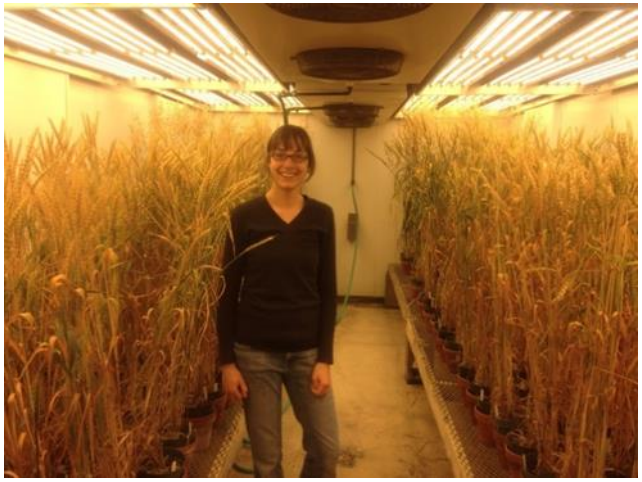
Participatory wheat and oat breeding

M. Entz, A. Kirk, M. Carkner, I. Vaisman, S. Fox and J. Mitchell Fetch



THE BAUTA FAMILY INITIATIVE ON CANADIAN SEED SECURITY
IN PARTNERSHIP WITH Seeds of Diversity
INITIATIVE DE LA FAMILLE BAUTA SUR LA SÉCURITÉ DES SEMENCES AU CANADA
SUPPORTED BY THE W. GARFIELD WESTON FOUNDATION

UNIVERSITY OF MANITOBA

Agriculture and Agri-Food Canada

Farmer plant breeders…

LOUIS BOLK INSTITUUT

WAGENINGEN UR
For quality of life

WASHINGTON STATE UNIVERSITY

Dr. Edith Lammerts van Bueren

Dr. Kevin Murphy

Dr. Steve Jones

www.slideshare.net
S. Ceccarelli 2010
Participatory plant breeding, biodiversity, genetic resources, gender and climate changes.

FEBRUARY, 1908 BULLETIN 251

CORNELL UNIVERSITY

AGRICULTURAL EXPERIMENT STATION OF THE COLLEGE OF AGRICULTURE

Plant Biology

PLANT-BREEDING

FOR FARMERS

By H. J. WEBBER.

ITHACA, N. Y.

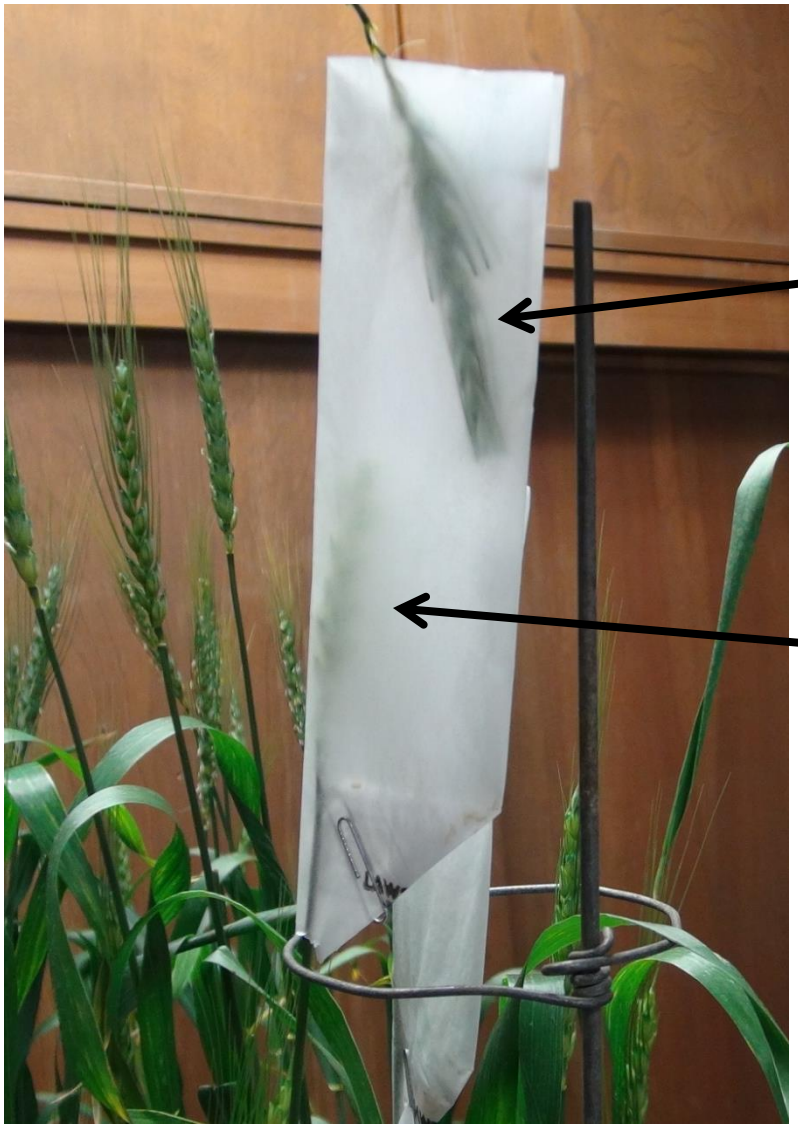
PUBLISHED BY THE UNIVERSITY.

