Great Plains Region - National Canola Research Program

TITLE: Development and Management of Canola in the Great Plains
START: 09/01/09 **TERM:** 08/31/10 **FY:** 09 **GRANT YEAR:** 2009
GRANT AMOUNT: $210,000

GREAT PLAINS REGIONAL DIRECTOR: Dr. Gary Pierzynski, Kansas State University
PROJECT DIRECTOR: Dr. J. Ernest Minton, Kansas State University
CO-PROJECT DIRECTOR: Mr. Michael J. Stamm, Kansas State and Oklahoma State Univ.

Objectives:
The long-term goal of this multi-state, multidisciplinary project is to facilitate the adoption of winter canola as a viable rotational crop for the Great Plains and the southern High Plains. Researchers have adopted the high-priority area winter canola production systems, including, but not limited to genetic improvement, and the following supporting objectives to aid in facilitating the program.

1. Continue the evaluation and development of high-yielding, locally adapted canola cultivars for the region. Priority objectives of the breeding project include: stand establishment and winter survival, tolerance to sulfonylurea herbicide carry-over and post-application of glyphosate herbicide, yield potential, quality of the grain and extracted oil, disease and pest resistance, shatter resistance, and forage quality.
2. Improve canola production systems in the region by addressing agronomic management issues including: planting date and systems, cropping systems, tillage systems, harvest management, irrigation, insect control, and forage production.
3. Extend production and marketing technology for canola through appropriate, coordinated technology transfer programs. Through technology transfer activities demonstrate to growers that winter canola is a viable rotational oilseed and/or grazing crop for the Great Plains and the southern High Plains.

Approach:

The winter canola breeding and production management program, established at K-State in 1991, has been supported by funding from the National Canola Research Program (NCRP) for almost two decades. The NCRP provides a structure to encourage multidisciplinary research networks that enhance limited state and industry resources, and it is funded through the Supplemental and Alternative Crops Competitive Grants Program (SACC). The Great Plains Canola Research Program (GPCRP), administered by K-State, fits the defined role of the NCRP as it links together researchers from the states of CO, KS, MO, NE, NM, OK, and TX who are interested in increasing winter canola production and acreage in the region.

Beginning in year 2009, the Great Plains Canola Research Program was strengthened by the inclusion of a research group centered in the southern High Plains (SHP). The SHP group received funding from the SACC grant program from 2007-2009. The needs of producers in this area are similar to those across the broader Great Plains region. SHP researchers provide expertise in the areas of deficit irrigation, extension education, and forage biomass for grazing. The area averages over 5 million wheat acres annually and 30% is irrigated. Producers are interested in the conventional and glyphosate weed control options provided by winter canola.

Throughout its long history, the needs of the Great Plains region have been canola variety development and production research. Researchers are developing new crop production systems, and adapted winter canola cultivars are necessary to sustain these systems. Therefore, the program has developed a coordinated testing network. Each group is required to perform some variety testing. The distribution of funds to researchers across the region is outlined in **Table 1.**

Stakeholder input is gained through the External Research and Advisory committee (**Table 2**). This committee meets annually to discuss the program's research progress, suggest new areas of research concentration, and identify hot-button topics important to canola growers. The committee includes producers, industry personnel, and canola researchers and extension experts throughout the region. Each member is given the opportunity to share his or her views of the direction of the canola breeding and management program. Another important opportunity to garner stakeholder input is the annual canola production conference held in Enid, OK. This conference brings together all entities involved with canola production including farmers, researchers, extension specialists, industry personnel, marketing analysts, USDA representatives, agricultural media, and many others. Between 200 and 400 people attend the annual conference.

A multifaceted technology transfer program using extension and research expertise, in cooperation with industry personnel and growers, is being implemented. A list of meeting dates and numbers attending is provided in **Table 3.** The annual NWCVT report of progress (see list of references) is an important publication for this effort as it provides information to growers on the performance of the latest public and private canola varieties and hybrids. Researchers participate in a number of field days and extension meetings, write agronomy production updates, and give radio and television interviews.

Progress Report:

The following report of progress addresses research studies established across the southern Great Plains and High Plains. Several new studies were initiated in fall 2009 on the High Plains and these have not reached fruition. Preliminary results are limited but observations are included where available. The results presented are from variety trials and production studies established in fall 2008 and completed in summer 2009.

In the southern High Plains (CO, NM, TX), field trials are focused on establishment, winter survival, and productivity. Detailed microclimate observations at the NM sites will be used to model evapotranspiration (ET) and water savings. Irrigation protocols will be implemented to gauge water use efficiency and optimum irrigation of winter canola. At Walsh, CO, the correlation between soil moisture and winter survival of winter canola is being studied. At Rocky Ford, CO researchers are looking at full versus limited irrigation and the effect of planting date and seed treatment on yield potential. At TX High Plains sights, an ideal target planting date will be identified with plantings 14 and 28 days later using two cultivars. High Plains sites also initiated a comparison of direct cutting, with and without diquat or sodium chlorate, versus swathing for the ability to reduce shattering and yield losses. High Plains sites are mimicking grazing to measure forage yield and grain yield using multiple clipping dates. Entomology studies determine the effect and duration of the seed insecticide treatment effects, geographical variation of insect pests, and susceptibility of canola growth stages to insect feeding. Approaches for developing insect thresholds and possible strategies for treatment will be developed for future testing beyond this proposed project work.

According to TAMU-Lubbock, established canola looks adequate but is not actively

growing. This is somewhat uncommon for mid-February. The southern High Plains had the sixth coldest December on record in 2009 and January 2010 was closer to average. Because of delays with fall harvest, trials near Plainview were planted about September 26, which is late and likely has delayed growth. October 3 plantings the two previous years have suffered mildly in one year and severely in the other. Winter injury could be a major factor. Canola forage plots did not have enough growth in early January to harvest.

The Great Plains Canola Germplasm Evaluation System, established in 1994, consists of a three-tiered performance trial system that tests experimental and released cultivars and hybrids developed by the program and from other public and private entities. The first trial is the Early Generation Screening Nursery (EGSN) and three locations were harvested in 2009 (**Table 4)**. To improve data quality, a plot swather was used at nearly all locations managed by the program. This machine improved data quality considerably and will be employed in the future.

