Seeding Rate and Seeding Depth

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Seeding Rates: Concerns and Opportunities…

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Seeding Rates

Concerns

- -Cost
- -Loss in yield if too much seed
- -Loss in yield if not enough seed
- -What is an average number of plants over a wide range of conditions and seeding rates?
- -Impact on Plant Diseases

Opportunities

Seeding Rates

Concerns

- -Cost
- -Loss in yield if too much seed
- -Loss in yield if not enough seed
- -What is an average number of plants over a wide range of conditions and seeding rates?
- -Impact on Plant Diseases

Opportunities

- -Strong stands to compete against weeds
- -More uniform maturity
- -Higher seeding rates can potential for lower root diseases

Desired Plant Populations by Crop

Crop	Plants per meter square	Plants per square foot
Spring, winter and durum wheat	200-250	19 - 23
Oat	250-300	23 – 28
Barley	200-250	19 – 23
Canola	➢40	➢4
Flax	300-400	28 – 37
Field Pea	50-60	5-6
Lentil	130	12

Seeding Rate Calculator

- How many lbs per acre to attain a given plant population?
- Formula:

$$\frac{\text{lbs}}{\text{acre}} = \frac{\text{Seeds}}{\text{m2}} * \text{Seed weight} * 0.0089$$

- Note: Seed weight = g/1000 seeds

Seeding Rate Calculator

What about mortality and germination potential?

[Above formulas assume 100% emergence.]

Seeding Rate Calculator

- **How many bushels per acre to attain a given plant population?**
- **Formula: Adjusting for mortality**

$$\frac{\text{lbs}}{\text{acre}} = \left[\frac{\text{Seeds}}{\text{m2}} * \text{Seed weight} * 0.0089\right] / \left[\frac{\%\text{germ} - \%\text{mortality}}{100}\right]$$

Canadian Seed Grower Assoc.
Minimum % Germination

Canada Certified	Barley	Wheat	Rye	Flax	Field Pea
#1					
#2					

Canadian Seed Grower Assoc.
Minimum % Germination

Canada Certified	Barley	Wheat	Rye	Flax	Field Pea
#1	85	80	75	85	80
#2	75	70	65	70	70

Major factors determining number of seeds that will emerge?

- Seeding Rate
- % Germination and Emergence
- Seed Size or Weight

Spring Wheat – 1 bus/acre

	1000 Seed Weight g		
% Emerged	25	30	35
100	270	225	193
95	256	213	183
90	243	202	173
85	229	191	164
80	216	180	154
75	202	169	144
70	189	157	135
65	175	146	125
60	162	135	116
55	148	124	106
50	135	112	96

Spring Wheat – 1.5 bus/acre

	1000 Seed Weight g		
% Emerged	25	30	35
100	404	337	289
95	384	320	274
90	364	303	260
85	344	287	246
80	324	270	231
75	303	253	217
70	283	236	202
65	263	219	188
60	243	202	173
55	222	185	159
50	202	169	144

Spring Wheat – 2.0 bus/acre

	1000 Seed Weight g		
% Emerged	25	30	35
100	539	449	385
95	512	427	366
90	485	404	347
85	458	382	327
80	431	360	308
75	404	337	289
70	378	315	270
65	351	292	250
60	324	270	231
55	297	247	212
50	270	225	193

Barley – 1 bus/acre

	1000 Seed Weight g		
% Emerged	35	40	45
100	154	135	120
95	146	128	114
90	139	121	108
85	131	115	102
80	123	108	96
75	116	101	90
70	108	94	84
65	100	88	78
60	92	81	72
55	85	74	66
50	77	67	60

Barley – 1.5 bus/acre

	1000 Seed Weight g		
% Emerged	35	40	45
100	231	202	180
95	220	192	171
90	208	182	162
85	196	172	153
80	185	162	144
75	173	152	135
70	162	142	126
65	150	131	117
60	139	121	108
55	127	111	99
50	116	101	90

Barley – 2.0 bus/acre

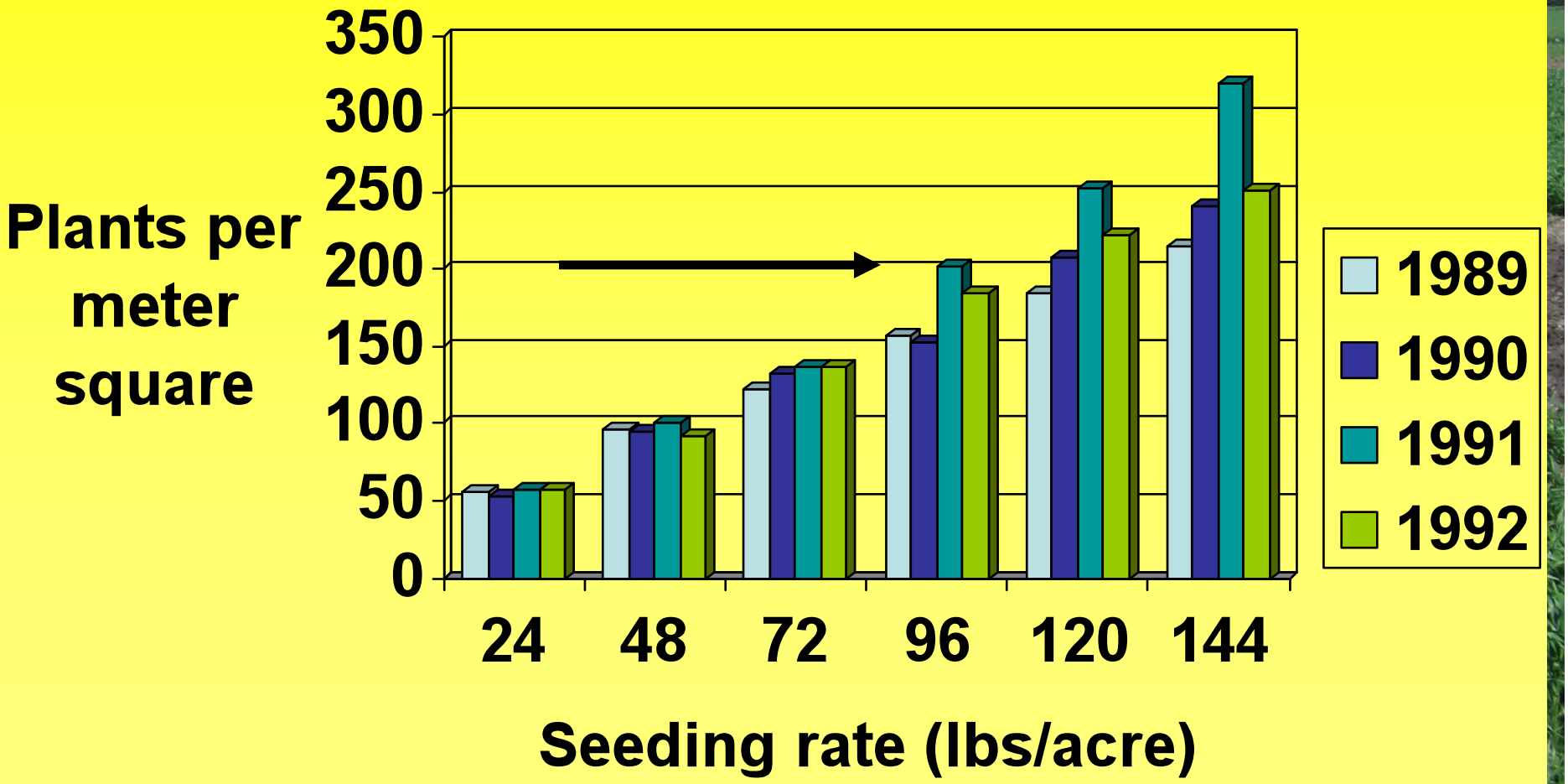
	1000 Seed Weight g		
% Emerged	35	40	45
100	308	270	240
95	293	256	228
90	277	243	216
85	262	229	204
80	247	216	192
75	231	202	180
70	216	189	168
65	200	175	156
60	185	162	144
55	170	148	132
50	154	135	120

