

Southern Great Plains Winter Canola Cultivar Trends



Michael Stamm, Department of Agronomy, Kansas State University, Manhattan, KS

Introduction

- Since 2003, winter canola hectares have increased from a few thousand to nearly 100,000 annually
- Introduction of winter canola into the southern Great Plains (SGP) has been primarily achieved by using open-pollinated (OP) cultivars
- Although the majority U.S. winter canola market is planted to OP cultivars, hybrids are gaining favor, especially in higher-yielding environments such as the eastern Great Plains and Midwest
- Heterosis of 25% or greater has been observed in canola worldwide
- Other hybrid benefits include vigorous fall establishment, higher oil content, and pod shatter tolerance
- Initial adaptability of hybrids to the SGP was not ideal; hybrids lacked winter hardiness, but this trait has improved with time

Objective & Methods

- Yield trends were evaluated using data from SGP locations of the National Winter Canola Variety Trial (NWCVT)
- The NWCVT is coordinated by Kansas State University and provides producers, marketers, and breeders valuable performance data for winter canola across about 35 U.S. locations annually
- Two high-yielding cultivars were plotted from 2012-2016 to show yield trends in high and low-yielding SGP environments
- Proc MIXED in SAS 9.3 was used to conduct head-to-head comparisons of OP and hybrid cultivar checks for years 2012-2015
- Beginning in the 2015-16 growing season. OP and hybrid cultivars were seeded in side-by-side trials at full-sized NWCVT sites
- This new procedure was undertaken to minimize competition and performance bias between the two cultivar types

Figure 1. Total planted hectares and yield trends for U.S. canola and SGP winter canola, 1995-2016 (Sources: USDA-NASS; NWCVT).



Figure 2. Number of OPs and hybrids (experimental and commercial) tested in the National Winter Canola Variety Trial, 1995 to 2017



Results

- Spring type canola makes up the majority of U.S. hectares (Figure 1)
- · Initially, SGP yields were below the national average, but the influx of EU hybrids and genetic gain through breeding have contributed to vields trending above the national average
- Hybrid winter canola cultivars were first introduced into the USA and NWCVT testing in 2003 (Figure 2)
- The number of hybrids tested in the NWCVT has increased to average one-half or more of the total entries annually
- Most hybrids tested are contributed by overseas seed companies with an interest in growing the U.S. market for winter canola
- In a head-to-head comparison, hybrids checks significantly out yielded most of the OP checks, except for 'Riley' (Table 1)
- The top hybrid check, 'Safran' averaged about 13% more than Riley
- OP cultivars generally show better winter survival than hybrid cultivars. Hybrid checks were approximately to the level of 'Wichita,' the cultivar that set the standard for winter survival.
- Surprisingly, oil contents were equal

Table 1. Head-to-head comparison of OP and hybrid check cultivars across Great Plains environments tested in the NWCVT, 2012-2015.

			Grain	Percentage of	Winter	
Name`	Туре	Source	yield	test-yield avg.	survival [†]	Total oil
			Mg ha-1	%	%	g kg-1
DKW46-15	OP	DEKALB	2.1	85.4	60.8	393
HyCLASS115W	OP	CROPLAN	2.3	91.1	54.4	384
Riley	OP	Kansas State	2.7	107.7	62.8	391
Wichita	OP	Kansas State	2.4	98.2	55.5	385
46W94	HYB	DuPont Pioneer	2.7	104.0	44.6	394
Chrome	HYB	Photosyntech	2.9	1145	45.7	396
Hornet	HYB	Rubisco Seeds	2.7	104.0	57.7	392
Safran	HYB	Rubisco Seeds	3.1	125.5	52.1	388
P-value			<0.0001	<0.0001	< 0.0001	0.3250
LSD (0.05)			0.1	6.6	4.1	ns
Site years			22	22	18	24
Minter eupinal rated	as the or	mont of supplying fall sta	nd			

Figure 4. Yield regression of Riley and Mercedes across different yield environments in the SGP, 2012-2016



Figure 5. NWCVT site at Kiowa, KS, on April 21, 2016.



- · New EU hybrids such as 'Mercedes' have shown improved adaptability (Figure 4)
 - Even in the lower yielding environments (0.5 to 1.5 Mg ha-1), Mercedes shows a slight yield advantage to Riley
 - As environmental yield potential improved, the yield advantage of Mercedes also increased; however, Riley was typically within 1 Mg ha-1 of Mercedes in these environments

Results

- The 2016 NWCVT at Kiowa, KS provided conditions for optimal hybrid performance (Table 2), with mean yield over 3.7 Mg ha-1
- · The top OP cultivar yielded about 13% less than the top hybrid
- · Fall vigor of the hybrids averaged less than the OP cultivars; mostly because of some less-vigorous semi-dwarf hybrids in the trial
- Entries in the 2017 NWCVT were split into OP and hybrid tests with common checks to allow for better comparison at trial sites

			Fall vigor [†]	Grain yield
Name	Source	Туре	1-5	Mg ha-1
Quartz	Photosyntech	OP	2.7	3.8
VSX-3	Virginia State	OP	3.3	3.6
Riley	Kansas State	OP	2.3	3.4
HyCLASS125W	CROPLAN	OP	4.3	3.4
KSUR1211	Kansas State	OP	3.3	3.4
Mean [‡]			3.4	3.2
CV			15.0	12.9
LSD (0.05)			0.8	NS
Mercedes	Rubisco Seeds	Hyb	3.0	4.4
Einstein	DL Seeds	Hyb	4.0	4.3
MH12AY27	MOMONT	Hyb	2.0	4.2
PX112	DuPont Pioneer	Hyb	1.7	4.2
Inspiration	Rubisco Seeds	Hyb	3.3	3.9
Mean [‡]		-	3.2	3.7
CV			15.0	8.6
LSD (0.05)			0.8	0.5

Figures 6 & 7. Male sterile parent line development using the OGURA-INRA hybrid breeding system at Kansas State University.



Conclusions

- Winter canola hybrids introduced over the past five years show improved performance, even in yield limited environments
- Current OP cultivars show a slight disadvantage in yield over SGP environments although winter survival is often greater than hybrids
- Competitive OP cultivars offer benefits to new canola growers such as lower seed cost and less production risk than hybrids
- Within the next decade, it is anticipated that the majority of winter canola hectares will be planted to hybrid winter canola
- The K-State canola breeding program will contribute adapted winter canola hybrid parent lines using the OGURA-INRA cytoplasmic male sterility system
- Performance should continue to improve as adapted parent lines and hybrids are introduced in the SGP

Acknowledaments

This research was funded through the USDA-NIFA Supplemental and Alternative Crops Competitive Grants program, proposal number 2015-06585, and with entry fees collected from the National Winter Canola Variety Trial