The second yield trial is the Great Plains Canola Variety Trial (GPCVT). The GPCVT is planted at 12 locations across the states of CO, IL, KS, MO, NE, OK, and TX. It contains 36 entries each year, including commercial varieties used as checks. The GPCVT provides the first opportunity to gauge adaptability of experimental lines across the broader Great Plains region. **Table 5** shows yield results from the trials that were harvested.

The third trial is the National Winter Canola Variety Trial (NWCVT). Since 1994, the NWCVT has been coordinated by the canola breeding and management program at K-State. The NWCVT includes released cultivars that have not been extensively tested across the United States, advanced experimental lines in the final stages of yield testing, and standard commercial varieties as checks. Results from the trials aid canola growers with variety selection and have assisted various breeding programs in making decisions on the release of experimental lines. This trial has grown from 12 locations in 6 states in 1994-95 to 60 locations in 27 states in 2008-09. Thirty-three of the locations were successfully harvested. This trial included 54 entries from 11 breeding programs from around the world. Results for yield and oil are reported in **Tables 6** and **7**, respectively, for locations in the southern Great Plains. Overall, yields were excellent at locations where moisture was plentiful and there were no adverse effects from the weather (KSCL, OKE, OKL – dryland; COF, COY – irrigated).

KS4158 is the next targeted variety for release. It is a conventional variety having 1% higher oil content over current varieties grown in the Great Plains. In 2009, it ranked in the top 5 for yield at 3 locations in KS and OK. It has out yielded 'Wichita' by 200 lbs/a across KS and OK locations for two consecutive years.

Grazing winter canola in the late fall and early winter will aid in its adoption in southern Kansas and the High Plains. The effect of simulated grazing on winter survival and grain yield of canola is being examined. **Table 8** shows results from the 2008-2009 forage clipping study at Manhattan, KS and **Table 9** shows results from the 2007-2008 study at Hutchinson, KS. Simulated grazing had a significant effect on winter survival and yield. Experimental variety KS4022 has been identified as a potential dual-purpose forage and grain canola cultivar.

Swathing as a harvest aid versus direct harvesting was compared in a study planted at Hutchinson and Manhattan, KS and Stillwater, OK. Each cultivar was swathed and direct cut at the optimum timing to evaluate the effect of harvest method on final moisture, test weight, grain yield, and oil content. **Tables 10** and **11** show results from Kansas. A significant difference for grain yield was recorded for harvest method at Hutchinson.

Determining the optimum planting date of canola is crucial for successful stand

establishment and yield. **Figures 1** and **2** show canola can be established at multiple planting dates in the fall in southwest Kansas**.** However, planting winter canola with tillage around September 1 provides the best chance of winter survival and obtaining a successful spring stand.

Impact:

Adding winter canola in rotation with wheat improves the overall sustainability of wheat cropping systems common to the Great Plains. A high-value domestic market exists for healthy cooking oil and high-protein meal. As a result, the potential exists for winter canola to become a major crop in the region. The number of planted acres of winter canola has increased substantially since 2003. Around 55,000 acres were seeded in 2008-2009. Approximately 100,000 acres are planted for the 2009-2010 crop year. Federal crop insurance is available and seed crushing and processing industries have emerged. More adapted cultivars are needed to expand production even further to meet demand. More production research is needed as current data from management studies provides insufficient information for those interested in planting canola. Winter canola is a feasible option today, both agronomically and economically.

Publications:

Holman, J., M. Stamm, S. Maxwell, G. Miller, C. Godsey, K. Roozeboom, and V. Martin. 2009. Effect of row spacing, tillage, opener, and coulter on winter canola. Rep. Prog. 1014:112-119. Kans. Ag. Exp. St. and Coop. Ext. Serv., Manhattan, KS.

Holman, J., M. Stamm, S. Maxwell, G. Miller, C. Godsey, K. Roozeboom, and V. Martin. 2009. Effect of planting date on winter canola. Rep. Prog. 1014:120-126. Kans. Ag. Exp. St. and Coop. Ext. Serv., Manhattan, KS.

Stamm, M. 2009. Kansas performance tests with winter wheat varieties – excerpts from the national winter canola variety trial. Rep. Prog. 1018:14-21. Kans. Ag. Exp. St. and Coop. Ext. Serv., Manhattan, KS.

Stamm, M., C. La Barge, A. Berrada, H. Bhardwaj, B. Caldbeck, S. Casteel, E. Cebert, G. Cramer, D. Day, N. Dunford, J. Enjalbert, J. Gassett, M. Gilmer, J. Hagan, W. Heer, S. Hulbert, J. Johnson, J. Kelly, J. Krall, R. Kratochvil, J. Lamle, E. Lentz, C. Mansfield, V. Martin, J. Nachtman, S. O'Daniel, M. O'Neil, C. Owen, C. Pearson, C. Rife, R. Sidwell, D. Spradlin, D. Starner, K. Tungate, and G. Ware. 2010. 2009 National Winter Canola Variety Trial. Rep. Prog. 1026. Kans. Ag. Exp. St. and Coop. Ext. Ser., Manhattan, KS. 58 pp.

Stamm, M., C. La Barge, R. Bacon, A. Berrada, H. Bhardwaj, B. Caldbeck, E. Cebert, E. Christmas, M. Claassen, D. Day, J. Enjalbert, J. Gassett, N. George, C. Godsey, J. Hagan, J. Holman, S. Hulbert, F. Iutzi, B. Johnson, J. Johnson, J. Kelly, R. Kochenower, J. Lamle, K. Larson, E. Lentz, C. Mansfield, J. Massey, J. Moore, J. Nachtman, M. O'Neill, E. Nielsen, C. Owen, A. Pavlista, C. Pearson, W. Phippen, C. Rife, C. Sams, C. Schmidt, M. Schmidt, J. Sij, L. Strang, R. Thacker, K. Tungate, J. Valliant, G. Ware, and D. West. 2009. 2008 National Winter Canola Variety Trial. Rep. Prog. 1009. Kans. Ag. Exp. St. and Coop. Ext. Ser., Manhattan, KS. 82 pp.