Seeding Rate Effects on Plant Populations

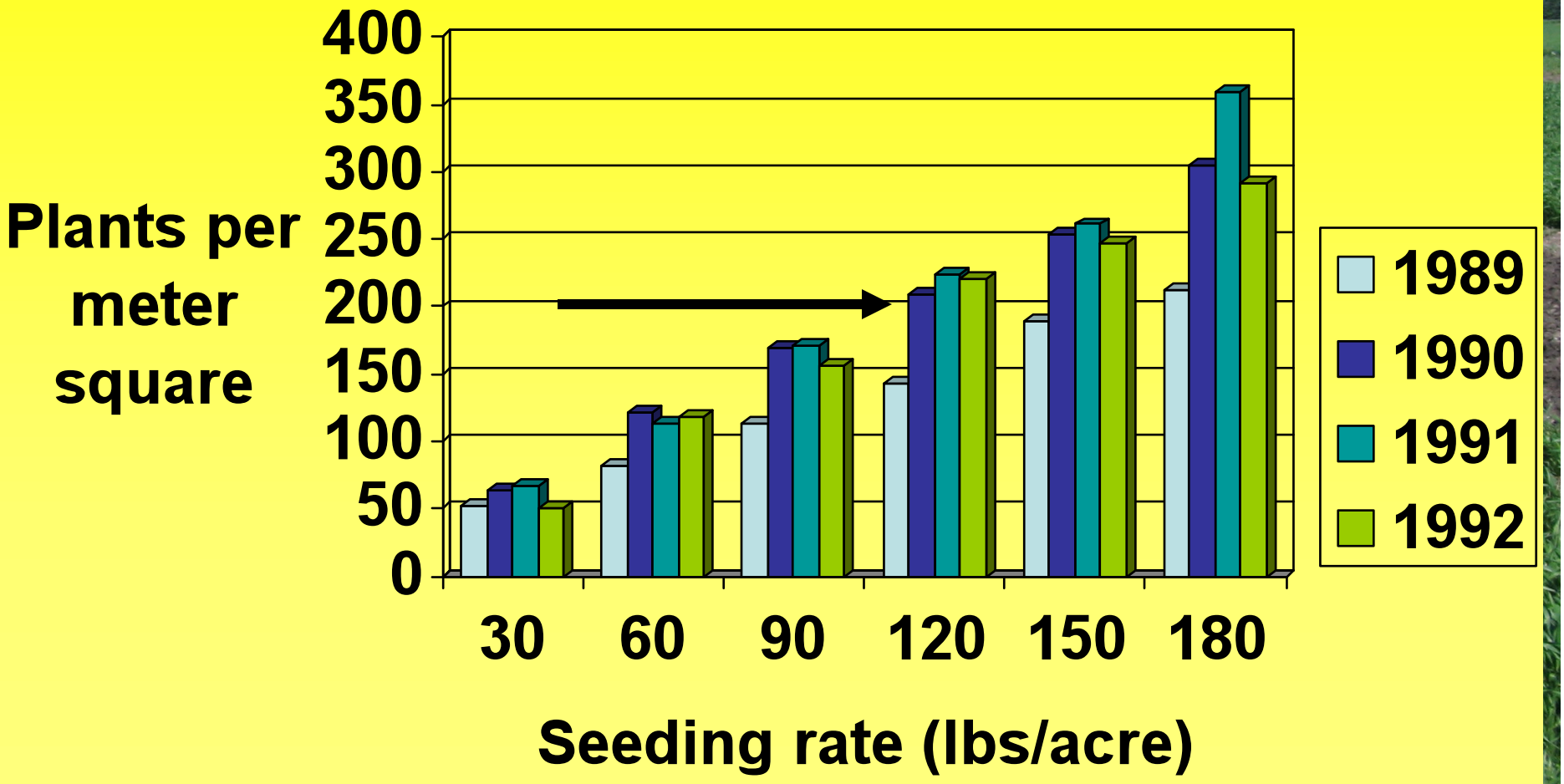
-Flax, Durum, Barley, Spring wheat
-Contrasting years

From - Lafond 1993. Can. J. Plant Sci. 73:375-382
- Lafond 1994. Can. J. Plant Sci. 74:703-711

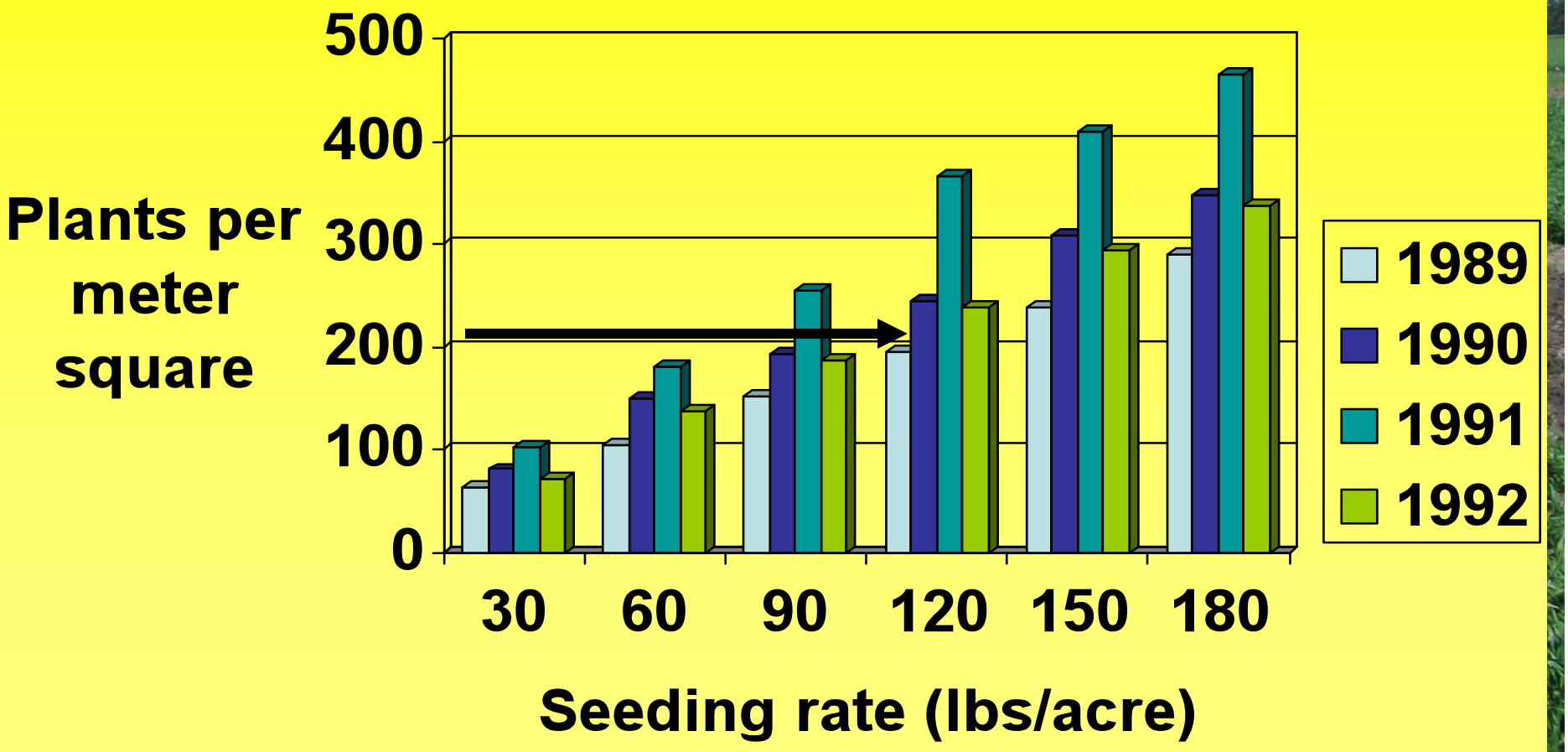
Barley


Plants per meter square
350
300
250
200
150
100
50
0
24
48
72
96
120
144
Seeding rate (lbs/acre)
1989
1990
1991
1992