Slide credit: S. Jones

Create genetic diversity and let farmer make selections

Make crosses - Anne Kirk

Farmer-breeder



Male (pollen donor)

Female (pollen recipient)

- Each farmer is provided with 3 F_2 populations
- Plot size: 10 – 20 m^2 (4,000 seeds provided/pop)

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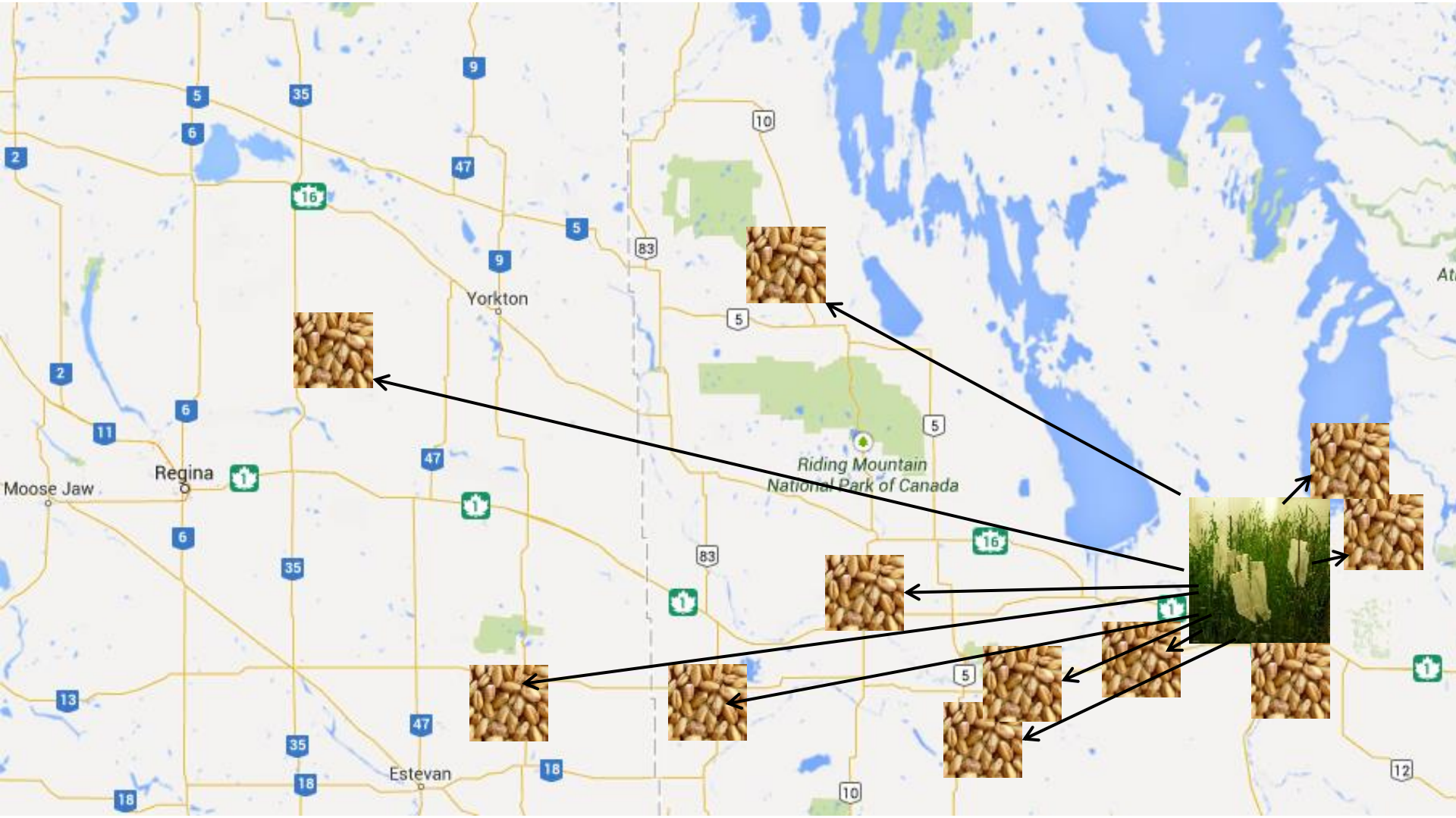
Pilot Project: 11 Farmers started in 2011
Common garden experiments in 2014, 2015



University of Manitoba

The Bauta Family Initiative on Canadian Seed Security

Example of farmer's 3 populations

3 years of on-farm selection

Replicated trial

How do farmer selections compare with check cultivars?

