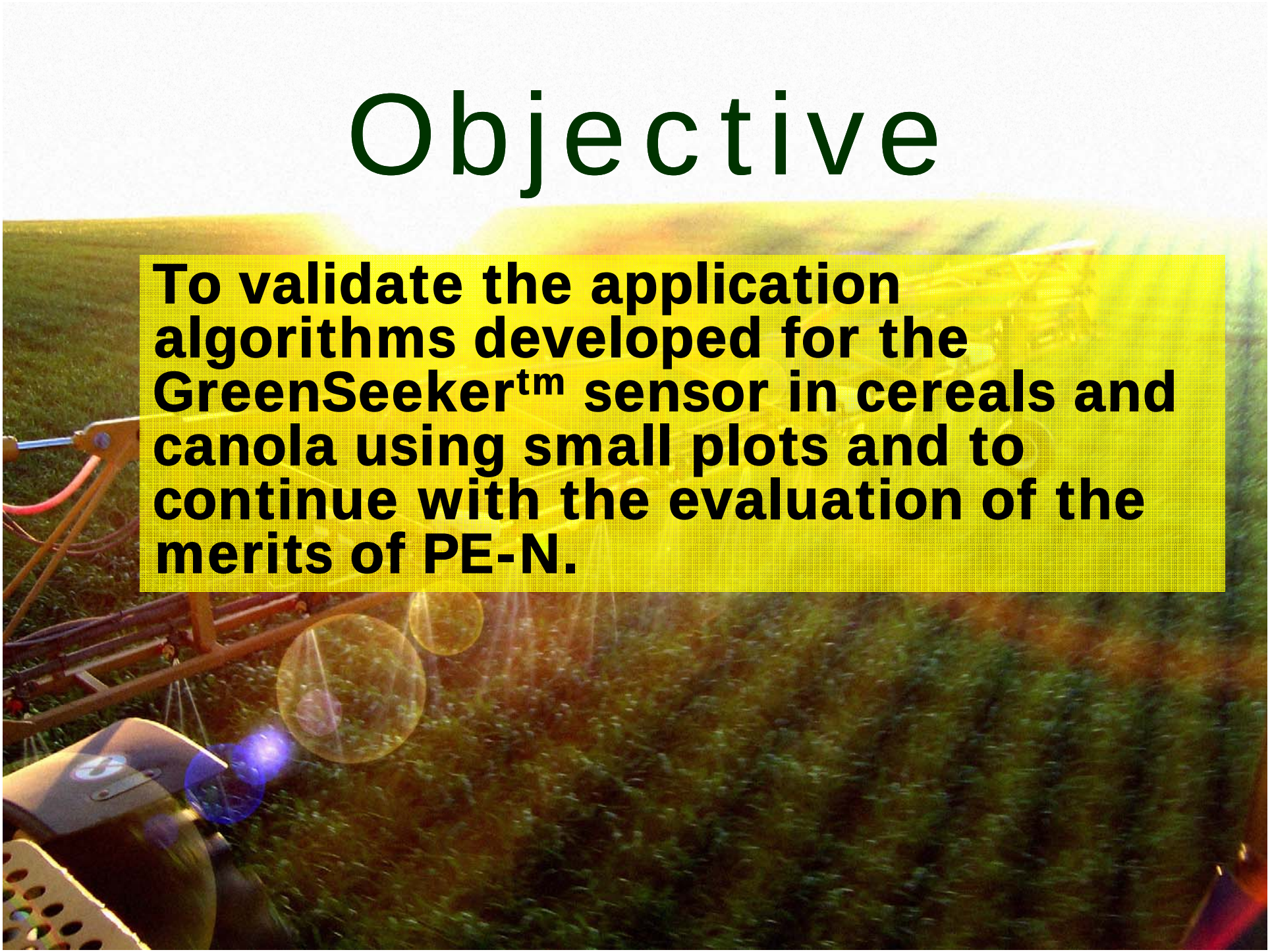
- **Test Crops: Spring wheat and Canola**
- **Adding some N at seeding significantly reduces the risks of post-emergent N applications.**
- **Recommend a minimum of 50% of total fertilizer N requirements as starter N**
- **Spring wheat: PE-N up to 5-6 leaf stage**
- **Canola: PE-N up to appearance of first flowers**


Nitrogen Fertilizer Management
Form
(Right Form)
Placement
(Right Place)
Timing
(Right Time)
Rate
(Right Rate)
Most challenging aspect


The next step...


