Agriculture and Agri-Food Canada
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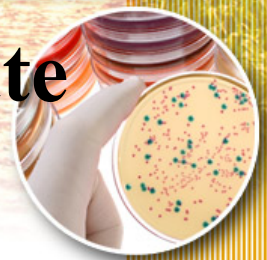
Condiment Mustard Breeding: Update



Bifang Cheng, Mustard Breeder
Agriculture and Agri-Food Canada, Saskatoon Research Centre

Canada

Outline of the Presentation

- Agronomic performance of brown mustard hybrid variety AAC Brown 18 (experiment number B3318)
- Seeding rate test: AAC Brown 18 vs Centennial Brown
- Nitrogen response test: AAC Brown 18 vs Centennial Brown
- Brown and oriental mustard yield trials
- Yellow mustard yield and adaption trials
- Short, medium and long-term objectives

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Yield of AAC Brown 18 in the yield trial in 2016 (5 tests)

	Centennial Brown (check) (kg/ha)	AAC Brown 18		LSD (5%)
		(kg/ha)	% of check	
Saskatoon	2126	2446*	115	242
Scott	2007	2745*	137	388
Swift Current	1333	1555*	117	217
Redvers	1958	2658*	137	407
Medicine Hat	1855	1834	99	293

Yield of AAC Brown 18 in the Mustard Adaption Test and yield trial in 2017 (12 tests)

	Centennial Brown (check) (kg/ha)	AAC Brown 18		LSD (5%)
		(kg/ha)	% of check	
Co-op, Saskatoon date 1	1715	2349*	137	337
Co-op, Saskatoon date 2	1358	1832*	135	110
Co-op, Scott	2464	2807*	114	252
Co-op, Swift Current	1606	1972	123	274
Co-op, Redvers	2053	2422*	118	322
Co-op, Brooks	1306	1837*	141	323
Co-op, Lethbridge	1242	1560*	126	269
Co-op, Medicine Hat	1297	1354	104	213
Co-op, Melita	2186	2398*	110	193
Yield trial, Saskatoon	1822	2408*	132	330
Yield trial, Redvers	2017	2776*	138	556
Yield trial, Swift Current	1083	1351*	125	195

Yield of AAC Brown 18 in the Mustard Adaption Test in 2018 (5 tests)

	Centennial Brown (check) (kg/ha)	AAC Brown 18		LSD (5%)
		(kg/ha)	% of check	
Saskatoon date 1	1713	2371*	138	359
Saskatoon date 2	1343	1730	129	323
Scott	2173	2196	101	388
Swift Current	2234	2698*	121	217
Coaldale	2863	2754	96	407

Agronomic performance of brown mustard hybrid variety AAC Brown 18

	Yield		Plant height	Allyl glucosinolate	Resistance to white rust	Fixed oil	Protein	Seed weight	Maturity
	Kg/Ha	%Check	cm	mg/g seed	2a	% seed	% seed	g/1000 seeds	Days
Centennial Brown	**1827**	**100**	**129**	**11.0**	**S**	**35.4**	**29.8**	**3.03**	**87**
AAC Brown 18	**2219***	**121**	**133**	**10.8**	**R**	**37.3**	**28.5**	**2.93**	**88**
Station years	22		22	17		22	22	17	22
F-Value	99.3**		6.62*	3.97 ns		235**	119**	22.4**	3.78ns
LSD (5%)	78.3		2.58			0.25	0.25	0.05	
LSD (1%)	104.4		3.43			0.34	0.33	0.06	

* Significant a

Data from the yield trials (2016 and 2017) and Mustard Adaption Test (2017-2018) (22 station years)

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Seeding rate test: AAC Brown 18 vs Centennial Brown

Seeding rate (Ib/ac)		
TKW: 3g	TKW: 4g	Plants/m^2
1.9 (Ib/ac)	2.8 (Ib/ac)	70
2.8 (Ib/ac)	4.2 (Ib/ac)	105
3.8 (Ib/ac)	5.6 (Ib/ac)	140
4.7 (Ib/ac)	7.0 (Ib/ac)	175
5.6 (Ib/ac)	8.4 (Ib/ac)	210

Seeding rate test: AAC Brown 18 vs Centennial Brown (Saskatoon)

Expected (Plants/m^2)	Centennial Brown	AAC Brown 18
	Yield (kg/ha)	Yield (kg/ha)
70	2179^{bcd}	2718^{a}
105	1977^{def}	2357^{b}
140	1854^{ef}	2286^{b}
175	1812^{f}	2218^{bc}
210	1792^{f}	2040^{cde}

Seeding rate test: AAC Brown 18 vs Centennial Brown (Redvers)

Expected (Plants/m^2)	Centennial Brown	AAC Brown 18
	Yield (kg/ha)	Yield (kg/ha)
70	1683^{e}	1933^{bcd}
105	1768^{de}	1992^{abc}
140	1831^{cde}	2139^{a}
175	1815^{cde}	2086^{ab}
210	1794^{de}	2038^{ab}

Seeding rate test: AAC Brown 18 vs Centennial Brown (Swift Current)