2014 Results

	Leaf disease (%)	DTM	Height (cm)	Lodging	Yield (kg ha^{-1})	TKW (g)	Kernel number (KNO m^{-2})
Means							
Farmer selected	6.7	100	100	3.2	4672	34.0	11687
Check cultivars	6.1	96	91	2.4	4372	35.4	10961
P value	0.6916	<.0001	<.0001	<.0001	0.0002	0.05	0.0002

2015 Results

	Leaf disease (%)	DTM	Height (cm)	Lodging	Yield (kg ha^{-1})	TKW (g)	Kernel number (KNO m^{-2})
Means							
Farmer selected	3.4		101	2.7	2756		
Check cultivars	3.1		90	2.0	2699		

Treatment	DTM			Height (cm)			Lodging[1]			Yield (kg ha^{-1})		
	C 14	C 15	B 15	C 14	C 15	B 15	C 14	C 15	B 15	C 14	C 15	B 15
BJ08A-N-IG				102	107	73	3.7	4.0	3.3	4658	3256	810
BJ22A-N-IG	99	92		103	100	70	1.5	2.5	3.3	4983	2650	570
BJ23A-N-IG	98	91		100	98	70	3.0	2.3	3.0	4928	2578	612
BJ26A-N-KS	94	88		101	101	75	3.5	2.8	4.0	4622	2699	636
BJ32A-N-KS	96	92		99	102	70	3.8	3.5	3.3	4027	2404	638
BJ18A-N-KS	100	92		103	105	68	4.5	2.3	2.7	5318	2696	557
BJ08A-N-CG				103	101	71	3.3	2.5	2.3	5095	2808	569
BJ10A-N-SC	100	89		92	95	71	2.8	1.5	2.3	4750	2622	534
BJ11A-N-SC	104	93		103	102	73	3.8	4.0	3.3	4740	2313	590
BJ25A-N-SC				91	96	75	4.5	1.3	2.3	4536	2725	580
BJ28A-N-MW	98	92		100	97	73	1.8	2.3	3.3	4834	3359	630
BJ27A-N-MW	95	89		96	100	75	3.3	3.3	4.0	5102	3018	511
BJ13A-N-HRE	99	91		104	106	78	4.0	3.8	3.7	4635	2946	802
BJ21-N-HRE	99	90		94	99	67	1.8	1.8	2.7	4856	2572	592
BJ25A-N-KB				100	103	69	2.8	2.3	2.3	4311	2862	451
BJ10A-N-KB	101	92		109	106	76	2.8	3.3	2.7	4716	2711	594
BJ05-N-GM	100	91		99	100	68	2.5	1.8	2.0	4184	2567	698
BJ43A-N-GM	102	89		96	96	70	2.5	2.5	2.3	4041	2559	478
PA00-KB-AL	101	92		108	107	75	4.5	3.8	3.7	4453	2899	651
Cadillac	96	89		102	99	74	4.5	3.3	4.0	4437	2323	697
Glenn	99	89		91	95	65	1.3	2.0	2.7	4834	2773	482
AAC Brandon	97	88		83	82	62	2.5	2.3	2.3	4272	2415	533
Carberry	97	88		81	81	67	1.8	1.8	2.3	3315	2491	590
Unity	98	87		98	100	68	3.5	2.8	2.7	5108	2659	496
Vesper	94	88		93	95	69	2.0	2.0	3.0	5050	3377	770
PT245	93	87		91	83	59	1.0	1.3	1.7	3591	1453	460
Cardale	-	87		-	89	66	-	1.8	2.3	-	2583	420
Pr > F	<.0001	<.0001		<.0001	<.0001	0.0003	<.0001	<.0001	<.0001	<.0001	<.0001	0.0465
LSD	4.23	2.77		3.60	4.03	7.62	1.01	0.93	0.99	505	487	230.41