Boyles, M., T. Peeper, M. Stamm, J. Criswell, F. Epplin, K. Giles, C. Godsey, W. Heer, G. Hergert, J. Holman, D. Jardine, C. Jones, V. Martin, D. Peterson, K. Roozeboom, T. Royer, H. Sanders, P. Sloderbeck, and C. Thompson. 2009. Great Plains Canola Production Handbook. Kans. Ag. Exp. St. and Coop. Ext. Ser., Manhattan, KS. MF-2734.

Table 1. Distributions of the Great Plains Canola Research Program Funds								
Total Funds: $210,000	**State[1]**							
	Colorado	Kansas	Missouri	Nebraska	New Mexico	Oklahoma	Texas	
Projects	CSU[2]	K-State	UM	UNL	NMSU[2]	OSU	TAMU - Vernon	TAMU – Lubbock[2]
Canola Variety Development		X		X		X		X
National Winter Canola Variety Trial	X[3]	X	X		X	X	X	X
Great Plains Canola Variety Trial	X	X	X	X		X	X	X
Early Generation Screening Nursery		X		X		X		
Canola Establishment	X	X			X	X		X
Irrigation	X	X		X	X		X	X
Cultivar Development in No-till		X				X		
Planting Date		X			X			X
Canola Harvest Management		X				X		X
Canola Forage Clipping Study		X						X
Insect Assessment					X			X
State Totals	$30,500	$90,000	$5,000	$7,500	$30,500	$11,000	$5,000	$30,500

1. State Project Participants: CSU – Jerry J. Johnson, Mike Bartolo, Perry Cabot, Kevin Larson, Abdel Berrada, Calvin Pearson, James Valliant; KSU – Michael Stamm, John Holman, Victor Martin, Kraig Roozeboom; UM – Bill Wiebold; UNL – Dipak Santra; NMSU – Sangu Angadi; OSU – Rick Kochenower, Chad Godsey; TAMU (Vernon) – John Sij; TAMU (Lubbock) – Calvin Trostle, Christian Nansen, Dick Auld

2. Researchers at these southern High Plains locations were added to the broader Great Plains Canola Research Program in 2009. The program's $90,000 raised the total award to $210,000 for FY09.

3. X – Indicates participation in project. The Great Plains region has allowed the individual institution to determine how to divide their funding between projects and therefore amounts for individual projects within a state are not listed. However, planting of the National Winter Canola Variety Trial or the breeding program's intermediate trials is mandatory.

Table 2. Winter Canola Production Research and Extension Activities			
Event	***Location***	***Date***	***Attendees***
Custar County Canola Tour	Weatherford, OK	4/15/2009	25
Woods County Canola Tour	Dacoma, OK	4/16/2009	40
Sedgwick County Wheat and Canola Tour	Clearwater, KS	5/20/2009	60
Harvey County Spring Field Day	Hesston, KS	5/21/2009	120
Central Kansas Canola Tour	Hutchinson, KS	5/23/2009	30
5th Annual Winter Canola Conference	Enid, OK	7/21/2009	300
Pre-plant Wheat and Canola Meeting	Wichita, KS	8/11/2009	60
Kansas Legislative Aids Meeting	Manhattan, KS	8/24/2009	30
South Plains Oilseeds Workshop	Lubbock, TX	1/13/2010	
ES NM & W TX High Plains Oilseeds Workshop	Clovis, NM	2/5/2010	

Table 3. Canola external advisory committee for the Great Plains Canola Research Program and canola breeding and management program.		
Name	***Affiliation***	***City/State***
John Fenderson	Monsanto, Technology Development Rep	Kiowa, KS
John Haas	Canola producer	Larned, KS
Gene McVey	President, Johnston's Seed Company	Enid, OK
Van Schuermann	Johnston's Grain Company	Enid, OK
Jeff Scott	President, Great Plains Canola Association	Pond Creek, OK
Bob Schrock	Canola producer	Kiowa, KS
Siva Tirumalaraju	Monsanto, Canola Breeder	Mt. Hope, KS
Clark Woodworth	Canola producer	Sterling, KS
Mark Boyles	OSU OKanola Project Specialist	Stillwater, OK
Tom Royer	OSU IPM Coordinator and Entomologist	Stillwater, OK
William Heer	KSU Agronomist-in-Charge, South Central Experiment Field	Hutchinson, KS
Victor Martin	KSU Alternative Crops and Forages Agronomist	Hutchinson, KS
Thomas Peeper	OSU OKanola Project Leader	Stillwater, OK
David Porter	Co-Chair, Head of the OSU Department of Plant and Soil Sciences	Stillwater, OK
Kraig Roozeboom	KSU Cropping Systems/Crop Production Agronomist	Manhattan, KS
Heath Sanders	OSU Canola Extension Specialist	Enid, OK
Michael Stamm	KSU & OSU Canola Breeder	Manhattan, KS
Gary Cramer	Sedgwick County Crops and Soils Agent	Wichita, KS
Francis Epplin	OSU Agricultural Economist	Stillwater, OK

Table 4. Yield results for three 2009 Early Generation Screening Nursery locations

