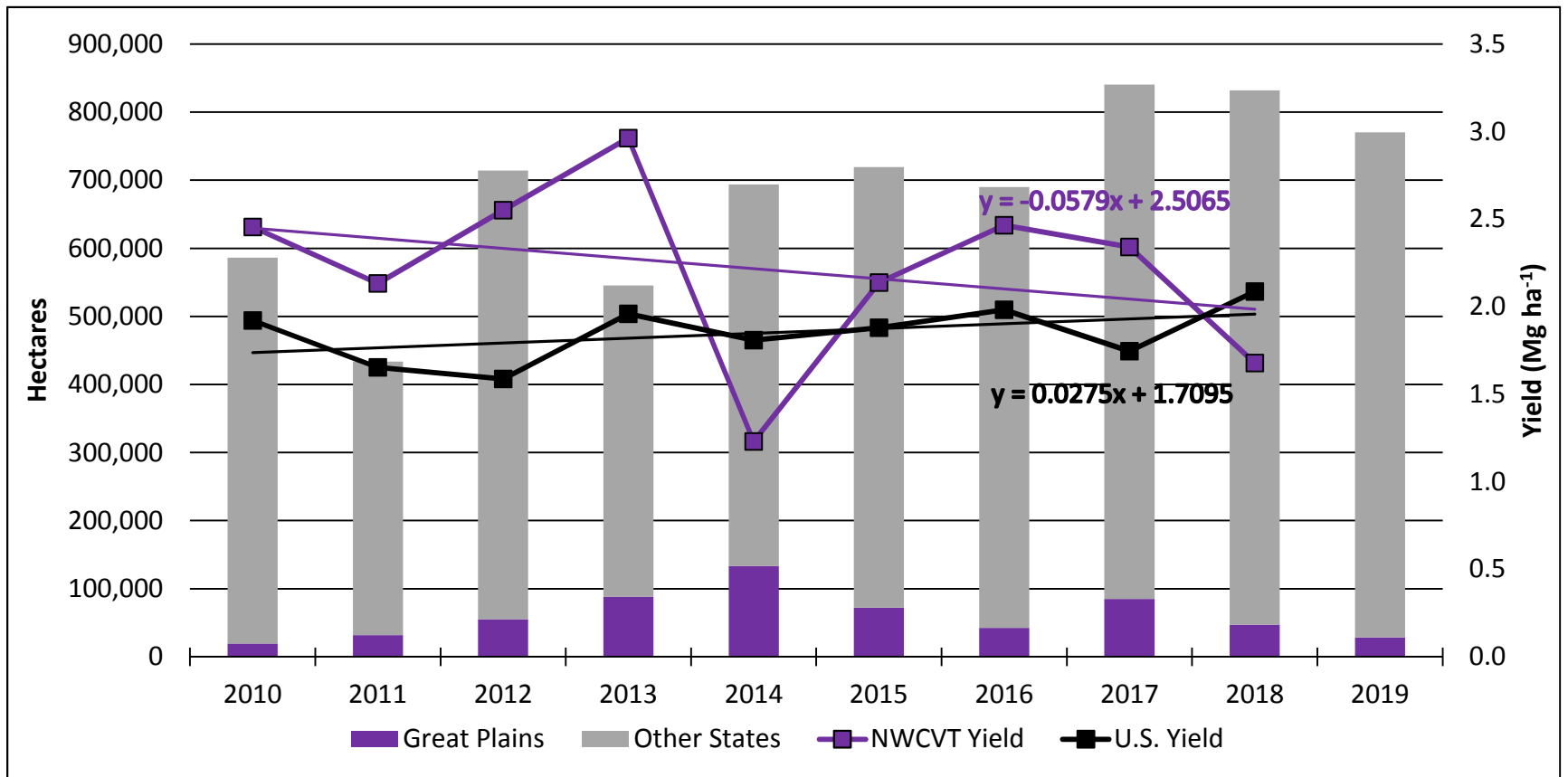




Winter Canola Requires Unique Adaptation to the U.S. Southern Great Plains

Michael Stamm, Scott Dooley
Kansas State University
15th International Rapeseed Congress
Berlin, Germany
16-19.06.2019