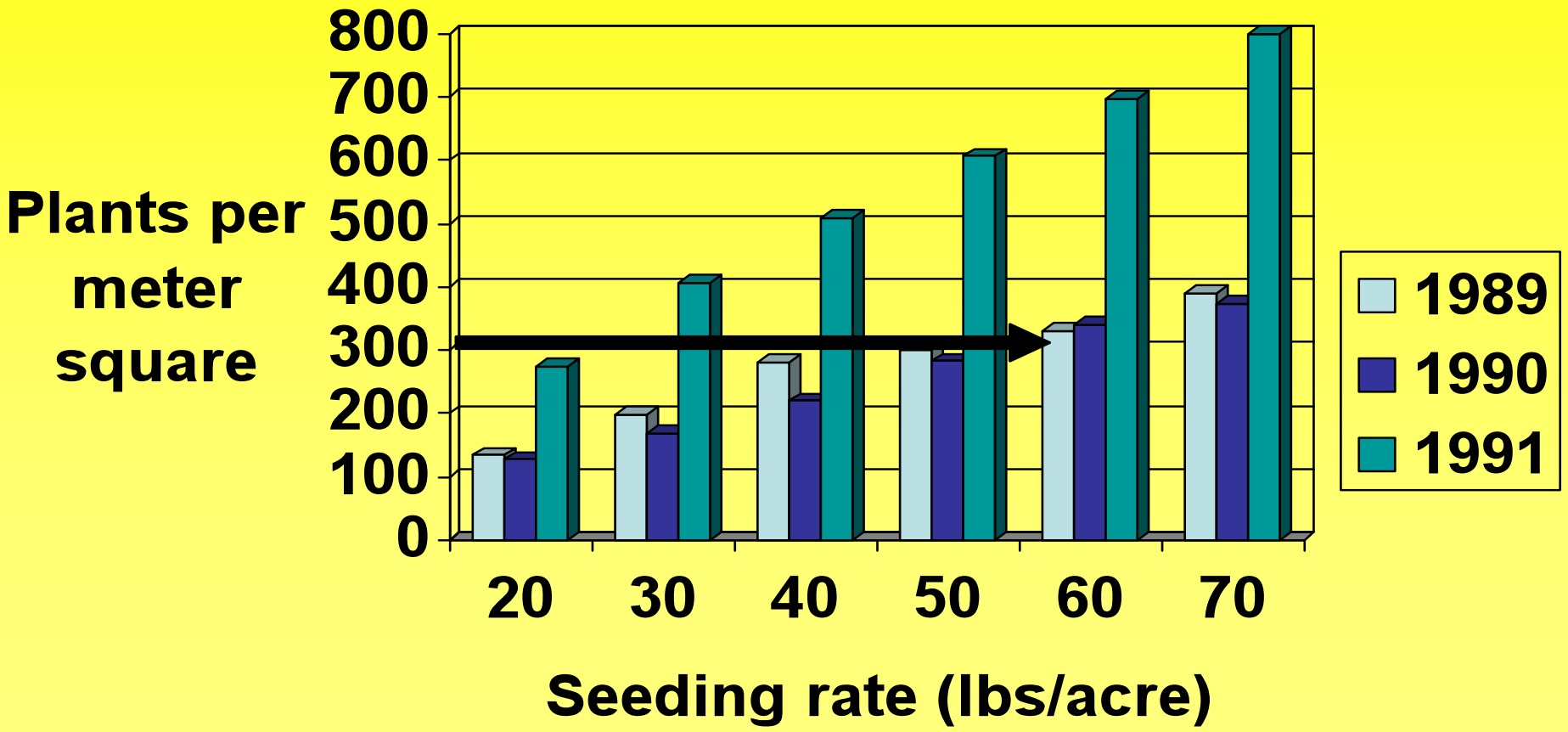
Durum


Plants per meter square
400
350
300
250
200
150
100
50
0
30
60
90
120
150
180
Seeding rate (lbs/acre)
1989
1990
1991
1992