Entry	Line	Hutchinson[1] KS	Manhattan KS	Enid OK
		Yield (lb/a)		
1	KS4399	966	1114	**1883**
2	KS4401	820	**1653**	**2068**
3	KS4420	**1110**	1106	1750
4	KS4421	837	**1664**	**1885**
5	KS4422	874	1386	1730
6	KS4423	987	1420	**2061**
7	KS4425	805	1451	**2093**
8	KS4427	842	1061	**1820**
9	KS4428	**1273**	1392	**1928**
10	KS4440	1035	1413	1679
11	KS4441	993	1446	**1817**
12	KS4442	**1107**	1530	**1893**
13	KS4391	1089	1308	**1928**
14	KS4406	757	1347	1694
15	KS4410	1025	1364	1692
16	KS4429	**1142**	1411	**2145**
17	KS4432	**1116**	**1667**	1730
18	KS4437	896	1309	1763
19	KS4438	1016	1238	1568
20	KS4439	982	1361	1728
21	KS4455	424	1285	1627
22	KS4390	535	1258	1786
23	KS4392	562	1012	1548
24	KS4396	1018	1372	1411
25	KS4402	1010	1374	1728
26	KS4403	966	1340	1266
27	KS4407	665	1428	1504
28	KS4408	591	1116	1763
29	KS4417	1064	1311	**2001**
30	KS4430	971	1308	1662
31	KS4452	913	1475	**2047**
32	KS4460	850	1152	1608
33	KS4462	**1146**	1232	1288
34	KS4463	680	1297	1433
35	KS4465	730	1288	**1805**
36	KS4466	879	1289	**1805**
37	KS4468	948	1335	1770
38	KS4469	843	1168	**1938**
39	KS4470	**1153**	1446	1623
40	KS4471	1014	1267	1419
41	KS4472	833	1487	1617
42	KS4473	1088	**1752**	1672
43	KS4474	929	1256	1498
44	KS4475	**1137**	**2132**	**2146**
45	KS4476	1001	1542	**1855**
46	KS4477	**1127**	**1671**	**1863**
47	KS4478	901	**1896**	**1818**
48	KS4479	914	1502	1727
49	KS4480	850	1583	**1857**
50	KS4481	887	**1873**	1582
51	KS4482	**1119**	1556	**2088**
52	KS4483	976	1293	1538
53	KS4484	883	1630	1720
54	KS4485	**1102**	1481	1513
55	KS4486	**1297**	**1743**	1666
56	KS4487	**1164**	1473	1767
57	KS4488	868	1493	**2003**
58	KS4489	**1447**	**1918**	**1904**
59	KS4490	**1281**	1480	**1857**
60	KS4491	765	1206	1652
61	KS4492	671	1421	1664
62	KS4493	785	1571	**1918**
63	KS4494	1073	1419	1596
64	KS4495	602	1416	1400
65	KS4496	**1273**	1127	**1936**
66	KS4497	**1192**	1629	**2060**
67	KS4498	1066	1541	1770
68	KS4499	**1119**	**1906**	**2065**
69	Kiowa	943	1387	**2041**
70	Sumner	516	951	1653
71	Virginia	**1345**	**1862**	**2140**
72	Wichita	791	1346	**2110**
	Mean	952	1430	1772
	CV	23	21	12
	LSD (0.05)	357	494	348

BOLD - Superior LSD Group - Unless two entries differ by more than the LSD, little confidence can be placed in one being superior to the other. 1/ Yield potential reduced by shattering prior to and after swathing.

Table 5. Yield results for 7 locations of the 2009 Great Plains Canola Variety Trial

Line	Hutchinson	Manhattan	Parsons[1]	Columbia[2]	Lahoma	Weatherford[3]	Chillicothe[4]
	KS	KS	KS	MO	OK	OK	TX
				Yield (lb/a)			
Kiowa	937	1496	**545**	897	**1368**	1110	309
KS3R09	965	1227	----	----	**1372**	----	----
KS3R13	1282	1258	----	----	**1624**	----	----
KS4018	1194	1215	**592**	873	1072	1159	417
KS4023	1160	1401	**589**	521	1036	1052	290
KS4031	1114	1596	**647**	1013	**1480**	1270	**508**
KS4033	1471	1446	305	1019	**1305**	865	345
KS4035	1380	1311	**563**	780	1129	1052	318
KS4083	1164	1672	**614**	642	**1523**	995	408
KS4106	----	----	335	441	----	1027	363
KS4112	----	----	422	1008	----	889	363
KS4124	1247	1536	267	1117	1218	1063	**517**
KS4127	1106	1329	414	852	**1638**	842	272
KS4134	1250	1366	**639**	860	**1242**	1243	**517**
KS4138	1009	1644	**558**	688	**1657**	966	**554**
KS4155	1366	1519	**619**	1083	**1328**	875	**708**
KS4191	675	1478	**546**	865	**1254**	1082	345
KS4192	1392	1153	451	909	861	1103	245
KS4280	1208	1346	**562**	504	**1456**	1360	**608**
KS4313	1261	2024	**546**	800	**1411**	1074	390
KS4323	1116	1187	**565**	1066	**1523**	1217	**445**
KS4395	1195	1452	**629**	485	1216	930	345
KS4404	1558	1117	442	486	1212	1120	417
KS4409	1118	1072	318	626	1195	756	**699**
KS4416	1313	1341	**591**	723	**1370**	967	**526**
KS4419	1286	1240	142	659	**1501**	767	281
KS4424	1300	1459	**803**	659	**1536**	1060	**617**
KS4426	1217	2020	453	601	**1559**	1078	390
KS4433	1599	1543	393	794	**1303**	923	**563**
KS4436	1179	1779	370	619	**1503**	1113	**445**
KS4443	1337	1603	188	878	**1284**	1083	345
KS4459	1326	1397	**638**	1050	908	950	345
KS4461	1115	887	227	963	**1275**	1024	**463**
KSIU182	1236	1217	426	703	**1275**	1025	327
KSIU331	1042	1503	**536**	855	**1401**	1252	318
Sumner	1301	982	362	804	1171	846	272
Virginia	1316	1373	**746**	482	**1258**	1190	**472**
Wichita	1373	1682	**473**	761	**1530**	1085	**617**
Mean	1225	1413	487	780	1333	1039	427
CV	21	25	42	42	20	20	38
LSD (0.05)	NS	NS	336	NS	432	NS	267

one being superior to the other. 1/ A dry March decreased yield potential significantly. 2/ Yield loss to winter survival. 3/ A hard spring freeze reduced yields despite a full recovery. 4/ Drought and aphid infestations reduced yields.

Table 6. Yields results for 12 Great Plains locations of the 2009 National Winter Canola Variety Trial.