U.S. National and Southern Great Plains – Hectares and Yield



April 21, 2016

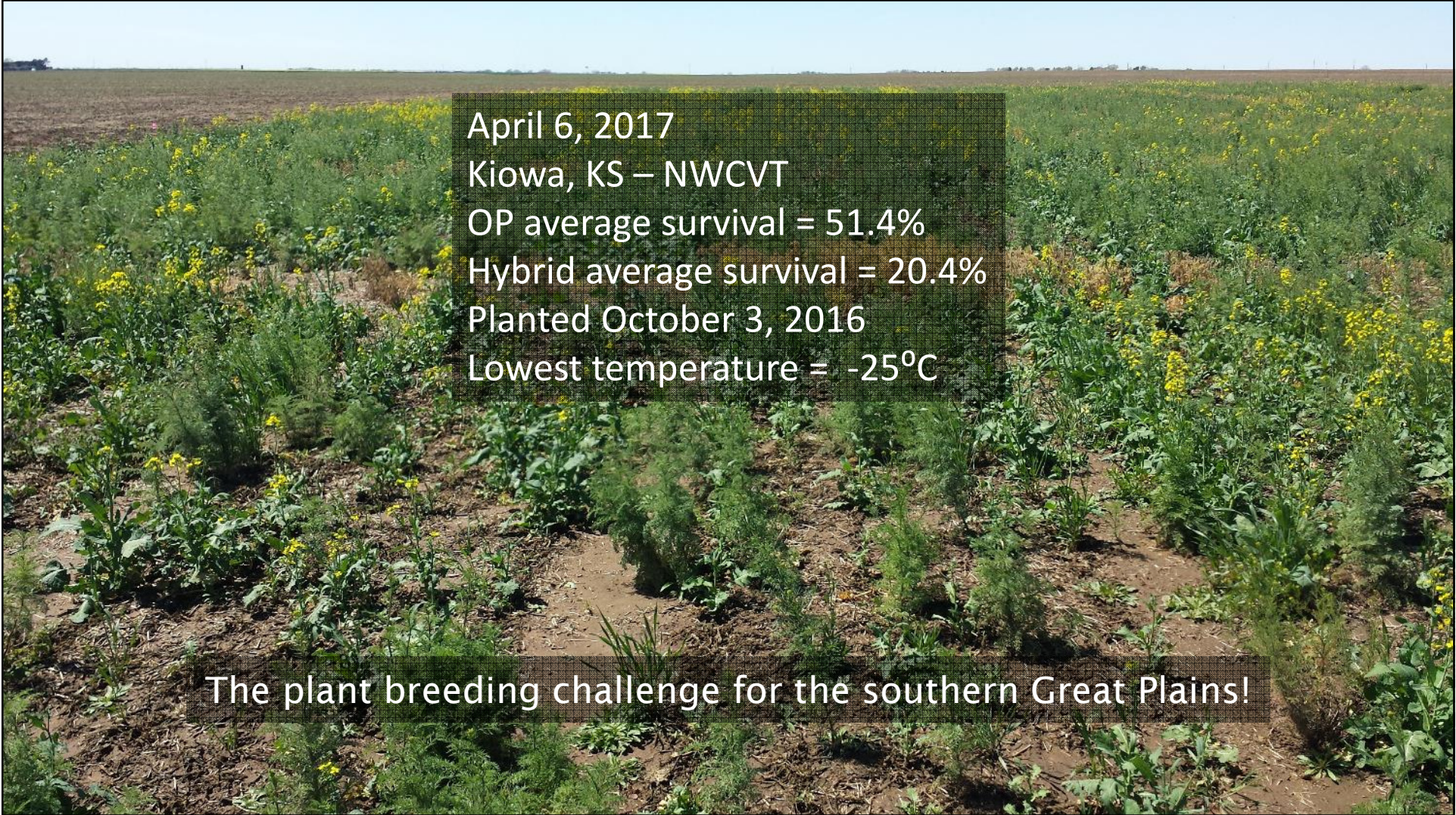
Kiowa, KS – NWCVT

OP average = 3.2 t/ha