At seeding
PE-N
(Split-Uniform Rate)
50 %
50 %
66 %
34 %
At seeding
PE-N
(GreenSeeker™)
50 %
??
66 %
??

Objective

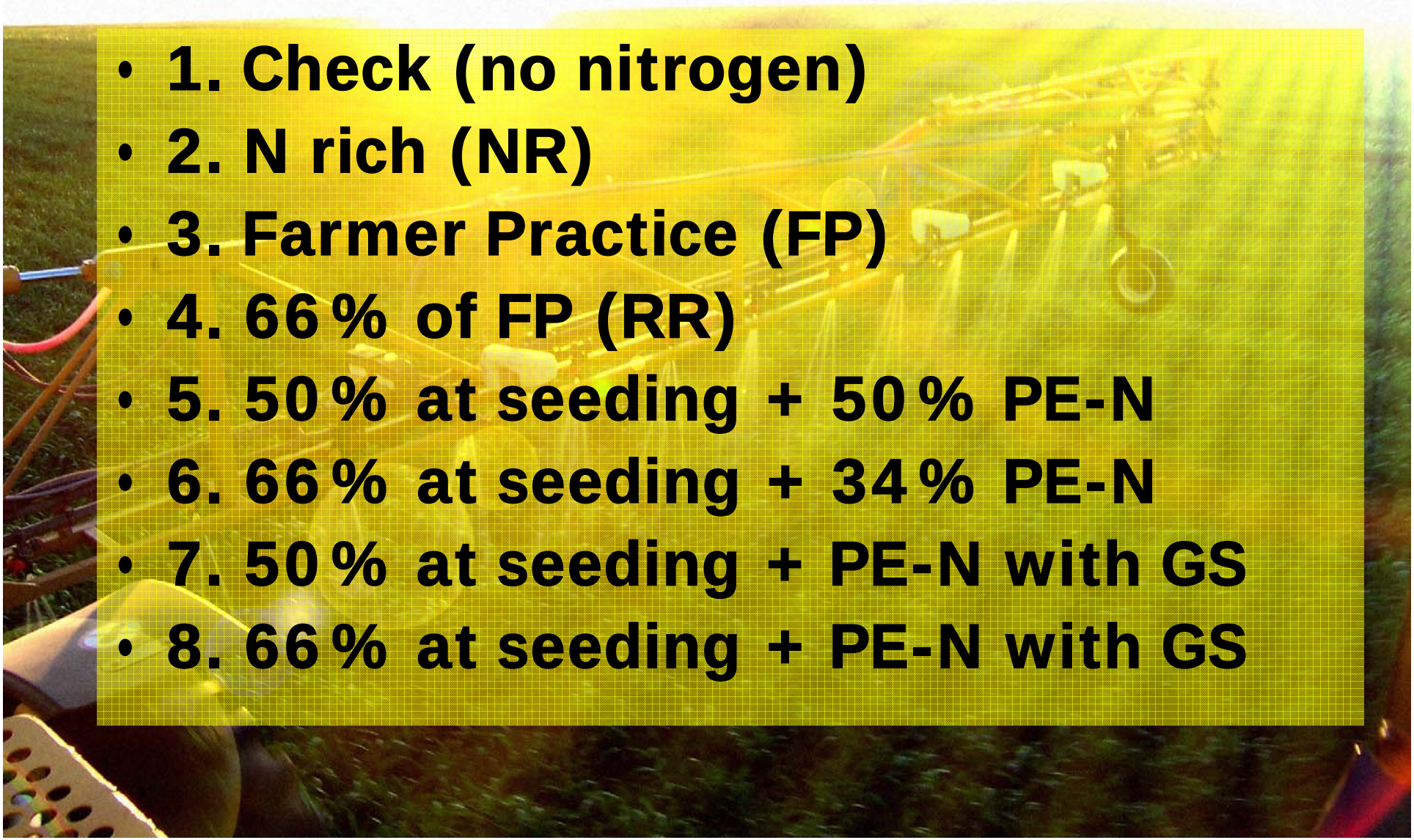


To validate the application algorithms developed for the GreenSeeker^{tm} sensor in cereals and canola using small plots and to continue with the evaluation of the merits of PE-N.