Spring Wheat

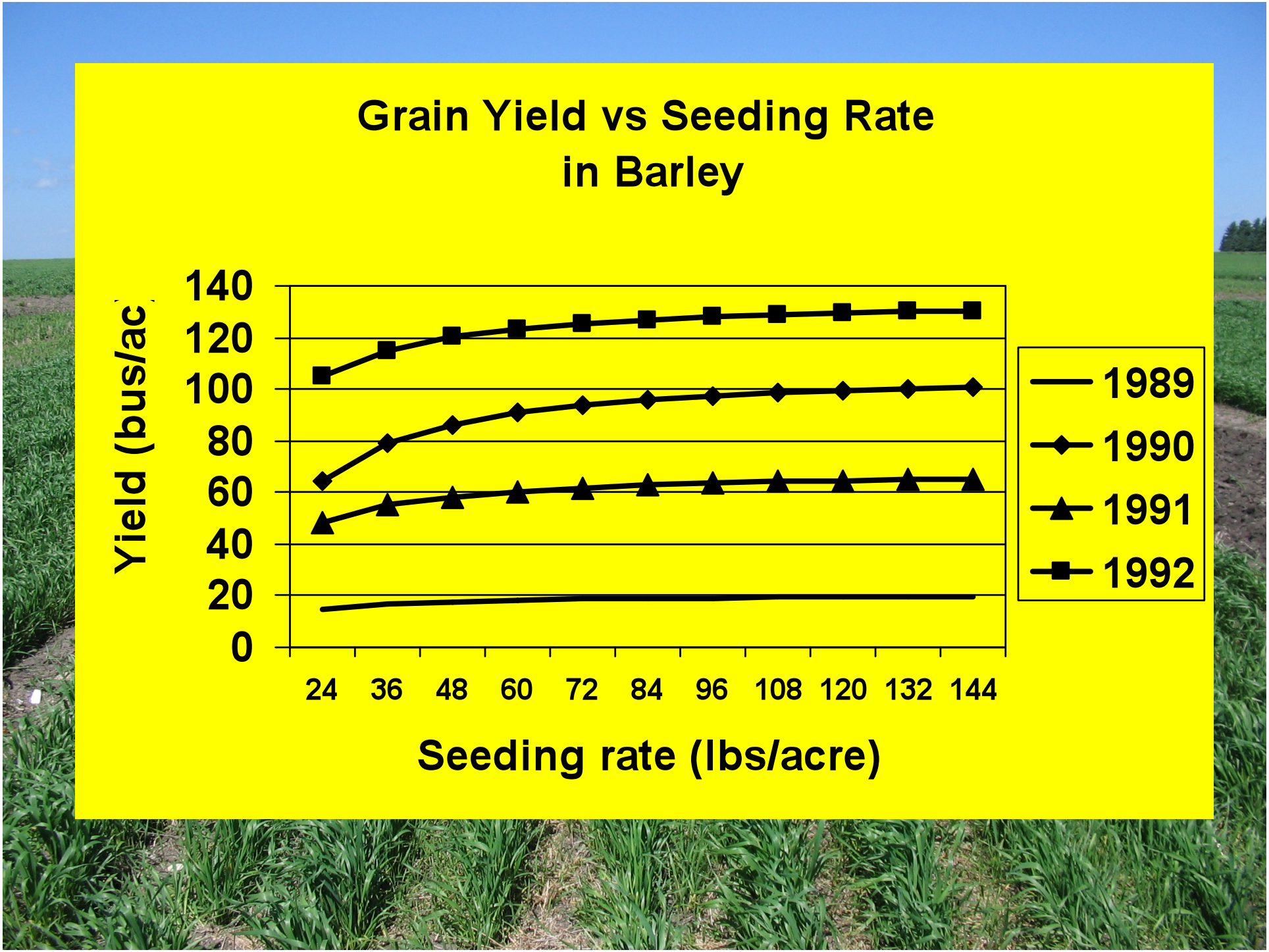


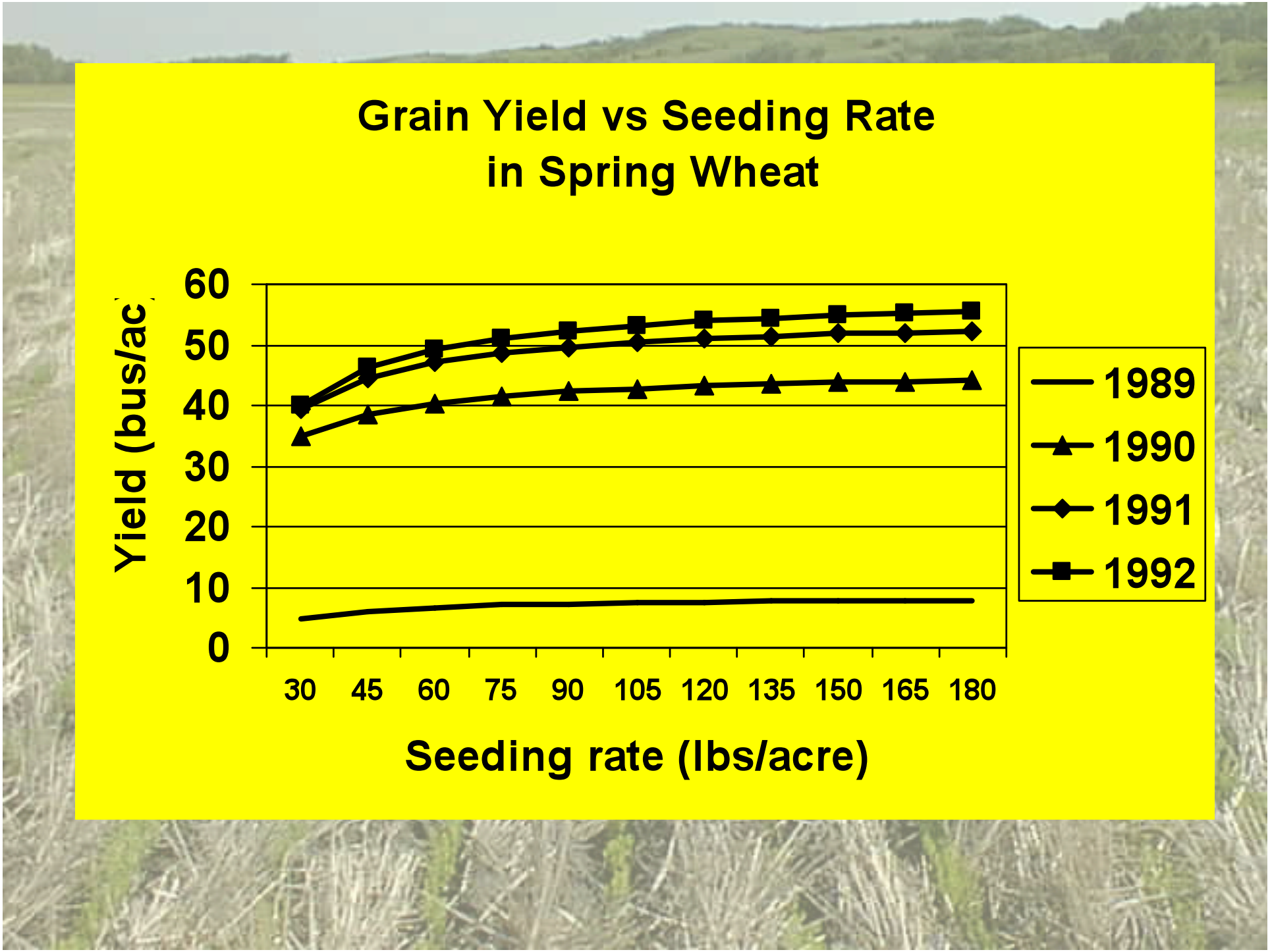
Flax

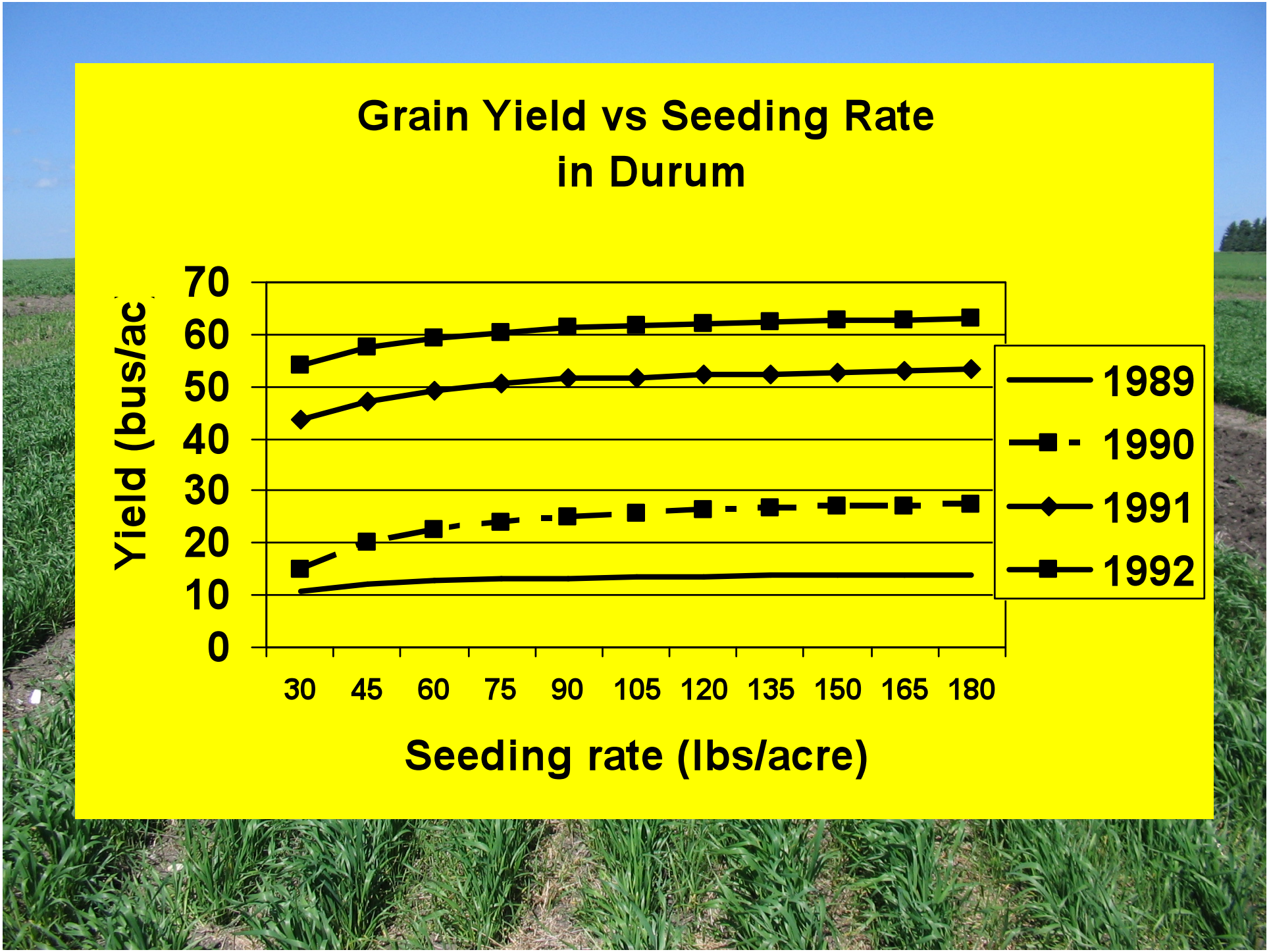

Plants per meter square
800
700
600
500
400
300
200
100
0
20
30
40
50
60
70
Seeding rate (lbs/acre)
1989
1990
1991

Impact of Seeding Rates on Grain Yield

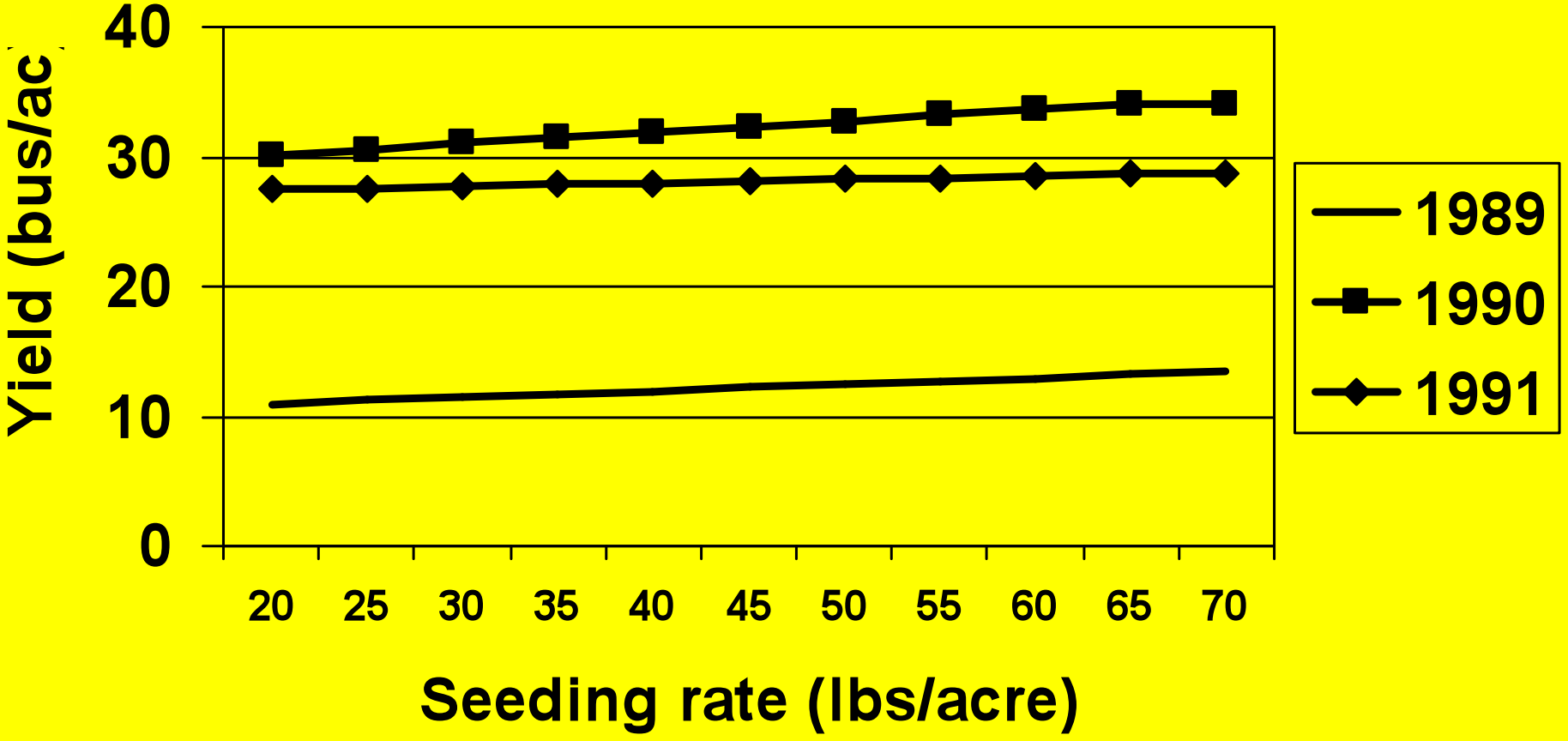
Assumption: No weeds


Grain Yield vs Seeding Rate
in Barley
Yield (bus/ac)
140
120
100
80
60
40
20
0
24
36
48
60
72
84
96
108
120
132
144
Seeding rate (lbs/acre)
1989
1990
1991
1992


Grain Yield vs Seeding Rate
in Spring Wheat
Yield (bus/ac)
60
50
40
30
20
10
0
30
45
60
75
90
105
120
135
150
165
180
Seeding rate (lbs/acre)
1989
1990
1991
1992