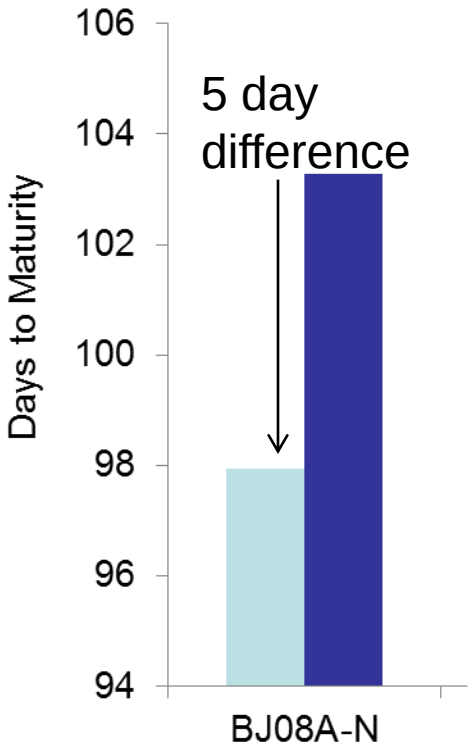
Days to Maturity

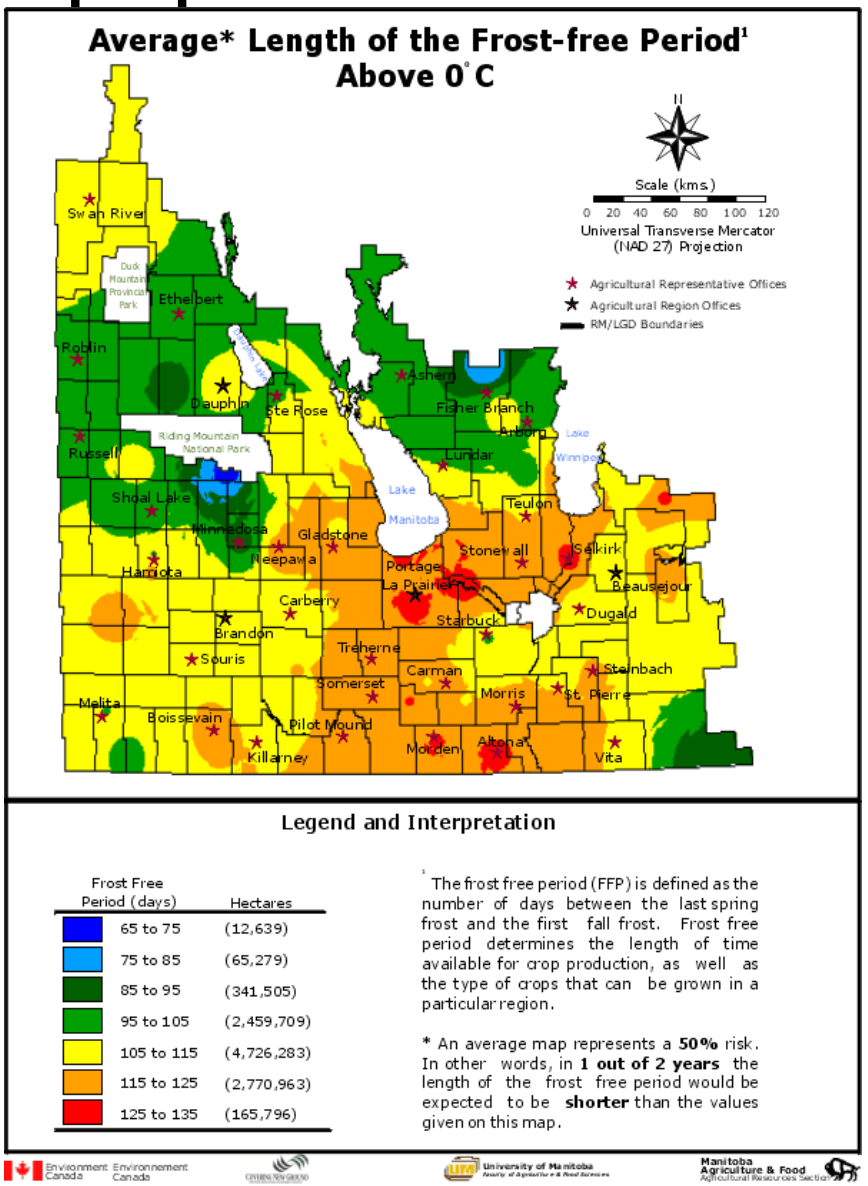
Also note awns!

Trt 18 – BJ25-KB
99 DTM

Trt 11 – BJ25-SC
103 DTM

Three years of on-farm selection have a large impact on populations





Height

Trt 11 – BJ25-sc 91 cm

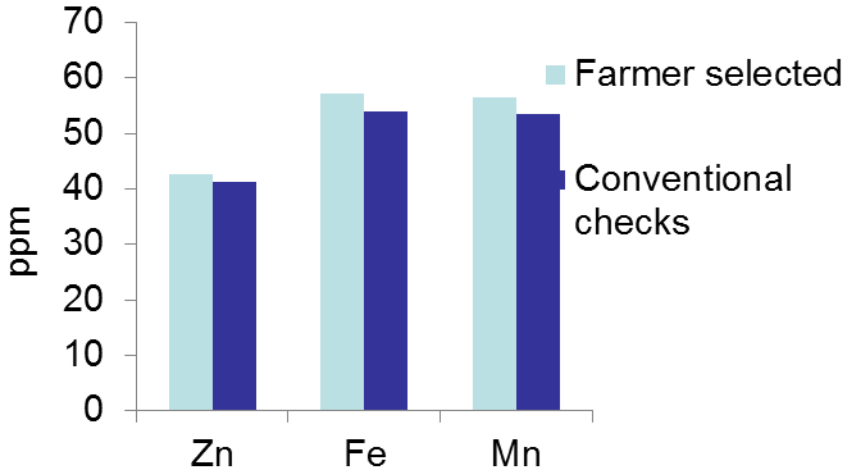
Trt 18 – BJ25-KB 100 cm

Grain Nutrient Analysis

	Total N	P	K	S	Ca	Mg
	---------- % ----------					
Farmer selected	2.99	0.38	0.29	0.17	0.033	0.19
Conventional checks	2.97	0.38	0.29	0.17	0.030	0.19
Contrasts	ns	ns	ns	-	**	ns

3. Wheat populations with the highest zinc and iron concentrations hit the target levels required to have a measurable biological impact on human health (Zhao et al. 2009)

	Zn	Fe	Mn	Cu	B
	---------- ppm ----------				
Farmer selected	42.7	57.2	56.6	3.8	0.29
Conventional checks	41.3	53.9	53.5	4.0	0.29
Contrasts	*	***	**	ns	ns