Expected (Plants/m^2)	Centennial Brown	AAC Brown 18
	Yield (kg/ha)	Yield (kg/ha)
70	1866^{d}	2025^{bcd}
105	1914^{cd}	2069^{a-d}
140	2048^{bcd}	2313^{ab}
175	1955^{cd}	2167^{abc}
210	2001^{cd}	2361^{a}

Seeding rate test: AAC Brown 18 vs Centennial Brown (Scott)

Expected (Plants/m^2)	Centennial Brown	AAC Brown 18
	Yield (kg/ha)	Yield (kg/ha)
70	2105[a]	2146[a]
105	2254[a]	2236[a]
140	2364[a]	2271[a]
175	2162[a]	2193[a]
210	2330[a]	2468[a]

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Nitrogen response test: AAC Brown 18 vs Centennial Brown (Saskatoon)

Nitrate	Centennial Brown (kg/ha)	AAC Brown 18 (kg/ha)
0 kg/ha	1801^{h}	2166^{e-h}
25kg/ha	1934^{fgh}	2327^{cde}
50 kg/ha	1914^{gh}	2403^{a-e}
100kg/ha	1850^{h}	2390^{a-e}
200 kg/ha	1799^{h}	2334^{b-e}

CV: 11.5%
LSD (p=0.5) = 377
* Significant at *P*=0.05

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Brown mustard replicated yield trial

- Entries: 15 (14 test hybrids and the check Centennial Brown)
- 4 Replicates
- Randomized complete block design
- Locations:
    1. Saskatoon (AAFC): CV: 7.5%
    2. Scott (AAFC): CV: 10.5%
    3. Swift Current (AAFC): CV: 6.0%
    4. Redvers: CV: 12.8%

Yield of the brown mustard hybrids B3700 and B3701

	Centennial Brown (check) (kg/ha)	B3700 (kg/ha)	B3701 (kg/ha)
AAFC-Saskatoon	1618	2140*	2278*
AAFC-Scott	1869	2222*	2155
AAFC-Swift Current	2239	2518*	2535*
Redvers	1384	1762*	1795*

Agronomic performance of the hybrids B3700 and B3701 in the yield trials

	Yield		Oil	Protein	Color	Height	Lodging	Maturity
	Kg/Ha	% check	%	%	WI	cm	1-5	Days to
Centennial Brown (Check)	**1771**	**100.0**	**36.4**	**30.6**	**-3.46**	**113**	**2.5**	**88**
B3700	**2155****	**121.7**	**37.9****	**29.7***	**-3.53**	**113**	**2.6**	**86***
B3701	**2193****	**123.8**	**38.7****	**29.3****	**-4.53****	**115**	**2.7**	**86***
F-Value	10.99**		51.5**	46.3**	21.3**	5.46**	2.43**	3.54**
LSD (5%)	145		0.82	0.77	0.48	5.35	0.43	0.99
LSD (1%)	191		1.08	1.02	0.63	7.05	0.57	1.30

Oriental mustard replicated yield trial

- Entries: 11entries (10 test hybrids and Cutlass (check)
- 4 Replicates
- Randomized complete block design
- Locations:
    1. AAFC-Saskatoon (AAFC): CV: 6.7%

Agronomic performance of the oriental mustard test hybrids in 2019 Co-op Mustard Test

	Yield		Oil	Protein	Color	Height	Lodging	Maturity
	Kg/Ha	%Cutlass	%	%	WI	cm	1-5	Days to
Cutlass	**2028**	**100**	**37.9**	**33.5**	**-47.6**	**100**	**2.0**	**83**
O3620	**2421***	**119**	**37.7**	**33.8**	**-44.8***	**115**	**2.3**	**86***
O3635	**2899***	**143**	**40.2***	**31.3***	**-39.0***	**112**	**1.0***	**86***
O3766	**2208**	**109**	**35.2***	**36.2***	**-35.9***	**110**	**2.5**	**85***
O3767	**2421***	**119**	**35.9***	**35.3***	**-36.3***	**109**	**1.3***	**85***
O3768	**2611***	**129**	**37.1***	**34.1***	**-30.4***	**97**	**1.3***	**84***
F-Value	19.2**		67.0**	45.0**	33.2**	2.17^{ns}	8.82**	8.33**
LSD (5%)	185		0.63	0.58	2.50		0.58	1.06
LSD (1%)								

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Yellow Mustard Adaption Test

Locations	CV (%)
AAFC-Saskatoon date 1	5.3
AAFC-Saskatoon date 2	8.2
AAFC-Scott date 1	11.3
AAFC-Scott date 2	8.5
AAFC-Swift Current date 1	5.1
AAFC-Swift Current date 2	5.4
Redvers	9.0
Brooks	12.9