Grain Yield vs Seeding Rate
in Durum
Yield (bus/ac)
70
60
50
40
30
20
10
0
30
45
60
75
90
105
120
135
150
165
180
Seeding rate (lbs/acre)
1989
1990
1991
1992

Grain Yield vs Seeding Rate in Flax



Seeding Rate: Effects on root diseases of spring wheat and barley…

Seeding Rates in Barley: Effects on root diseases…

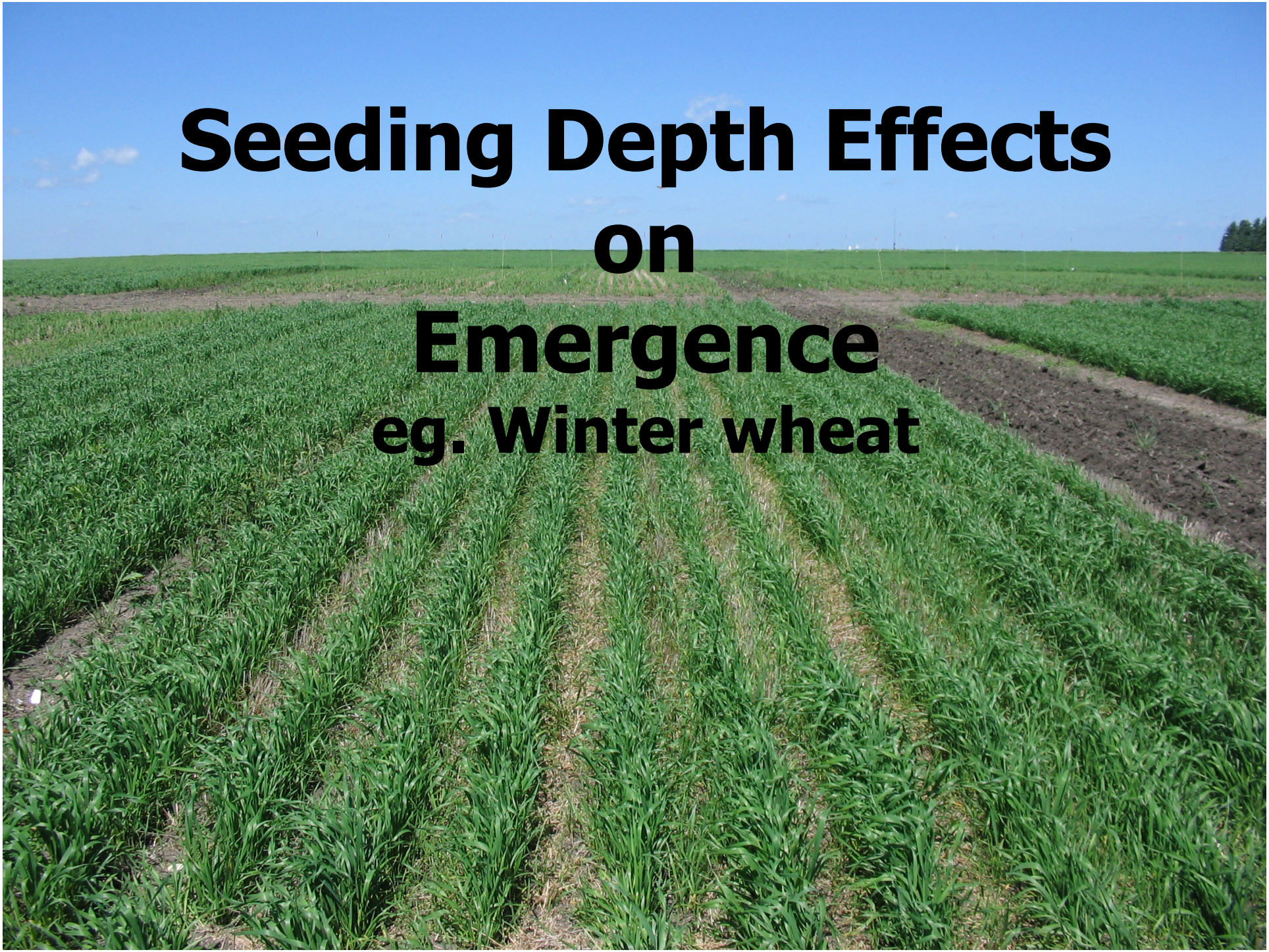
Seeding Rate (bus/ acre)	Root Rot Severity %
1	53
2	46
3	47
Sign.	*

From Bailey et al. 1998. Can. J. Plant Sci. 78:145-150.

Seeding Rates in Spring Wheat: Effects on root diseases…

Seeding Rate (bus/acre)	Root Rot Severity %	Take-All %	Fusarium spp %
1	53	72	50
2	46	70	48
3	47	63	45
Sign.	*	ns	*

From Bailey et al. 1998. Can. J. Plant Sci. 78:145-150.


Seeding Depth Effects
on
Emergence
eg. Winter wheat

Seeding Date and Seeding Depth on % Emergence in cereals eg. winter wheat

Seeding Date	Seeding Depth (inches)		
	0.75	1.5	3.0
Sept. 1	100	96	67
Sept. 21	99	97	79

Field Pea Seeding Depth

Depth (cm)	Plant emergence #/m^2	Yield kg/ha
2.5	66a	2087a
5.0	67a	2108a
7.5	67a	2124a
8.8	67a	2024a

From Eric Johnson, unpublished information Mean of 96 observations


Seeding Rate and Seeding Depth Effects Always Need to Consider Weeds

Plant Competition
- What are we looking for?

"It is evident that practically all the advantages or weapons of competing species are epitomized in two words - amount and rate".

Clements, F. E., J. E. Weaver, and H. C. Hanson. 1929. Plant competition – an analysis of community function. Publ. No. 398. Carnegie Institute, Wash., D.C. 340 pp.

Plant Competition
- What are we looking for?

- more rapid and complete germination
- more rapid growth of roots and shoots
- taller and more branching stems
- deeper and more spreading roots
- larger leaves

Clements, F. E., J. E. Weaver, and H. C. Hanson. 1929. Plant competition – an analysis of community function. Publ. No. 398. Carnegie Institute, Wash., D.C. 340 pp.

The Compelling Case for Higher Crop Density

The Compelling Case for Higher Crop Density

Of 91 cases in the literature in 29 different crops, only 6 failed to show decreasing weediness with increasing crop density.

Mohler CL. 2001. Enhancing the competitive ability of crops. *In*: M Liebman, CL Mohler, CP Staver (eds): *Ecological management of agricultural weeds*. Cambridge University Press, pp. 269-321.