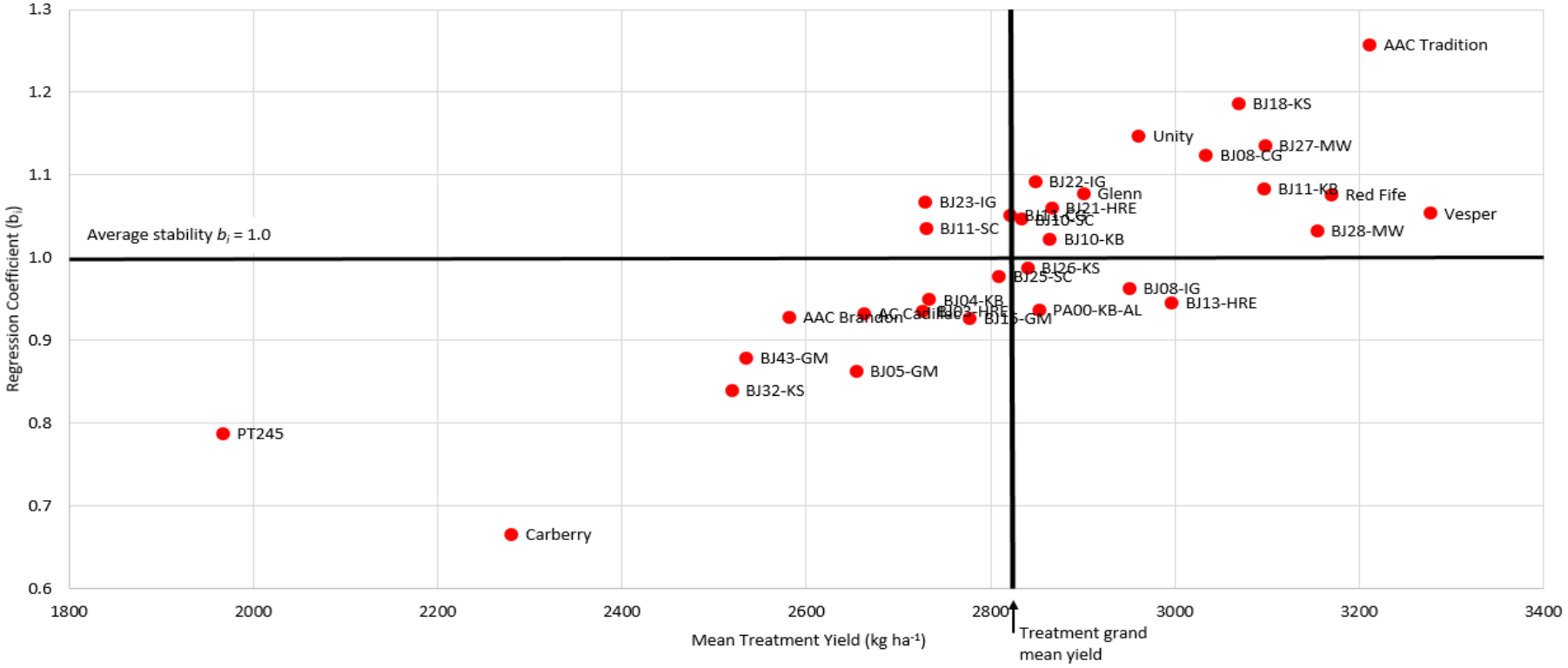
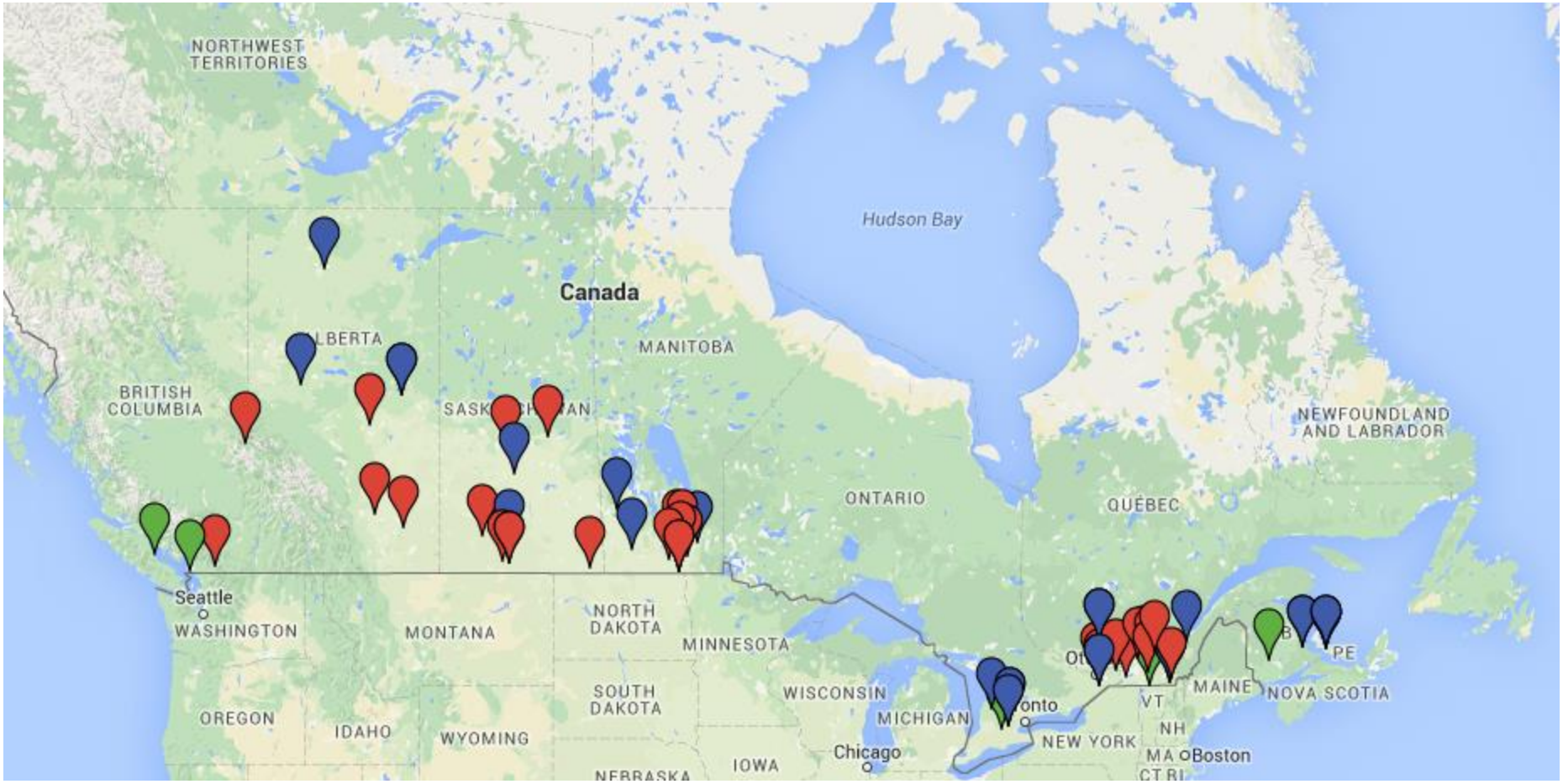