Brand	Name	Clearwater KS	Hutchinson KS	Manhattan KS	Enid OK	Lahoma OK	Weatherford OK	Akron CO	Akron[1] CO	Fruita[1] CO	Yellow Jacket[1] CO	Columbia MO	Chillicothe[1] TX	Average
							Yield (lb/a)							
Alabama A&M	AAMU-18-07	---	692	226	1710	1245	459	---	---	3553	---	54	218	1020
Alabama A&M	AAMU-33-07	---	1082	974	**2488**	1635	1054	---	---	**3625**	---	318	608	1473
Arkansas	ARC00004-2	---	906	717	**2571**	1577	998	---	---	2980	---	161	300	1276
Arkansas	ARC00005-2	---	864	974	**2592**	1655	1148	---	---	3101	---	431	354	1390
Arkansas	ARC00024-2	---	936	984	2254	1713	862	---	---	2607	---	118	463	1242
Arkansas	ARC2189-2	---	1148	1017	**2551**	1584	1256	---	---	2768	---	578	363	1408
Blue Sun	BSX-501	1279	**1318**	532	**2587**	1398	**1424**	827	1703	3000	3493	**982**	526	1617
Blue Sun	BSX-6131	---	**1312**	665	2216	1346	**1322**	494	1443	2729	3446	**633**	454	1460
Blue Sun	BSX-6242	---	938	**1249**	**2427**	1670	1171	576	1716	3568	**4168**	**897**	590	1725
Blue Sun	BSX-6271	---	**1259**	**1248**	**2532**	1395	1221	706	1358	3052	3770	604	581	1611
Blue Sun	BSX-6406	---	**1270**	**1177**	2242	1775	1199	781	1641	3050	3683	**623**	281	1611
Croplan	HyClass107W	**2077**	782	879	**2408**	1557	1191	702	1720	3116		147	336	1284
Croplan	HyClass110W	1423	794	149	2153	1576	821	---	---	2925	---	84	363	1108
Croplan	HyClass115W	1253	609	332	1861	1358	1062	---	---	3367	---	354	309	1156
Croplan	HyClass154W	---	**1251**	976	2198	1730	**1341**	641	1602	3242	3707	277	626	1599
DeKalb	CWH095D	---	**1616**	**1533**	2159	**2041**	1216	---	---	**4109**	---	**796**	354	1728
DeKalb	CWH101D	---	**1192**	**1229**	**2709**	**2036**	**1304**	---	---	**3833**	---	**842**	309	1682
DeKalb	CWH111	---	916	449	2109	1116	704	710	1159	3578	2946	132	227	1277
DeKalb	CWH633	---	1013	550	1954	1522	1149	673	1478	3131	3586	497	381	1449
DeKalb	DKW41-10	1170	580	697	1835	1360	758	229	812	2975	2710	607	209	1161
DeKalb	DKW45-10	1051	718	498	2179	1308	1082	428	1067	3567	3725	576	281	1403
DeKalb	DKW46-15	1175	1050	557	2126	**1810**	1156	417	1209	3214	3357	**653**	290	1440
DeKalb	DKW47-15	**1625**	782	688	1933	1701	1048	552	1063	3342	3491	475	290	1397
DL Seeds	Baldur	---	**1394**	**1089**	**2697**	**1942**	**1310**	628	**1837**	3249	3818	144	563	1697
DL Seeds	Dimension	1448	697	970	**2651**	**2066**	917	600	1306	3358	**3968**	78	490	1555
DL Seeds	Flash	**2298**	**1366**	**1045**	**2517**	**1989**	**1293**	234	468	**3701**	3680	102	**717**	1556
DL Seeds	Hornet	---	1137	**1363**	2085	1656	**1366**	**1093**	**1854**	**3903**	**4079**	439	526	1773
DL Seeds	Kronos	---	**1260**	811	**2391**	**2134**	**1350**	---	---	3355	3471	261	517	1728
DL Seeds	NPZ0604	---	953	761	2320	**1839**	1009	993	**1832**	**4211**	3564	439	481	1673
DL Seeds	Safran	---	**1513**	**1144**	**2731**	**1963**	**1584**	927	**2006**	**3741**	**4486**	20	**889**	1909
DL Seeds	Sitro	---	**1388**	**1424**	1907	**1919**	1258	740	1652	**4257**	**4738**	73	**717**	1825
DL Seeds	Visby	---	**1274**	688	**2447**	**1931**	---	847	**1940**	---	**3969**	---	---	1871
K-State	Kiowa	---	1120	971	2211	1470	1066	**1194**	**1801**	2806	3131	254	345	1488
K-State	Sumner	1441	946	479	**2465**	1380	892	711	1701	2897	3352	**687**	445	1450
K-State	Wichita	1012	**1238**	970	**2547**	1687	1050	828	1445	2877	3467	568	408	1553
K-State/OSU	KS3074	---	1035	**1105**	**2556**	1736	1197	---	---	3036	---	**726**	490	1485
K-State/OSU	KS3077	---	**1196**	490	**2448**	1593	---	---	---	---	---	---	---	1432
K-State/OSU	KS3132	---	**1530**	**1278**	**2578**	1641	1233	---	---	2874	---	**838**	309	1535
K-State/OSU	KS3254	---	**1317**	**1103**	**2490**	1774	1223	628	1743	3156	3732	**652**	572	1672
K-State/OSU	KS4022	---	1097	**1176**	2256	1434	1058	948	1511	2968	3647	**624**	481	1564
K-State/OSU	KS4085	---	**1278**	**1207**	**2394**	1619	976	715	**1797**	3064	3520	550	608	1612
K-State/OSU	KS4158	---	**1479**	**1353**	**2698**	1672	1275	732	1778	3232	3632	611	535	1727
Momont	Hybrigold	1193	968	423	2229	1389	863	---	---	**3759**	---	49	436	1264
Momont	Hybrilux	---	739	509	2342	**2004**	1098	---	---	**3698**	---	20	535	1368
Momont	Hybristar	---	869	666	1792	**1812**	1128	---	---	3184	---	139	517	1263
Momont	Hybrisurf	**1871**	777	680	1835	**2067**	996	---	---	**4043**	---	60	535	1374
Momont	Kadore	---	**1465**	923	**2503**	1402	**1482**	779	1698	3490		415	**708**	1486
Pioneer Hi-Bred	45D03	---	**1396**	974	**2759**	**1963**	1243	---	---	3581	---	147	590	1582
Pioneer Hi-Bred	46W14	---	1080	712	**2498**	**1940**	1064	---	---	**3828**	---	13	672	1476
Pioneer Hi-Bred	46W99	---	875	565	2248	**1830**	**1361**	---	---	3277	---	200	463	1353
TCI	Hearty	---	---	---	---	---	1107	---	---	2987	---	---	263	1452
TCI	Rossini	---	---	---	---	---	**1298**	---	---	**3764**	---	36	**717**	1454
Virginia State	Virginia	996	876	718	**2470**	1651	1078	644	1515	3405	3228	607	554	1522
	Mean	1421	1084	861	2330	1679	1132	699	1552	3336	3640	411	467	1563
	CV	29	25	37	10	12	17	27	15	12	14	55	28	
	LSD (0.05)	699	433	519	395	327	306	176	215	642	840	366	212	

BOLD - Superior LSD Group - Unless two entries differ by more than the LSD, little confidence can be placed in one being superior to the other.
For location agronomic information, please see the 2009 National Winter Canola Variety Trial, SRP 1026, http://www.ksre.ksu.edu/library/crpsl2/srp1026.pdf
1/ Site was irrigated.