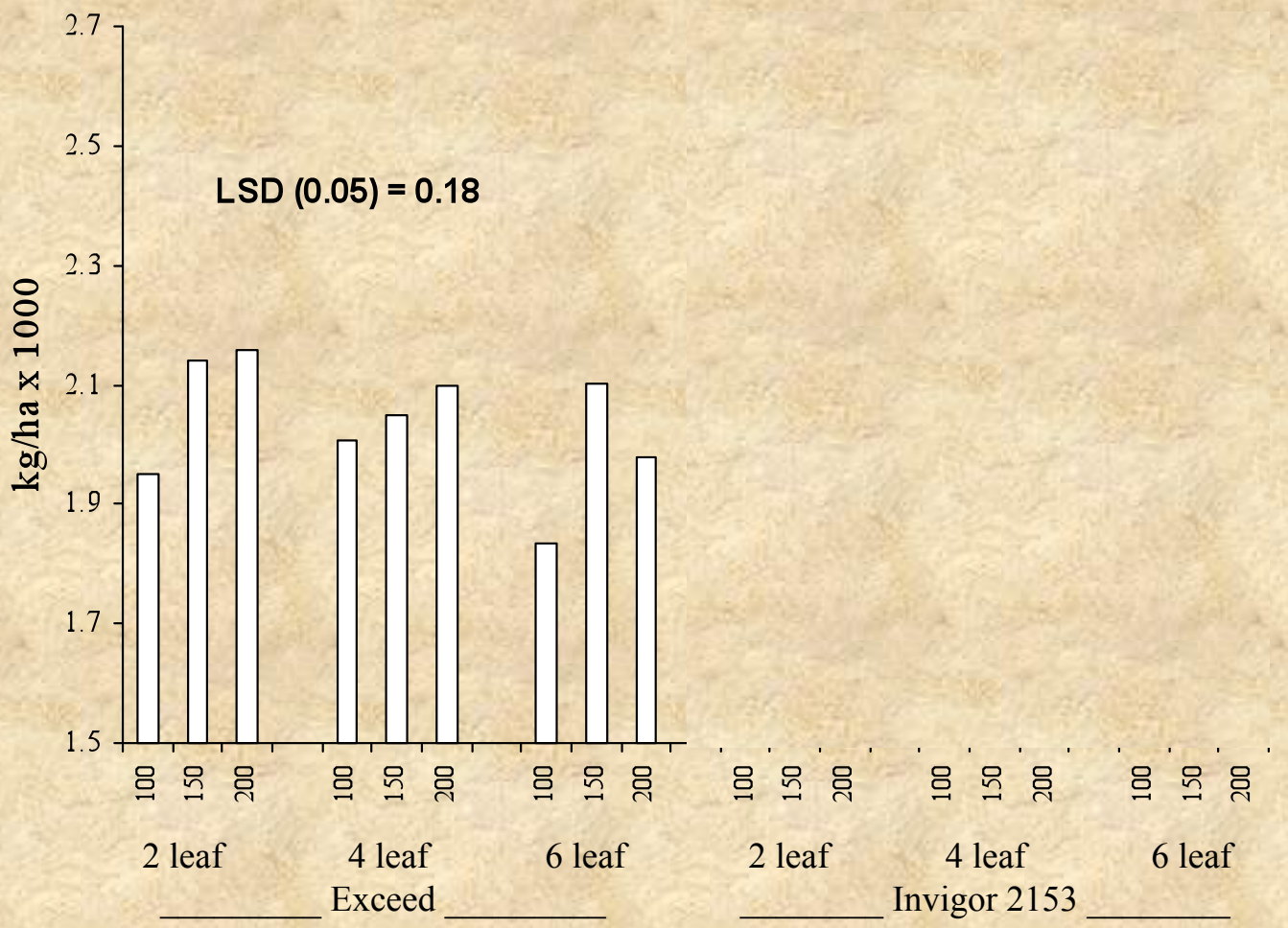

Seeding Rates and
Time of Weed Removal

Test 14 – Cultivar x TWR x Seed Rate

- Sites: Lacombe and Lethbridge (total of 5 site years)
- Two Canola Cultivars (InVigor 2153, Exceed)
- Time of Weed Removal (2, 4, 6 leaf)
- Canola Seeding rate
  - 100 plants/m^2
  - 150 plants/m^2
  - 200 plants/m^2

Harker et al. 2003
- Can. J. Plant Science 83:433-440

Canola Yield kg/ha x 1000

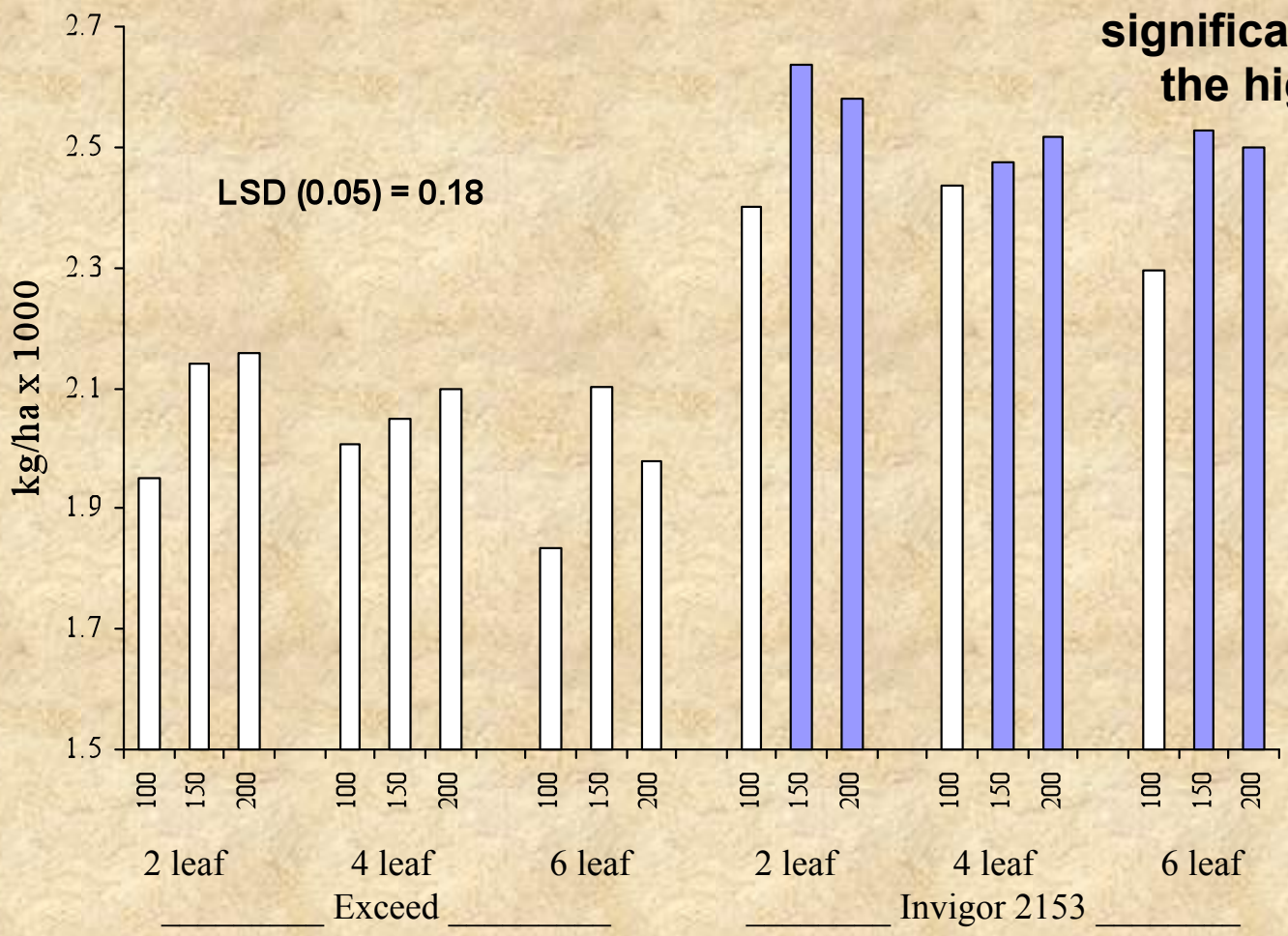


Note where yield was highest for 'InVigor 2153' (Hybrid)

Seeding rate = 100, 150 or 200 seeds/m²

Canola Yield kg/ha x 1000

Coloured bars are not significantly less than the highest yield

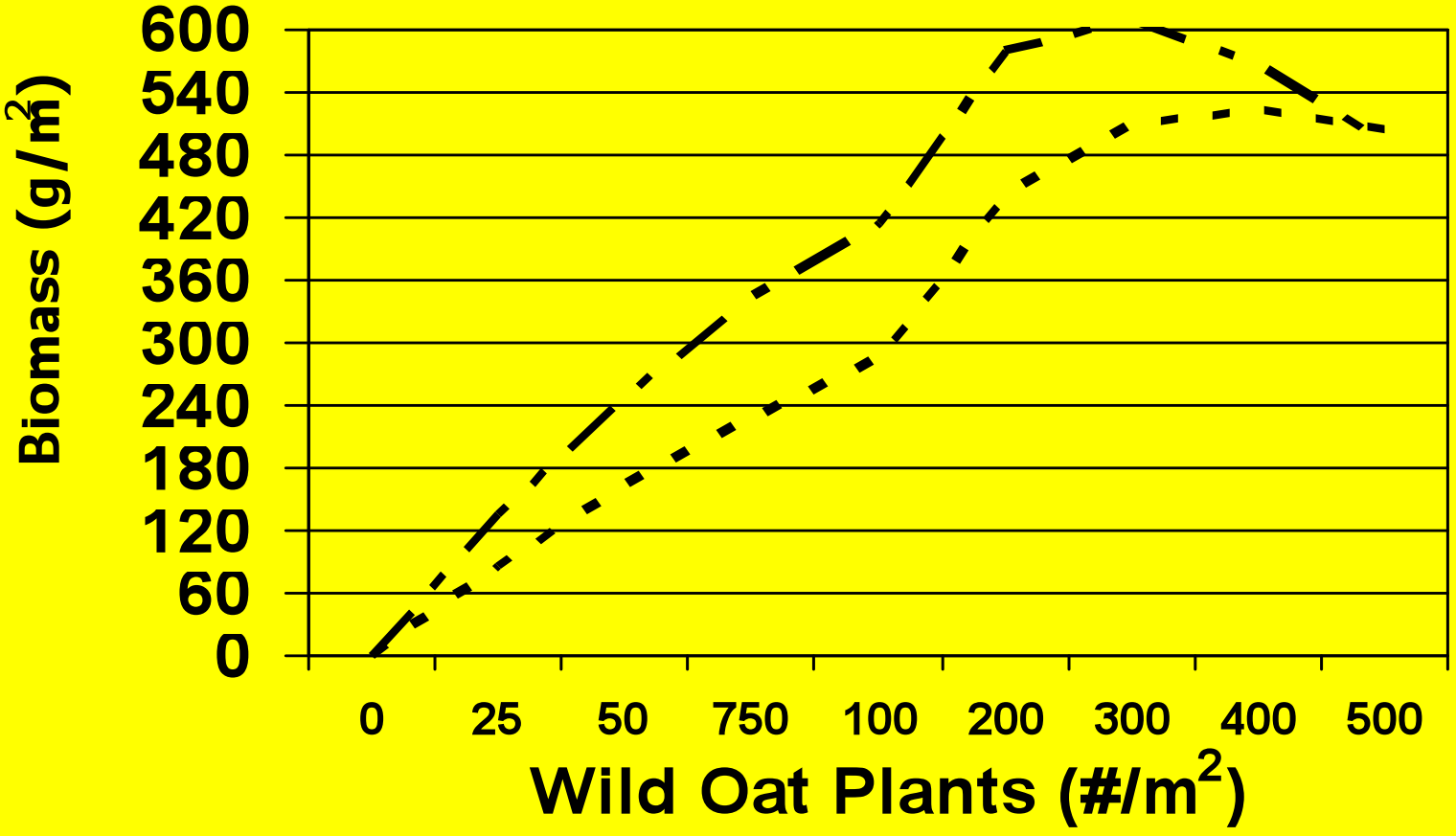


Note where yield was highest for 'InVigor 2153' (Hybrid)