List of Crops

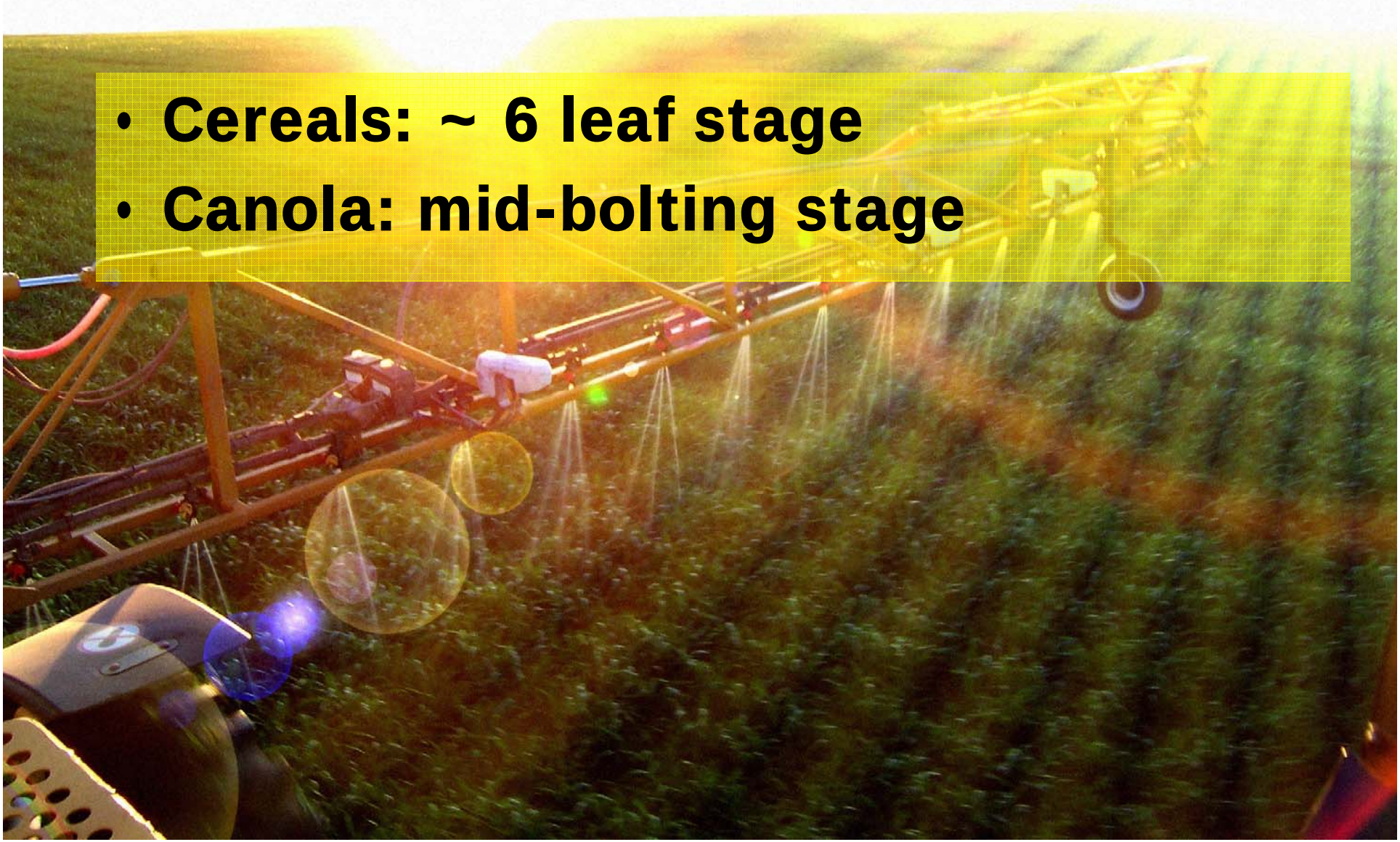
- **Durum wheat**
- **Spring wheat**
- **Winter wheat**
- **Malting Barley**
- **Oat**
- **Canola**

List of Treatments



- 1. Check (no nitrogen)
- 2. N rich (NR)
- 3. Farmer Practice (FP)
- 4. 66% of FP (RR)
- 5. 50% at seeding + 50% PE-N
- 6. 66% at seeding + 34% PE-N
- 7. 50% at seeding + PE-N with GS
- 8. 66% at seeding + PE-N with GS