Table 7. Oil results for 9 Great Plains locations of the 2009 National Winter Canola Variety Trial

Brand	Name	Clearwater KS	Hutchinson KS	Manhattan KS	Enid OK	Lahoma OK	Weatherford OK	Akron[1] CO	Fruita[1] CO	Yellow Jacket[1] CO	Average
						OIL (%)					
Alabama A&M	AAMU-18-07	---	42.9	38.2	37.5	39.5	33.4	---	45.2	---	39.5
Alabama A&M	AAMU-33-07	---	41.9	36.4	37.4	40.6	38.9	---	46.6	---	40.3
Arkansas	ARC00004-2	---	42.9	32.5	36.6	39.1	40.0	---	44.9	---	39.4
Arkansas	ARC00005-2	---	41.7	35.2	37.3	40.3	40.2	---	44.6	---	39.9
Arkansas	ARC00024-2	---	42.1	35.7	34.6	39.8	40.6	---	45.4	---	39.7
Arkansas	ARC2189-2	---	41.6	38.4	38.2	40.2	41.1	---	46.9	---	41.1
Blue Sun	BSX-501	---	42.4	33.6	36.8	40.4	39.8	35.1	44.8	40.9	39.2
Blue Sun	BSX-6131	---	41.4	31.2	36.7	39.9	39.9	34.6	48.0	39.2	38.9
Blue Sun	BSX-6242	---	40.9	37.4	37.4	41.0	40.2	36.4	46.5	39.7	39.9
Blue Sun	BSX-6271	---	41.8	37.9	38.4	41.1	40.7	37.3	45.3	41.1	40.5
Blue Sun	BSX-6406	---	40.7	36.9	38.4	39.9	41.0	36.9	44.8	42.2	40.1
Croplan	HyClass107W	38.9	40.8	38.2	37.7	41.1	40.0	36.9	45.4	40.5	39.9
Croplan	HyClass110W	38.7	40.5	34.7	36.7	40.6	39.4	---	46.6	---	39.6
Croplan	HyClass115W	35.5	42.7	36.7	37.5	41.5	40.7	---	45.5	---	40.0
Croplan	HyClass154W	---	40.3	32.6	36.6	39.0	41.4	34.7	45.7	---	38.6
DeKalb	CWH095D	---	41.3	37.0	36.5	41.3	41.0	---	44.6	---	40.3
DeKalb	CWH101D	---	41.6	36.3	36.4	42.1	41.4	---	45.1	---	40.5
DeKalb	CWH111	---	42.8	30.6	37.7	36.6	38.3	33.1	44.3	40.8	38.0
DeKalb	CWH633	---	41.0	36.1	37.6	40.6	40.4	35.3	45.3	40.7	39.6
DeKalb	DKW41-10	34.7	41.6	31.6	34.7	39.4	37.1	32.2	44.7	39.0	37.2
DeKalb	DKW45-10	34.5	42.4	38.5	37.8	40.7	40.8	33.3	46.8	38.5	39.2
DeKalb	DKW46-15	38.4	42.0	30.3	38.7	41.8	42.1	35.8	44.4	40.8	39.4
DeKalb	DKW47-15	36.5	42.3	37.6	36.8	41.0	40.7	33.7	46.3	41.4	39.6
DL Seeds	Baldur	36.0	42.3	35.4	37.6	40.7	41.7	35.7	46.1	40.5	39.6
DL Seeds	Dimension	35.9	42.5	38.1	39.9	42.0	40.5	34.4	46.8	44.2	40.5
DL Seeds	Flash	38.6	40.6	35.2	39.0	42.6	44.6	36.4	44.7	41.2	40.3
DL Seeds	Hornet	---	42.3	38.3	38.3	41.1	42.5	36.4	45.6	41.0	40.7
DL Seeds	Kronos	---	42.1	32.5	36.9	40.7	40.7	35.5	45.9	41.5	39.5
DL Seeds	NPZ0604	---	42.4	36.2	38.5	42.4	40.9	38.5	45.4	40.9	40.7
DL Seeds	Safran	---	41.7	36.4	38.0	41.5	42.6	37.6	47.2	40.6	40.7
DL Seeds	Sitro	---	42.6	36.1	37.0	42.2	40.1	34.7	45.4	41.3	39.9
DL Seeds	Visby	---	41.8	35.7	37.4	40.8	---	36.5	---	41.3	38.9
K-State	Sumner	35.0	41.7	37.4	37.4	40.8	37.5	36.3	46.3	41.6	39.3
K-State	Wichita	34.4	40.6	35.3	37.8	40.3	40.2	34.3	45.0	40.0	38.7
K-State	Kiowa	---	42.1	35.7	37.0	40.6	39.9	32.9	44.8	41.1	39.3
K-State/OSU	KS3074	---	42.1	37.3	37.5	41.5	40.3	---	46.1	---	40.8
K-State/OSU	KS3077	---	40.9	30.1	37.4	40.9	---	---	---	---	37.3
K-State/OSU	KS3132	---	42.1	35.4	38.1	40.2	39.6	---	44.7	---	40.0
K-State/OSU	KS3254	---	41.1	36.6	37.8	41.0	40.4	36.0	45.4	40.6	39.9
K-State/OSU	KS4022	---	42.0	36.0	37.1	40.9	35.5	32.8	44.6	41.5	38.8
K-State/OSU	KS4085	---	41.6	37.5	38.7	40.9	39.8	36.3	46.1	40.7	40.2
K-State/OSU	KS4158	---	41.6	39.6	38.7	41.3	41.5	37.0	45.9	43.5	41.1
Momont	Hybrigold	35.9	42.6	30.1	37.5	39.7	41.3	---	45.8	---	39.0
Momont	Hybrilux	---	42.1	33.8	38.4	41.8	40.0	---	46.4	---	40.4
Momont	Hybristar	---	40.5	35.7	37.5	41.7	40.9	---	46.8	---	40.5
Momont	Hybrisurf	36.3	41.1	34.9	38.4	43.6	42.1	---	46.2	---	40.4
Momont	Kadore	---	42.7	33.5	35.3	39.0	40.2	---	47.4	---	39.7
Pioneer Hi-Bred	45D03	---	40.5	34.5	38.7	40.4	43.1	---	45.0	---	40.4
Pioneer Hi-Bred	46W14	---	41.8	33.5	39.0	42.4	43.0	---	46.8	---	41.1
Pioneer Hi-Bred	46W99	---	42.1	36.7	39.0	41.6	42.0	---	45.6	---	41.2
TCI	Hearty	---	---	---	---	---	40.9	---	45.8	---	43.4
TCI	Rossini	---	---	---	---	---	40.8	---	45.4	---	43.1
Virginia State	Virginia	34.6	42.2	35.5	36.3	40.1	39.5	33.4	44.9	40.6	38.5
Mean		36.3	41.8	35.4	37.5	40.8	40.4	35.3	45.7	40.9	39.3
CV		10.5	2.6	8.2	2.0	2.3	3.8	4.1	2.7	3.0	
LSD (0.05)		NS	NS	NS	1.2	1.9	2.5	2.4	NS	NS	