Yellow Mustard Adaption Test

1	Andante (check)
2	Y1992
3	Y3423
4	Y3464
5	Y3496
6	Y3546

Agronomic performance of the yellow mustard lines in the Mustard Adaption Test

	Seed Yield		Fixed Oil	Protein	Seed Colour[1]	Mucilage	Height	Maturity
	kg/ha	% Andante	% whole seed		WI E313	cS*mlg^{-1}	cm	days
Andante	**1752**	**100.0**	**28.5**	**35.3**	**-38.4**	**80**	**95**	**86**
Y1992	**1827†**	**104**	**29.8‡**	**34.2‡**	**-40.3**	**103‡**	**95**	**87‡**
Y3423	**1800**	**103**	**29.5‡**	**34.1‡**	**-41.2**	**98‡**	**100†**	**87‡**
Y3464	**1870‡**	**107**	**29.7‡**	**34.0‡**	**-41.0**	**93‡**	**95**	**87‡**
Y3496	**1760**	**101**	**29.0‡**	**34.9**	**-42.5**	**100‡**	**100‡**	**87‡**
Y3546	**1771**	**101**	**29.3‡**	**35.0**	**-43.5**	**92‡**	**96**	**86†**
S.E.	37.6		0.16	0.21	0.55	3.5	1.99	0.25
F-Value	3.25		14.1	14.3	13.9	21.7	2.35	8.44
L.S.D. (5%)	74.1		0.32	0.41	1.08	6.8	3.93	0.49
# station yrs	8		8	8	8	6	8	6

Agronomic performance of the yellow mustard line Y3464 in the Mustard Adaption Test in 2017-2018

	Seed Yield		Seed Weight	Fixed Oil	Protein	GSL HoBe	Seed Colour[1]	Distinct Green	Chloro-phyll	Mucilage	Height	Maturity
	kg/ha	% Andante	g/1000 seed	% whole seed		µmole/g seed	WI E313	%	mg/kg seed	cS*mlg^{-1}	cm	days
Andante	**1716**	**100**	**5.73**	**29.0**	**34.3**	**149**	**-37.2**	**0.08**	**0.57**	**77.2**	**104**	**88**
Y3464	**1814‡**	**106**	**5.35‡**	**30.0‡**	**33.1‡**	**144**	**-39.0‡**	**0.17‡**	**0.77†**	**86.8‡**	**107**	**89‡**
S.E.	27.9		0.07	0.16	0.20	3.82	0.36	0.03	0.08	2.34	2.11	0.25
F-Value	12.4		30.0	45.6	33.5	1.44^{ns}	24.4	7.98	5.72**	17.0	2.86^{ns}	25.4
L.S.D. (5%)	55.8		0.14	0.31	0.40	7.87	0.72	0.06	0.17	4.71	4.22	0.50
# station yrs	15		7	15	15	7	15	7	7	13	15	11

Blackleg disease resistance of Y1992 and Y3464 will be evaluated in 2019 disease nursery

Yellow mustard replicated yield trial

- Entries: 30 entries (29 synthetics and Andante (check)
- 4 Replicates
- Randomized complete block design
- Locations:
    1. AAFC-Saskatoon (AAFC): CV: 5.1%
    2. AAFC-Scott: CV: 8.3%
    3. AAFC –Swift Current: 8.7%
    4. Redvers: CV: 12.8%
    5. Coaldale: CV: 10.4%

Yield of the yellow mustard synthetics (5 tests)

	AAFC-Saskatoon	AAFC-Scott	AAFC-Swift Current	Redvers	Coaldale
Andante (kg/ha)	2029	1498	2289	1648	2423
WY3421	2259*	1539	2219	1760	2640
WY3786	2229*	1639	2213	1829	2595
WY3787	2234*	1598	2171	1854	2603
WY3788	2141	1720	2166	1708	2755
WY3795	2230*	1471	2552*	1658	2397
LSD (p=0.05)	157	208	273	301	353

2019 Mustard Adaption Test

- **Brown and oriental mustard:**
  - **Centennial Brown (check), AAC Brown 18 and 6 test hybrids**
  - **Cutlass (check) and 5 test hybrids**

- **Yellow mustard:**
  - **11 entries (Andante and 10 synthetics)**

2019 yield trials

- **Brown mustard (2 trials): Each with 21 entries (Centennial Brown, AAC Brown 18 and 19 test hybrids)**
- **Oriental mustard (3 trials): Each with 20 entries (Cutlass and 19 test hybrids)**
- **Yellow mustard trials (2 trials): Each with 24 entries (Andante and 23 synthetics)**

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Short-term objectives (within 5 years)

- **Develop oriental mustard variety with over 15% higher yield than Cutlass**
- **Develop yellow mustard synthetic variety with over 10% higher yield than Andante**
- **Create herbicide (Solo or Dicamba) tolerant brown, oriental and yellow mustard germplasm through seed mutagenesis (non-GMO approach)**

Medium-term objectives (5-10 years)

- Herbicide tolerant oriental mustard hybrid variety
- Herbicide tolerant brown mustard hybrid variety
- Herbicide tolerant yellow mustard synthetic variety
- Create hybrid system for yellow mustard

Long-term objectives (10-15 years)

- **Yellow mustard hybrid variety**
- **Herbicide tolerant brown and oriental mustard varieties with further enhanced yield**

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