Timing of PE-N



- **Cereals: ~ 6 leaf stage**
- **Canola: mid-bolting stage**

Total N Applied for the Various Treatments in 2008 (kg N/ha)

Treatments	Durum	Spring wheat	Barley	Oat	Canola
1. Check	0	0	0	0	0
2. N Rich	130	130	160	120	148
3. Farmer Practice (FP)	90	90	105	60	114
4. 66% of FP (RR)	59	59	69	40	75
5. 50% N at Seeding + 50% PE	90	90	105	60	114
6. 66% N at Seeding + 34% PE	90	90	105	60	114
7. 50% N at Seeding + PE GreenSeeker					
8. 66% N at Seeding + PE GreenSeeker					

Total N Applied for the Various Treatments in 2008 (kg N/ha)

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1. Check	0	0	0	0	0
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5. 50% N at Seeding + 50% PE	90	90	105	60	114
6. 66% N at Seeding + 34% PE	90	90	105	60	114
7. 50% N at Seeding + PE GreenSeeker	46	48	52	30	59
8. 66% N at Seeding + PE GreenSeeker	64	64	73	37	75

Grain Yields in 2008 (bus/acre)

Coefficient of Variations

Treatments	Durum	Spring wheat	Barley	Oat	Canola
1. Check					
2. N Rich (NR)					
3. Farmer Practice (FP)					
4. 66% of FP (RR)					
5. 50% N at Seeding + 50% PE					
6. 66% N at Seeding + 34% PE					
7. 50% N at Seeding + PE GreenSeeker					
8. 66% N at Seeding + PE GreenSeeker					
cv%	16.6	7.0	9.4	5.4	5.0

Summary of Yield Results

Grain Yields in 2008 (bus/acre)

Check vs Rest

Treatments	Durum	Spring wheat	Barley	Oat	Canola
1. Check	31.2	31.0	48.2	97	24.5
2. N Rich (NR)	46.5	41.0	74.5	119	44.7
3. Farmer Practice (FP)	40.1	40.3	70.3	109	44.4
4. 66% of FP (RR)	44.4	39.2	68.8	111	39.8
5. 50% N at Seeding + 50% PE	41.9	38.3	75.6	112	40.8
6. 66% N at Seeding + 34% PE	45.5	38.3	73.8	116	43.0
7. 50% N at Seeding + PE GreenSeeker	39.3	38.0	62.0	105	38.9
8. 66% N at Seeding + PE GreenSeeker	39.4	39.7	70.1	115	37.7

Grain Yields in 2008 (bus/acre)

NR vs FP

(N rate kg/ha)

Treatments	Durum	Spring wheat	Barley	Oat	Canola
1. Check					
2. N Rich (NR)	46.5	41.0	74.5	119 (120)	44.7
3. Farmer Practice (FP)	40.1	40.3	70.3	109 (60)	44.4
4. 66 % of FP (RR)					
5. 50 % N at Seeding + 50 % PE					
6. 66 % N at Seeding + 34 % PE					
7. 50 % N at Seeding + PE GreenSeeker					
8. 66 % N at Seeding + PE GreenSeeker					

Grain Yields in 2008 (bus/acre)

FP(3) vs RR (4)

Treatments	Durum	Spring wheat	Barley	Oat	Canola
1. Check					
2. N Rich (NR)					
3. Farmer Practice (FP)	40.1	40.3	70.3	109	44.4
4. 66% of FP (RR)	44.4	39.2	68.8	111	39.8
5. 50% N at Seeding + 50% PE					
6. 66% N at Seeding + 34% PE					
7. 50% N at Seeding + PE GreenSeeker					
8. 66% N at Seeding + PE GreenSeeker					

Grain Yields in 2008 (bus/acre)

FP(4) vs Split N(5+6)

Treatments	Durum	Spring wheat	Barley	Oat	Canola
1. Check					
2. N Rich (NR)					
3. Farmer Practice (FP)	40.1	40.3	70.3	109	44.4
4. 66% of FP (RR)					39.8
5. 50% N at Seeding + 50% PE	41.9	38.3	75.6	112	40.8
6. 66% N at Seeding + 34% PE	45.5	38.3	73.8	116	43.0
7. 50% N at Seeding + PE GreenSeeker					
8. 66% N at Seeding + PE GreenSeeker					