BOLD - Superior LSD Group - Unless two entries differ by more than the LSD, little confidence can be placed in one being superior to the other. For location agronomic information, please see the 2009 National Winter Canola Variety Trial, SRP 1026, http://www.ksre.ksu.edu/library/crpsl2/srp1026.pdf. 1/ Site was irrigated.

Table 8. Results for the 2008-2009 forage clipping study at Manhattan, KS

	Grain Yield	Winter Survival	Forage Weight	Protein	[1]ADF	NDF	NEL	NEG	NEM	TDN	RFV
	(lbs/a)	*(%)*	*(lbs/a)*	*(%)*	*(%)*	*(%)*	*(Mcal/lb)*	*(Mcal/lb)*	*(Mcal/lb)*	*(%)*	
KS4022	1572.1 a	98.4 a	3823.7	26.5 a	19.0 b	21.3 b	0.796 a	0.549 a	0.876 a	76.5 a	332.1 a
KS9135	875.2 b	67.8 c	4492.2	25.8 a	20.0 b	22.2 b	0.780 a	0.534 a	0.861 a	75.3 a	315.3 a
Sitro	873.0 b	62.8 c	5078.2	23.0 b	20.7 b	22.7 b	0.773 a	0.521 a	0.850 a	74.4 a	305.8 a
Wichita	1443.8 a	83.7 b	3999.5	25.6 a	23.2 a	25.6 a	0.739 b	0.484 b	0.811 b	71.6 b	263.8 b
LSD (0.05)[2]	330.3	11.9	NS	2.5	2.2	1.8	0.029	0.035	0.035	2.6	29.2
4-Nov-08	1027.0 b	68.5 b	3746.9 b	24.9	22.9 a	25.3 a	0.744 b	0.489 b	0.816 b	71.9 b	265.1 b
25-Nov-08	1001.3 b	73.4 b	4949.9 a	25.6	18.6 b	20.5 b	0.799 a	0.555 a	0.883 a	76.9 a	343.3 a
None	1544.9 a	92.6 a	---	---	---	---	---	---	---	---	---
LSD (0.05)[2]	286.1	10.3	715.3	NS	1.6	1.3	0.021	0.025	0.025	1.9	20.6

1/ ADF=Acid Detergent Fiber, NDF=Neutral Detergent Fiber, NEL=Net Entery Lactation, NEG=Net Energy Gain, NEM=Net Energy Maintenance, TDN=Total Digestible Nutrients, RFV=Relative Feed Value

2/ Means followed by the same letter are not significantly different.

Table 9. Results for the 2007-2008 forage clipping study at Hutchinson, KS

Variety	Moisture	Dry Yield	Wet Yield	Crude Protein	ADF[1]	NDF	TDN	Nitrates	RFV
	(%)	*(lb/a)*	*(lb/a)*	*(%)*	*(%)*	*(%)*	*(%)*	*(ppm)*	
KS4022	84	1640	10,630	27.1	13.2	18.4	83.3	4770	401
KS9135	86	1700	12,250	28.5	10.4	16.6	86.6	6165	457
Sitro	86	1680	11,950	27.0	11.0	16.6	85.8	7838	542
Wichita	86	1560	10,820	27.3	9.9	15.4	87.1	4665	490
Mean	86	1645	11,410	27.5	11.1	16.8	85.7	5860	473

1/ADF=Acid Detergent Fiber, NDF=Neutral Detergent Fiber, TDN=Total Digestible Nutrients, RFV=Relative Feed Value

Table 10. Results from the 2008-2009 swathing study at Manhattan, KS

Treatment	Fall Stand	Plant Height	Grain Moisture	Test Weight	Yield	Protein	Oil
Hornet	---	---	7.1	46.8 a	2283.2 a	25.3 b	38.8 a
Sitro	---	---	7.0	46.9 ab	2092.7 b	25.5 b	37.8 b
Virginia	---	---	7.5	45.6 bc	1793.2 c	27.0 a	37.5 b
Wichita	---	---	6.9	45.0 c	1938.5 bc	27.1 a	36.8 c
LSD (0.05)			NS	1.3	159.1	0.5	0.4
Direct	---	---	7.6 a	46.1	2039.2	26.3	37.7
Swath	---	---	6.7 b	46.1	2014.6	26.1	37.7
LSD (0.05)			0.4	NS	NS	NS	NS

Table 11. Results from the 2008-2009 swathing study at Hutchinson, KS

Treatment	Fall Stand	Plant Height	Grain Moisture	Test Weight	Yield	Protein	Oil
Hornet	6.6 b	41.0 a	6.5 b	44.0	1422.3 a	22.5 b	40.7 a
Sitro	7.7 a	38.3 b	6.2 b	45.9	988.7 b	23.0 b	39.0 b
Virginia	7.6 a	39.3 b	7.7 a	45.9	1442.3 a	25.3 a	38.6 b
Wichita	6.6 b	41.3 a	6.1 b	46.0	1054.6 b	25.0 a	39.4 b
LSD (0.05)	0.4	1.1	0.6	NS	280.0	0.8	1.1
Direct	7.1	39.8	7.0 a	47.4 a	1368.8 a	24.1	39.7
Swath	7.1	40.1	6.3 b	43.5 b	1085.1 b	23.7	39.2
LSD (0.05)	NS	NS	0.4	2.1	198.0	NS	NS