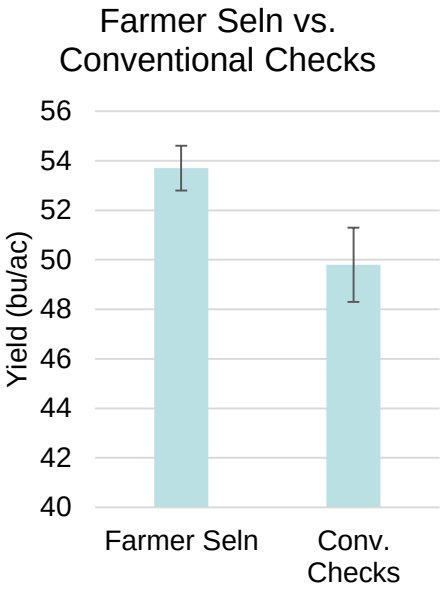
Figure 1. The yield stability for 23 farmer selected populations 9 check cultivars. Genotype regression coefficients (b_i) are plotted against the treatment's grand mean yield. The b value describes the linear response of a treatment across changing environments (3 site years). The vertical solid line is all treatments' grand mean yield. The horizontal solid line represents a regression coefficient of average stability (b_i = 1.0) (Finlay and Wilkinson, 1963).

..manuscript in review

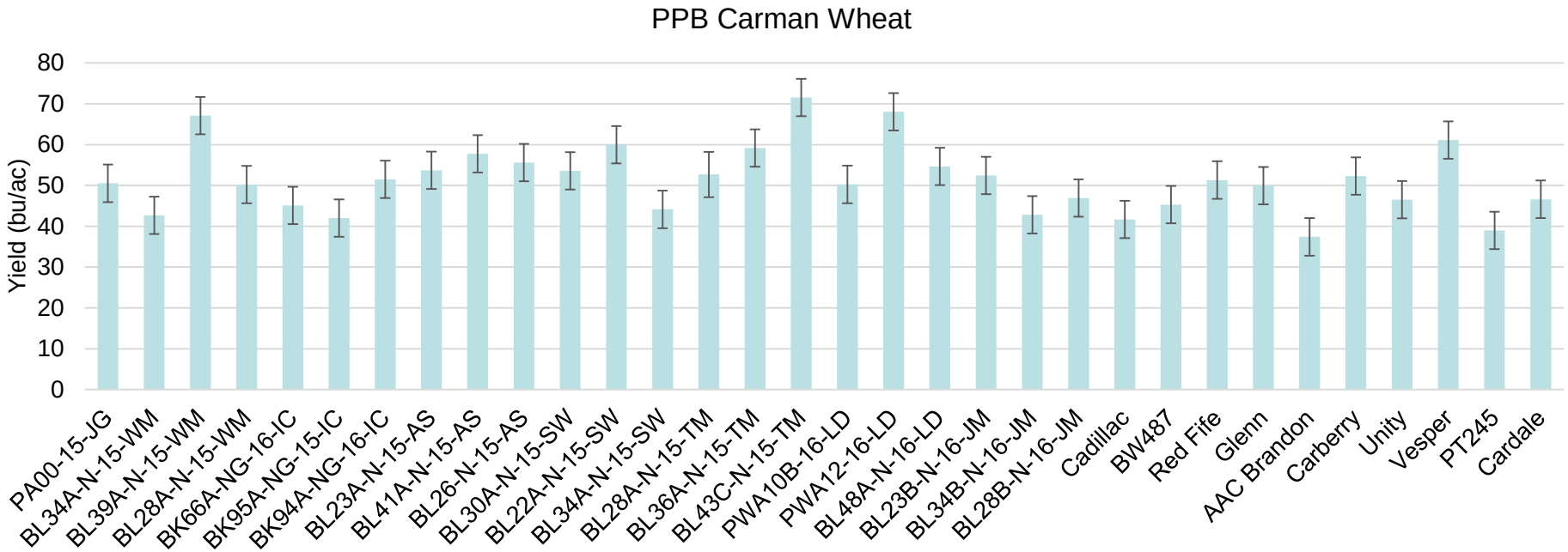
Phase II: 2013-2018
On-farm breeding locations