Hybrid average = 3.8 t/ha

Planted September 25, 2015

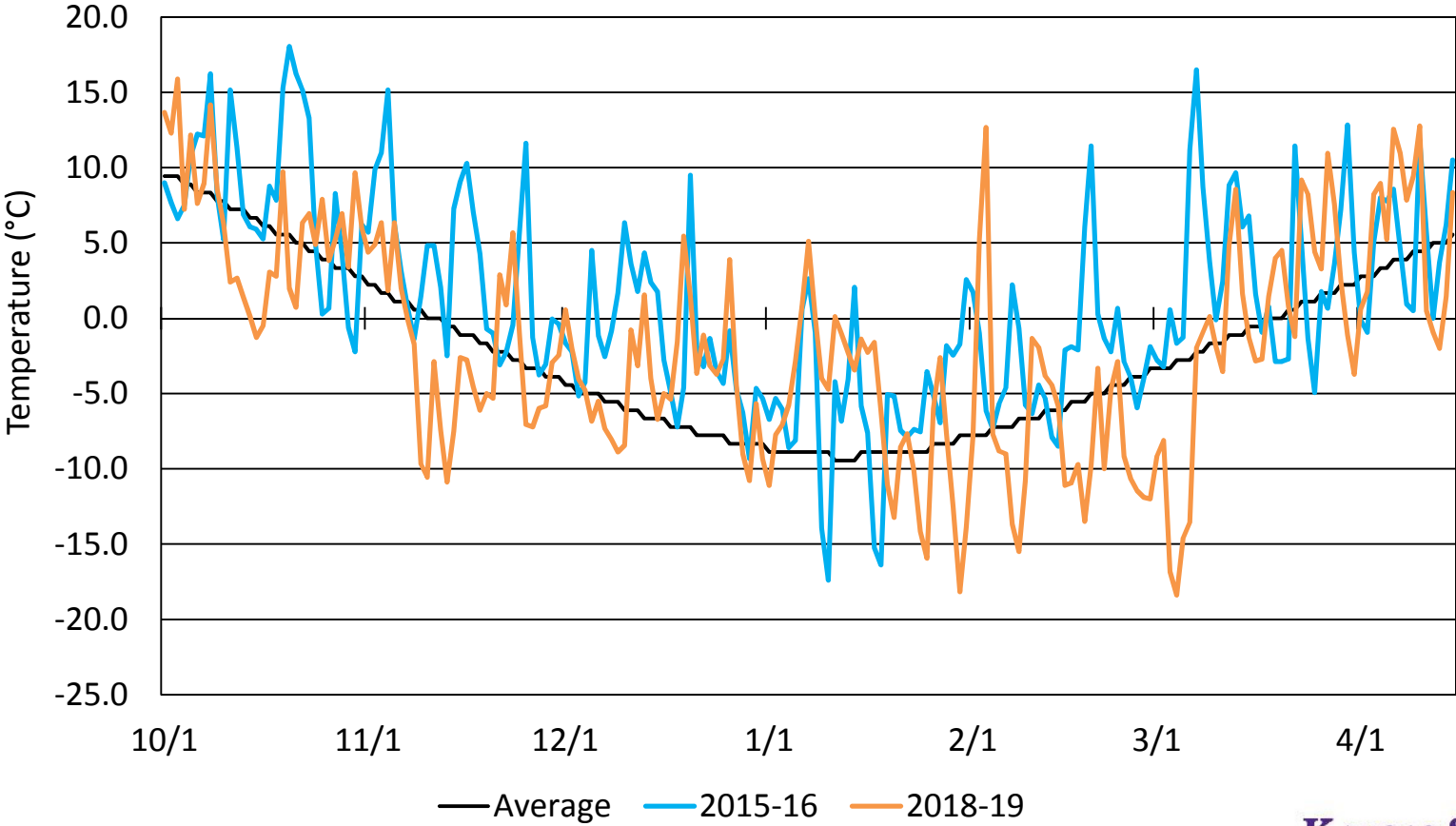




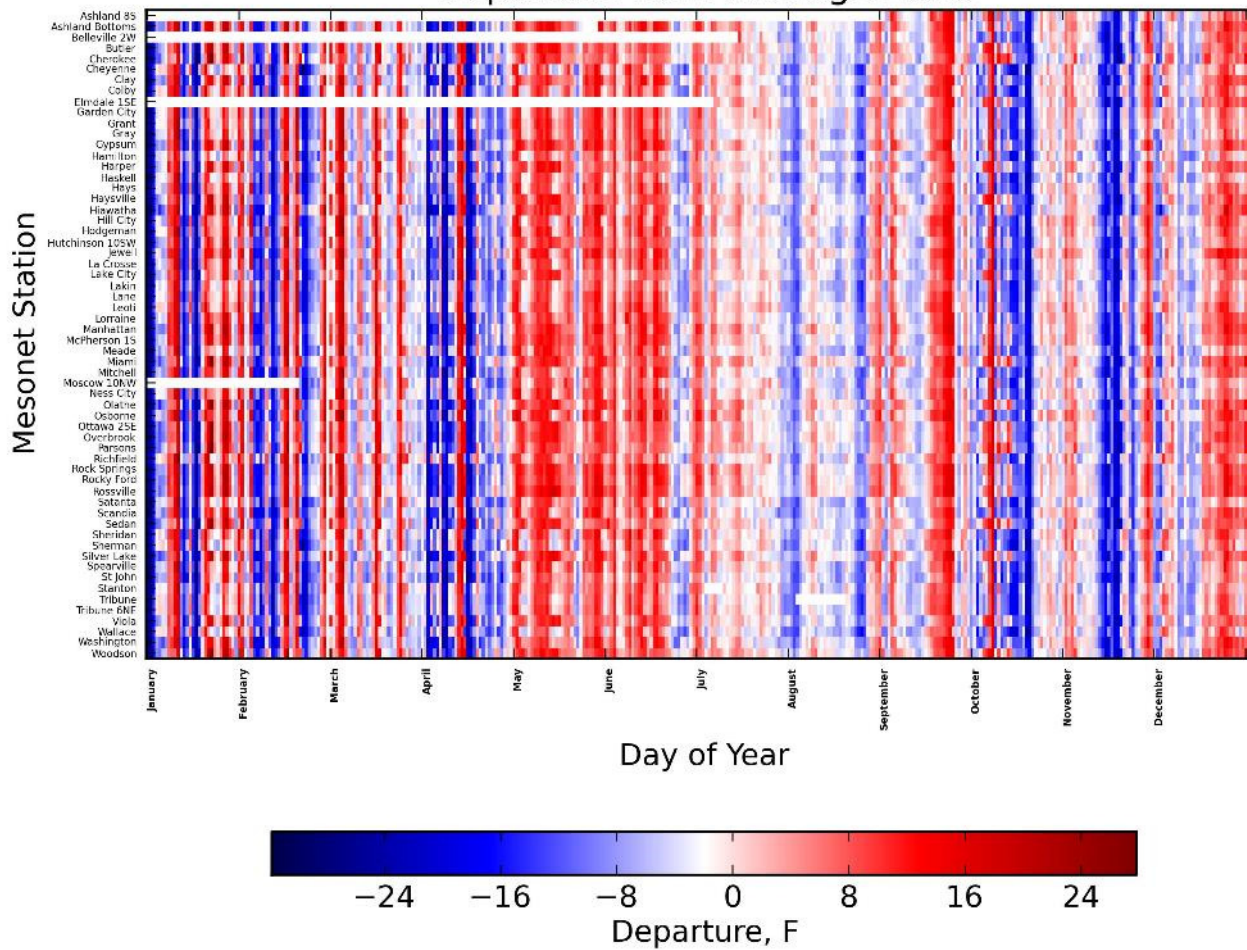
April 6, 2017
Kiowa, KS – NWCVT
OP average survival = 51.4%
Hybrid average survival = 20.4%
Planted October 3, 2016
Lowest temperature = -25°C

The plant breeding challenge for the southern Great Plains!