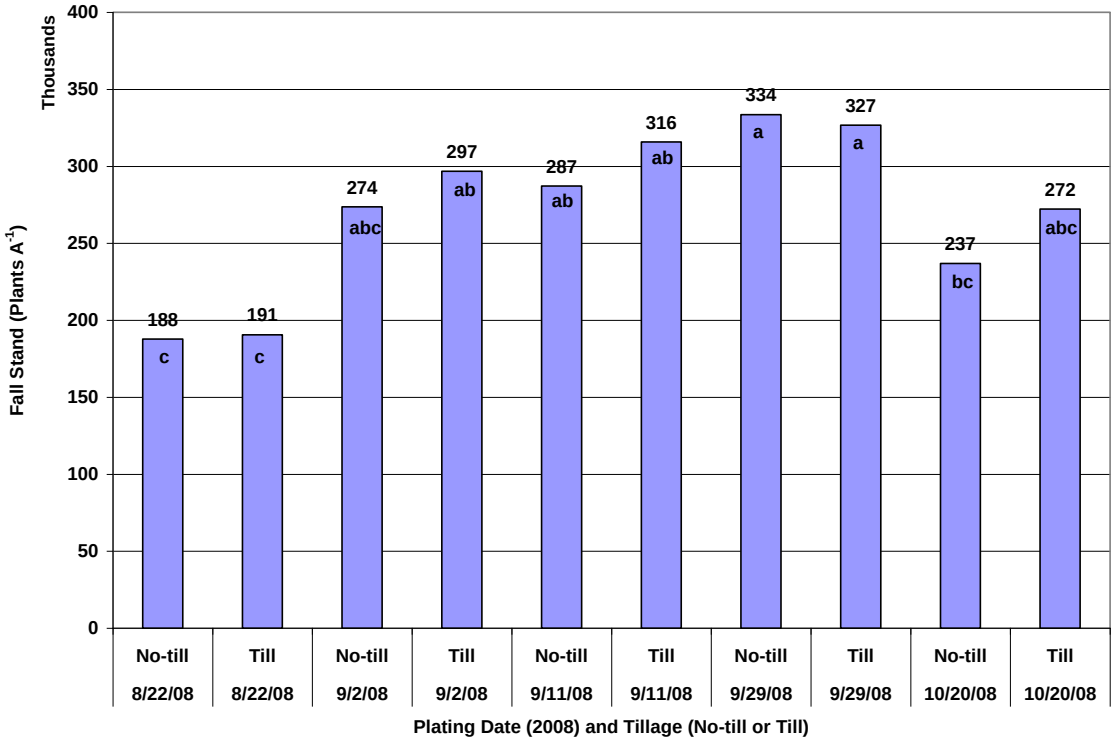

Figure 1. Winter canola fall stand establishment at five different planting dates in tillage and no-tillage, Garden City, 2009. Means followed by the same letter are not significantly different at $P \leq 0.05$.

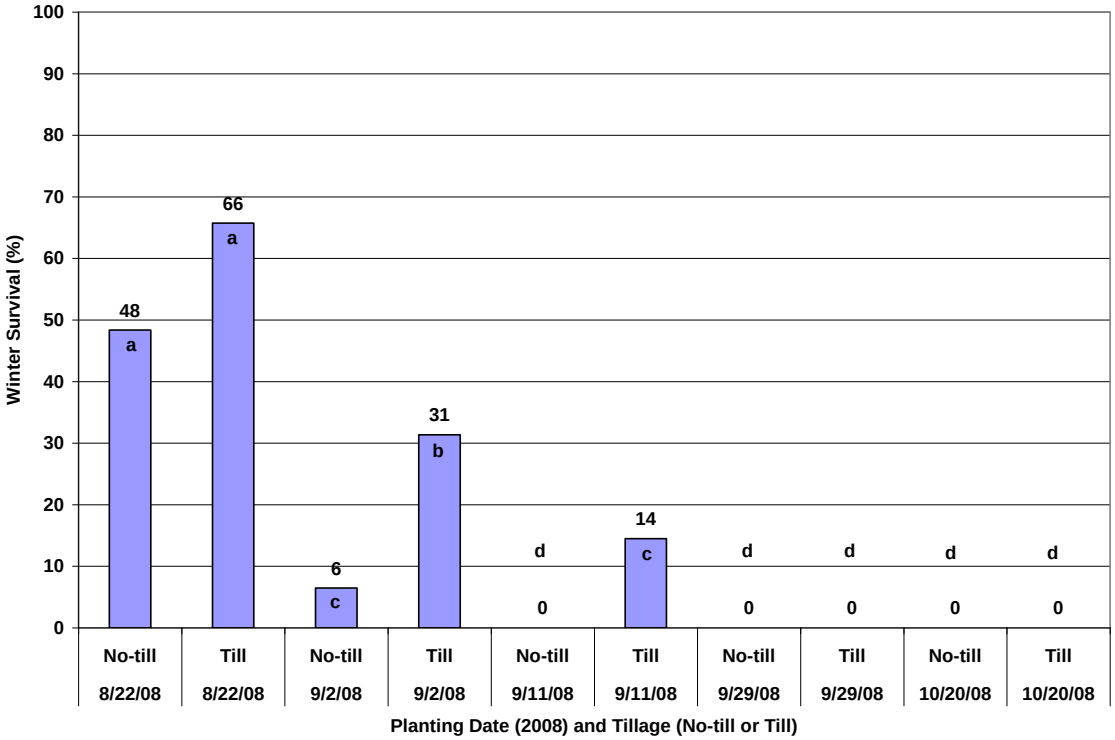

Figure 2. Winter canola winter survival at five different planting dates in tillage and no-tillage, Garden City, 2009. Means followed by the same letter are not significantly different at $P \leq 0.05$