PPB Wheat Program: 2015-2016 Farmer Selection Trial Results



Carman 2017



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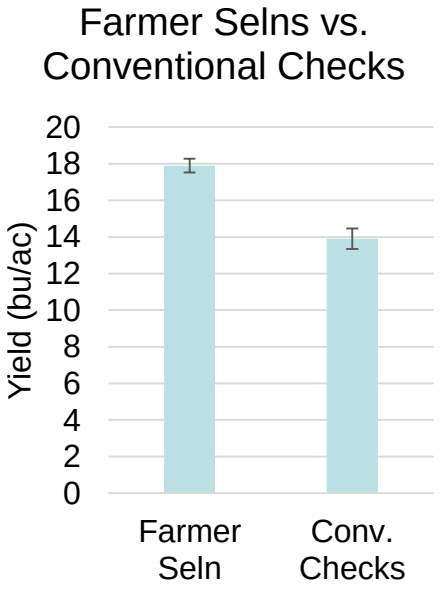
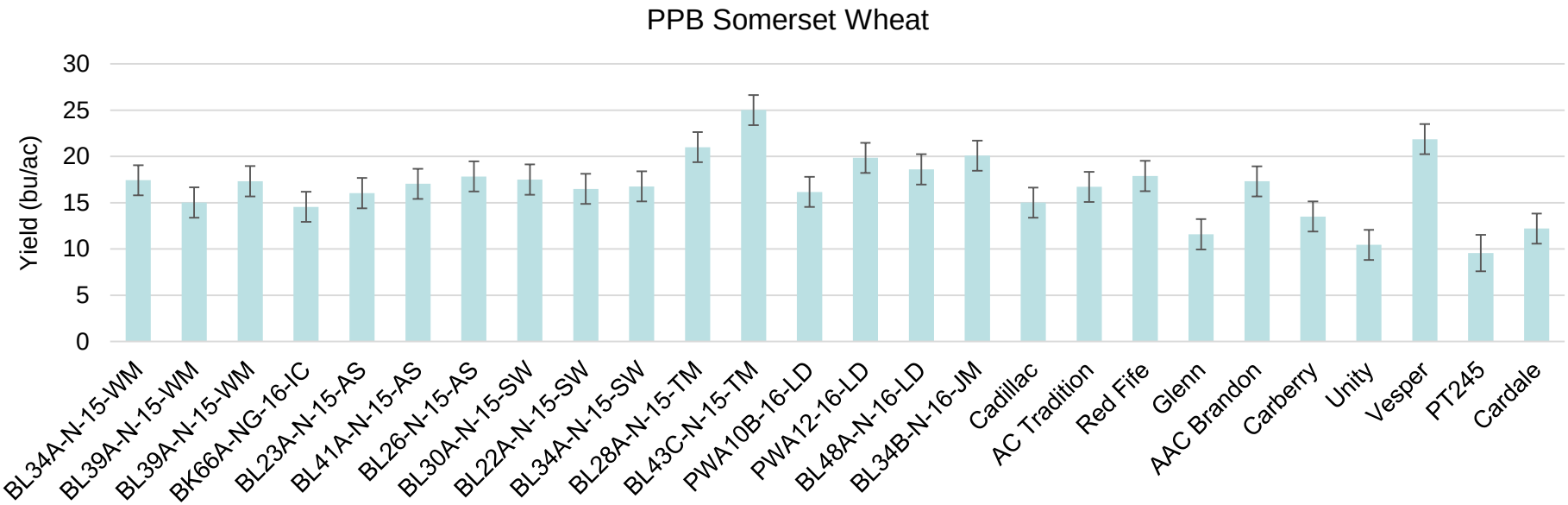
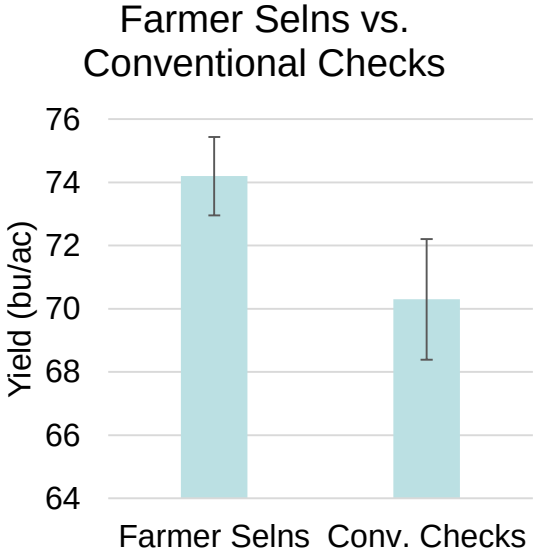