Grain Yields in 2008 (bus/acre)

FP(3) vs GreenSeeker (7&8)

Treatments	Durum	Spring wheat	Barley	Oat	Canola
1. Check					
2. N Rich (NR)					
3. Farmer Practice (FP)	40.1	40.3	70.3	109	44.4
4. 66% of FP (RR)					
5. 50% N at Seeding + 50% PE					
6. 66% N at Seeding + 34% PE					
7. 50% N at Seeding + PE GreenSeeker	39.3	38.0	62.0	105	38.9
8. 66% N at Seeding + PE GreenSeeker	39.4	39.7	70.1	115	37.7

NDVI in 2008

FP(3) vs GreenSeeker (7&8)

Treatments	Durum	Spring wheat	Barley	Oat	Canola
1. Check					
2. N Rich (NR)					
3. Farmer Practice (FP)	0.60	0.39	0.67	0.67	0.78
4. 66% of FP (RR)					
5. 50% N at Seeding + 50% PE					
6. 66% N at Seeding + 34% PE					
7. 50% N at Seeding + PE GreenSeeker	0.64	0.41	0.69	0.66	0.78
8. 66% N at Seeding + PE GreenSeeker	0.64	0.37	0.67	0.66	0.80

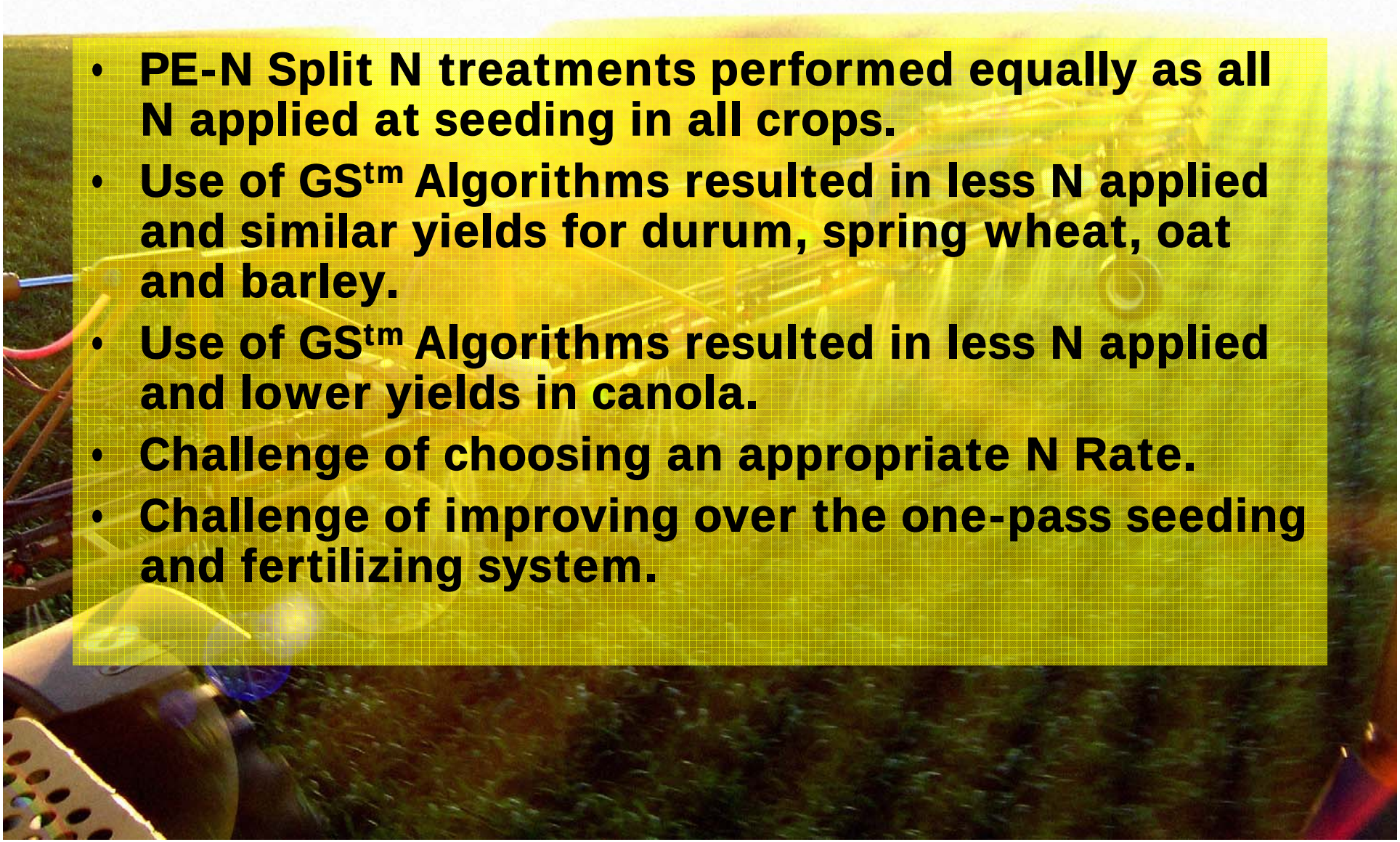
Grain Yields in 2008 (bus/acre)