Seeding rate = 100, 150 or 200 seeds/m²

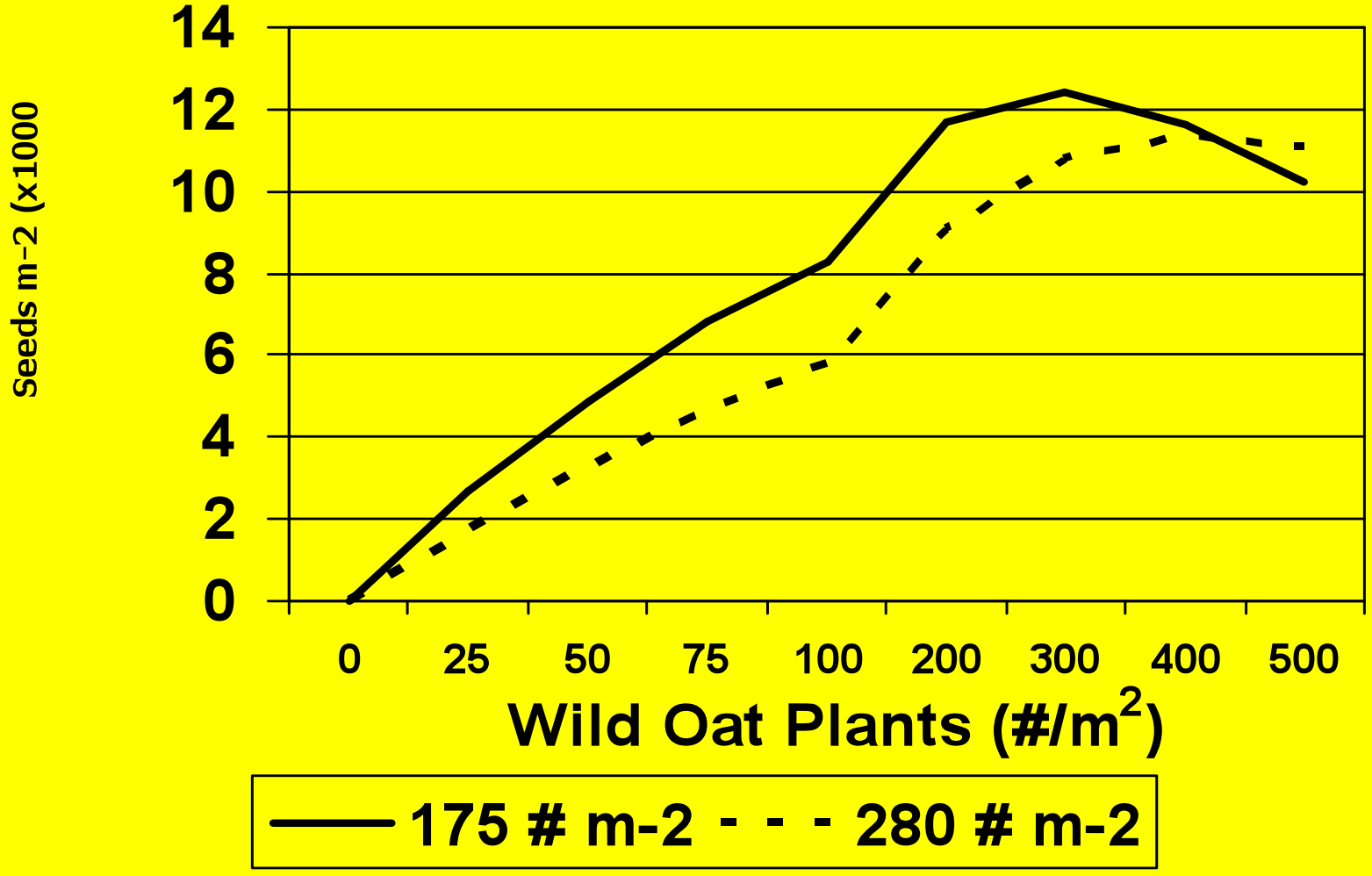
Impact of Seeding Rates in Spring wheat on Wild Oat Biomass and Seed Numbers