Somerset 2017

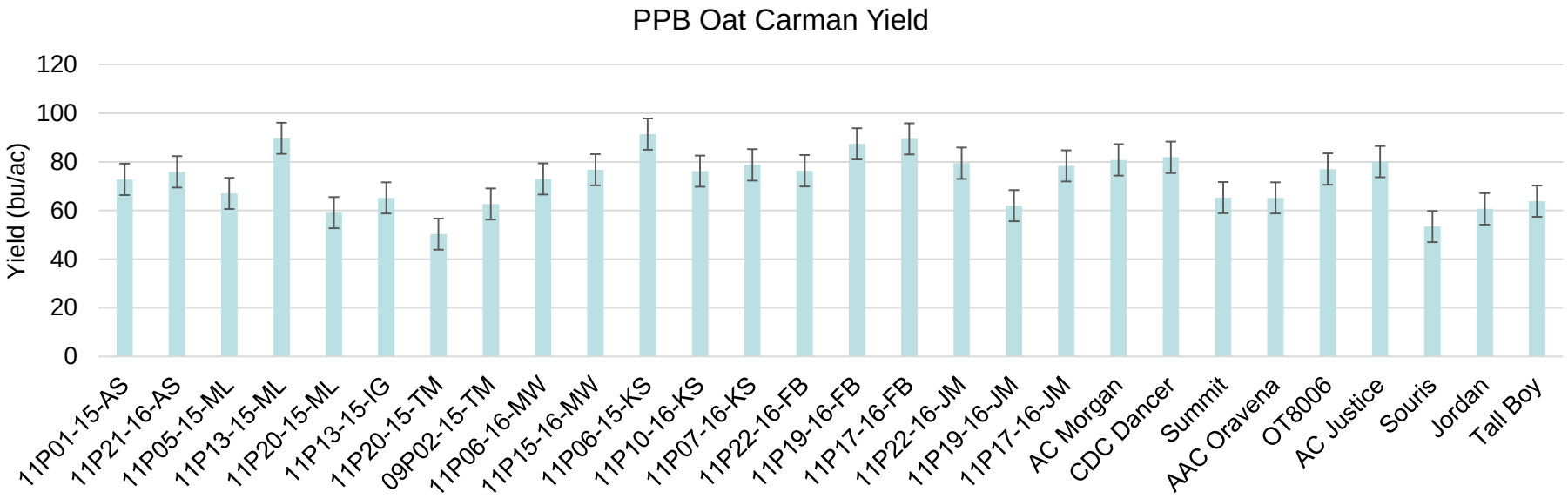
Drought and salinity stressed site



PPB Oat Program: 2015-2016 Farmer Selection Trial Results



Carman 2017



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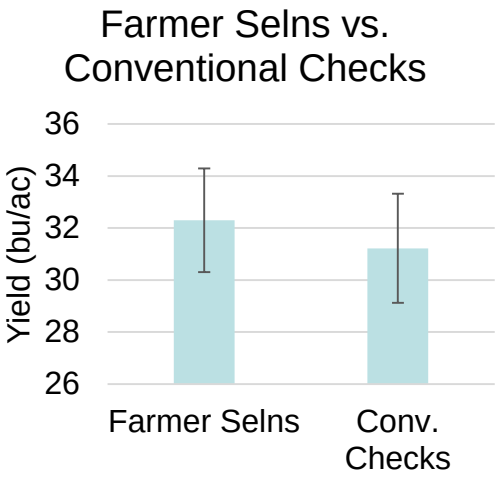

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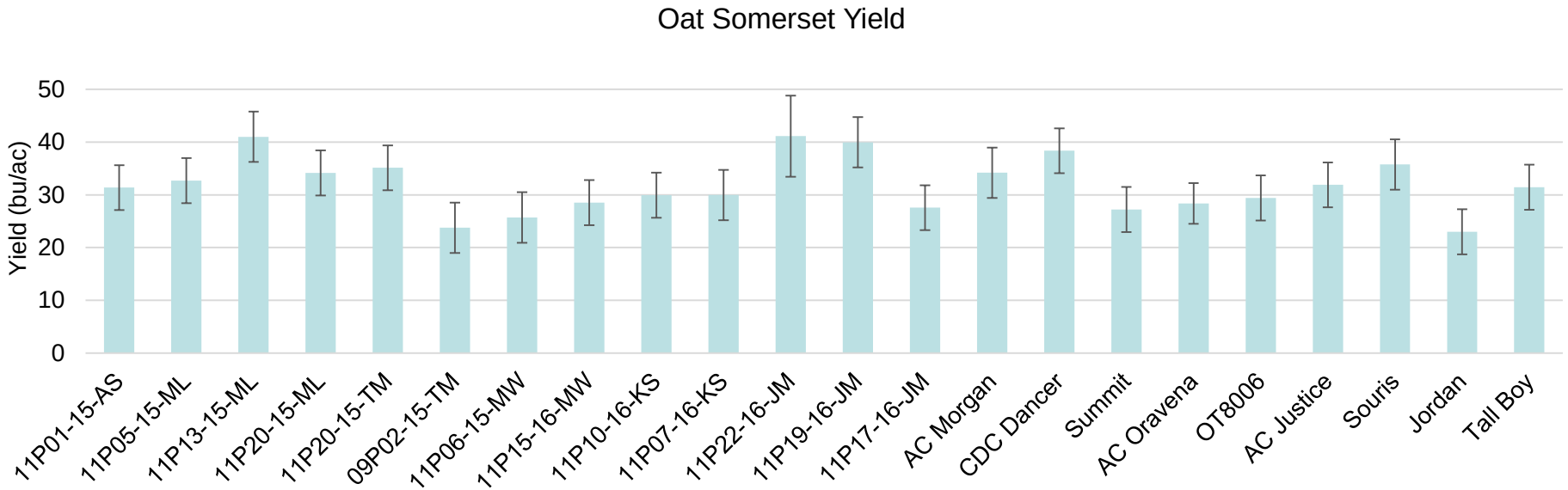

Thanks to all the participating farmers!