FP(3) vs GreenSeeker (7&8)

(N rate kg/ha)

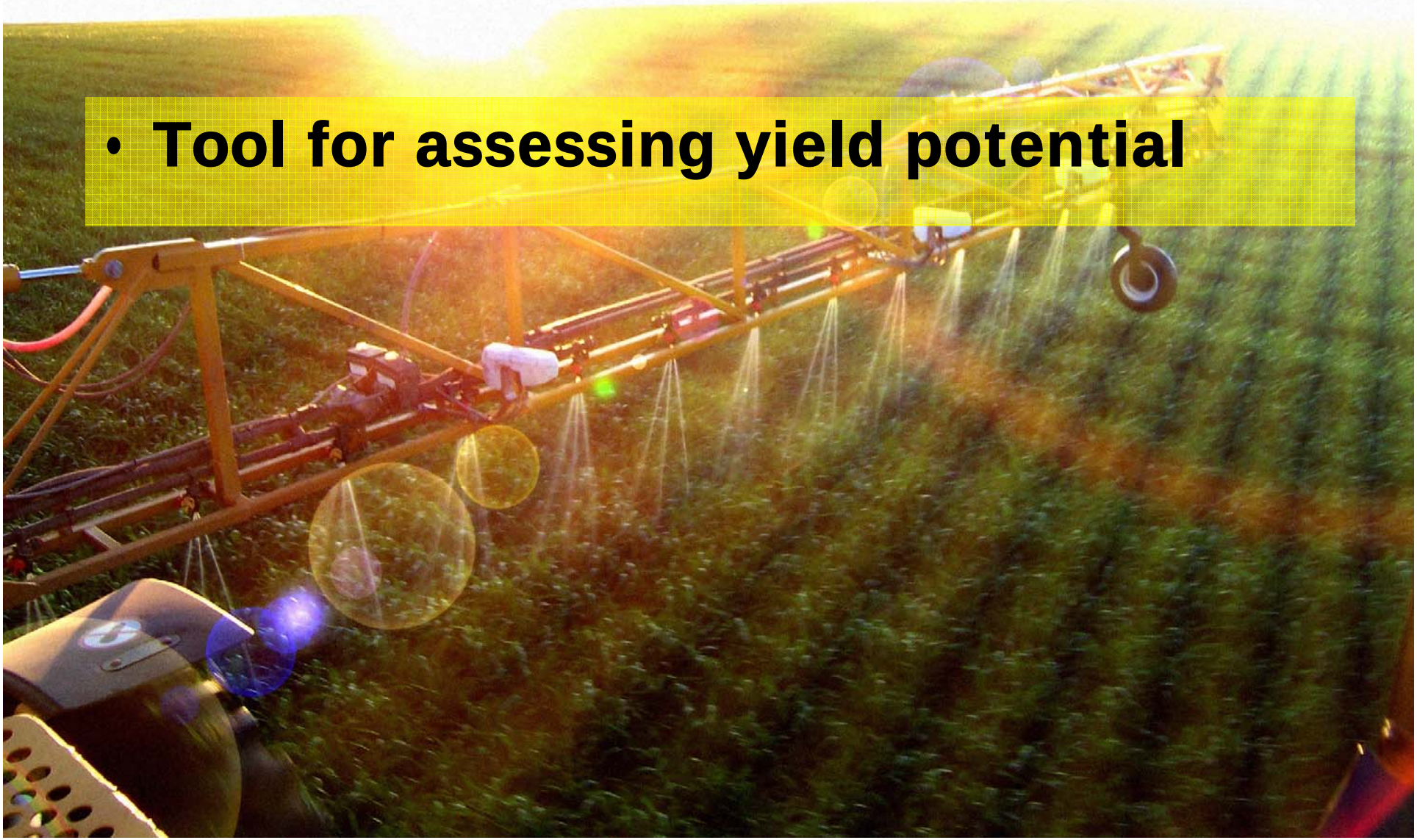
Treatments	Durum	Spring wheat	Barley	Oat	Canola
1. Check					
2. N Rich (NR)					
3. Farmer Practice (FP)	40.1 (90)	40.3 (90)	70.3 (105)	109 (56)	44.4 (114)
4. 66% of FP (RR)					
5. 50% N at Seeding + 50% PE					
6. 66% N at Seeding + 34% PE					
7. 50% N at Seeding + PE GreenSeeker	39.3 (45+1)	38.0 (45+3)	62.0 (52+0)	105 (28)	38.9 (57+2)
8. 66% N at Seeding + PE GreenSeeker	39.4 (59+5)	39.7 (59+5)	70.1 (69+4)	115 (37+0)	37.7 (75+0)