Seeding Rate Effects in Spring Wheat on Wild Oat Biomass

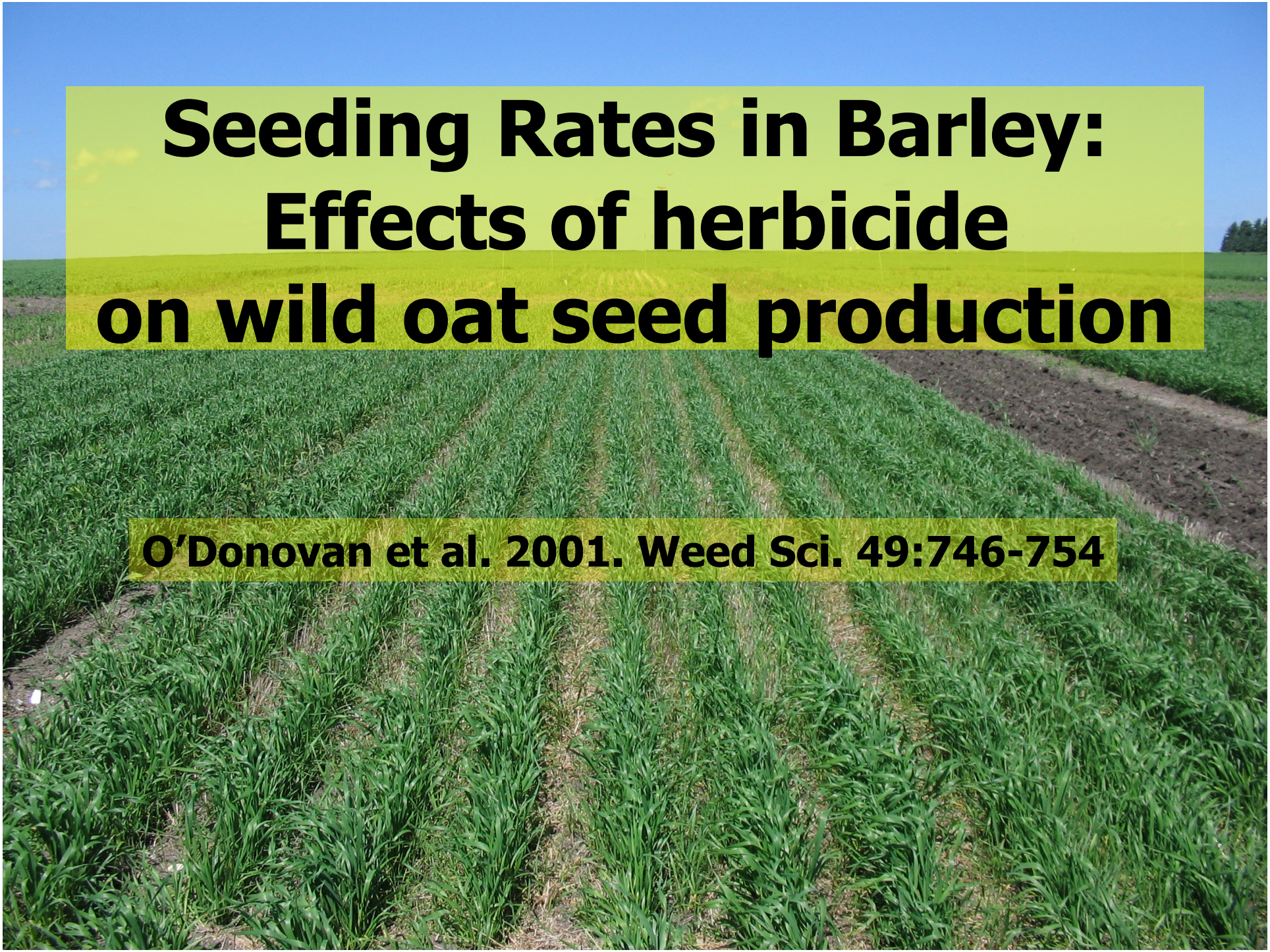


From Xue and Stougaard 2002. Weed Techn 50:312-320

Seeding Rate Effects in Spring Wheat on Wild Oat Seed Numbers

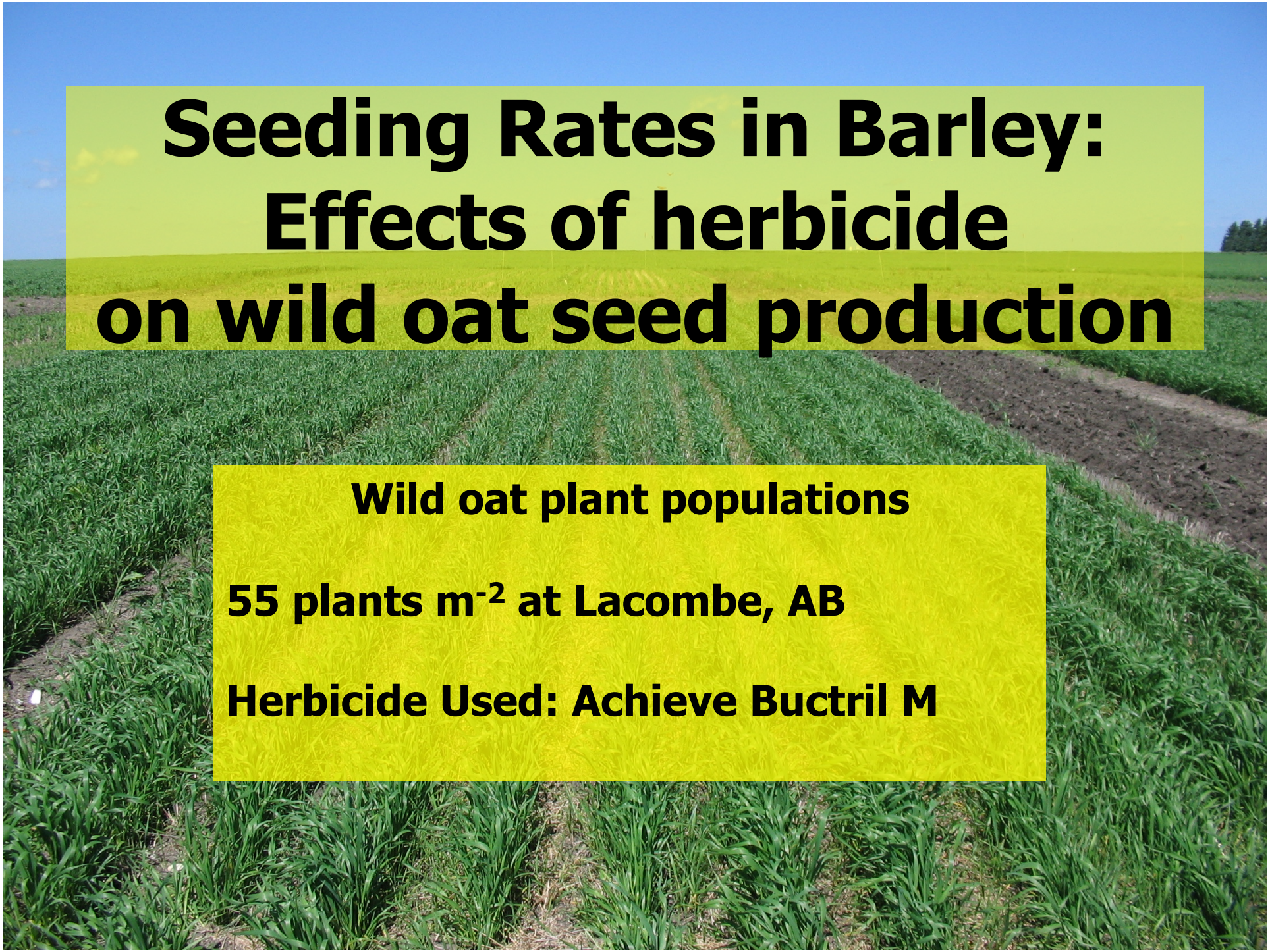


From Xue and Stougaard 2002. Weed Techn 50:312-320



Seeding Rates in Barley: Effects of herbicide on wild oat seed production

O'Donovan et al. 2001. Weed Sci. 49:746-754



Seeding Rates in Barley: Effects of herbicide on wild oat seed production

Wild oat plant populations

55 plants m^{-2} at Lacombe, AB

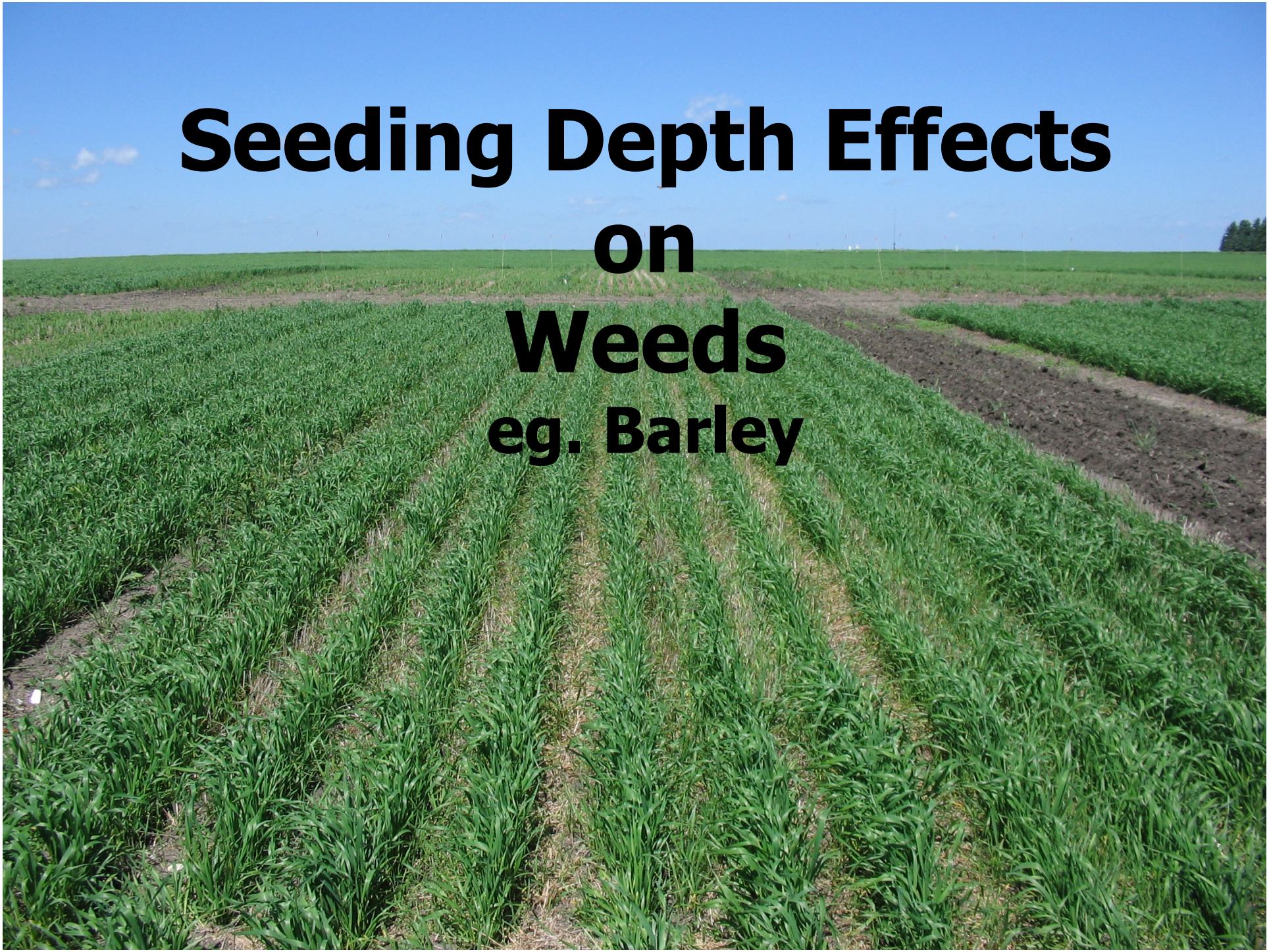
Herbicide Used: Achieve Buctril M

Lacombe – 1997
Wild Oat (seed m^{-2})

Herbicide rate (% of recomm.)	Barley (plants m^{-2})		
	75	125	175
0	3289	2042	2013
25	1692	461	293
50	378	40	73
75	50	65	25
100	0	0	0

Lacombe – 1998
Wild Oat (seed m^{-2})

Herbicide rate (% of recomm.)	Barley (plants m^{-2})		
	75	125	175
0	2414	1318	1033
25	640	257	20
50	15	0	0
75	0	0	0
100	0	0	0


Seeding Depth Effects
on
Weeds
eg. Barley

‘Kasota’ Barley Seeding Depth versus Rate

1” depth - 100 seeds/m^2

1” depth - 200 seeds/m^2

2.5” depth - 100 seeds/m^2

2.5” depth - 200 seeds/m^2

Conclusions

- **Higher seeding rates won't necessarily lead to reductions in yield**
- **Higher seeding rates will accelerate maturity**
- **Higher seeding rates nearly always have a +'ve effect in reducing weed growth.**
- **Shallow planting is always preferred to give the crop an advantage for speed of emergence except for field pea**

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Thank-you

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