Summary to Date



- **PE-N Split N treatments performed equally as all N applied at seeding in all crops.**
- **Use of GS^{tm} Algorithms resulted in less N applied and similar yields for durum, spring wheat, oat and barley.**
- **Use of GS^{tm} Algorithms resulted in less N applied and lower yields in canola.**
- **Challenge of choosing an appropriate N Rate.**
- **Challenge of improving over the one-pass seeding and fertilizing system.**

Other Potential Uses of the GreenSeeker Optical Sensor



- **Tool for assessing yield potential**

Accuracy of the Algorithms for Predicting Yield Potential (bus/ac)

Crop	Actual (A) Yield	*Predicted (P) Yield	% Difference (A-P/A) x 100
Durum			
Spring Wheat			
Canola			
Oat			
Barley			

*Measurements taken on June 23rd

Accuracy of the Algorithms for Predicting Yield Potential (bus/ac)

Crop	Actual (A) Yield	Predicted (P) Yield	% Difference (A-P/A) x 100
Durum	41.0	40.4	+1.5
Spring Wheat			
Canola			
Oat			
Barley			

Accuracy of the Algorithms for Predicting Yield Potential (bus/ac)

Crop	Actual (A) Yield	Predicted (P) Yield	% Difference (A-P/A) x 100
Durum	41.0	40.4	+1.5
Spring Wheat	38.2	24.2	+36.7***
Canola			
Oat			
Barley			

Accuracy of the Algorithms for Predicting Yield Potential (bus/ac)

Crop	Actual (A) Yield	Predicted (P) Yield	% Difference (A-P/A) x 100
Durum	41.0	40.4	+1.5
Spring Wheat	38.2	24.2	+36.7***
115 plants m^{-2} vs target of 200-250 plants m^{-2}			
Canola			
Oat			
Barley			

Accuracy of the Algorithms for Predicting Yield Potential (bus/ac)

Crop	Actual (A) Yield	Predicted (P) Yield	% Difference (A-P/A) x 100
Durum	41.0	40.4	+1.5
Spring Wheat	38.2	24.2	+36.7***
Canola	39.2	43.2	-10.2
Oat			
Barley			

Accuracy of the Algorithms for Predicting Yield Potential (bus/ac)

Crop	Actual (A) Yield	Predicted (P) Yield	% Difference (A-P/A) x 100
Durum	41.0	40.4	+1.5
Spring Wheat	38.2	24.2	+36.7***
Canola	39.2	43.2	-10.2
Oat	110	97	11.8
Barley			

Accuracy of the Algorithms for Predicting Yield Potential (bus/ac)

Crop	Actual (A) Yield	Predicted (P) Yield	% Difference (A-P/A) x 100
Durum	41.0	40.4	+1.5
Spring Wheat	38.2	24.2	+36.7***
Canola	39.2	43.2	-10.2
Oat	110	97	11.8
Barley	68	67	+1.5

Where do we go from here?

- **Need to bring the technology to the farm gate**
- **Need to address the logistics of using this technology at the farm gate**
- **Need to draw from more on-farm experience to enhance the potential of optical sensors**
- **Need to expand the applications of optical sensors as decision making tools to other situations given its ability to predict yield potential**

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Thank-you

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