Low Temperatures - Manhattan, KS



Departure from Average 2018

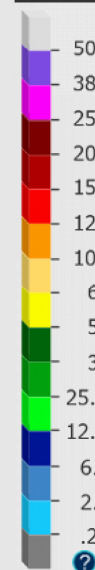
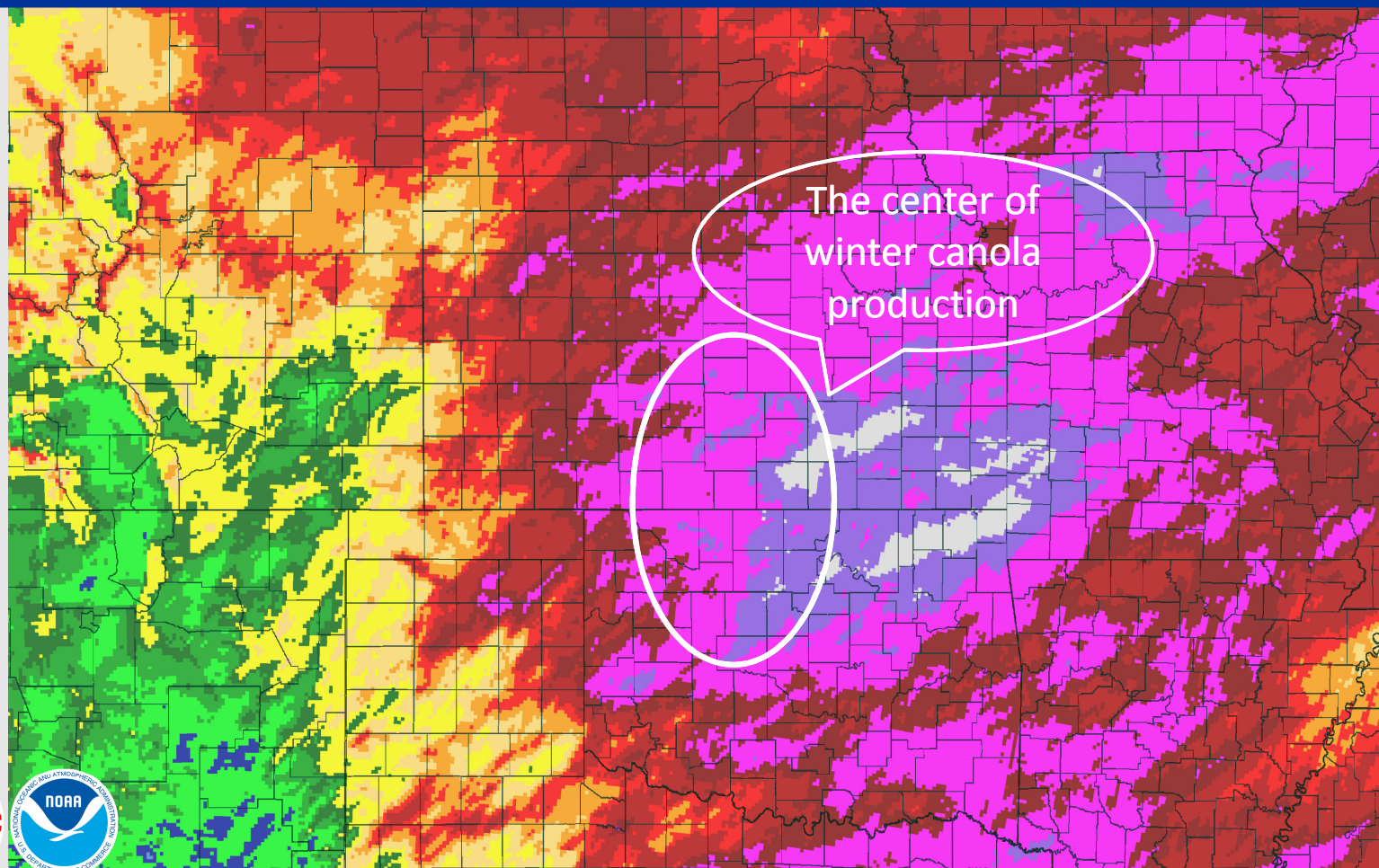


Source:
Kansas Mesonet

May 30, 2019 30-Day Observed Precipitation

Created on: May 30, 2019 - 18:17 UTC

Valid on: May 30, 2019 12:00 UTC



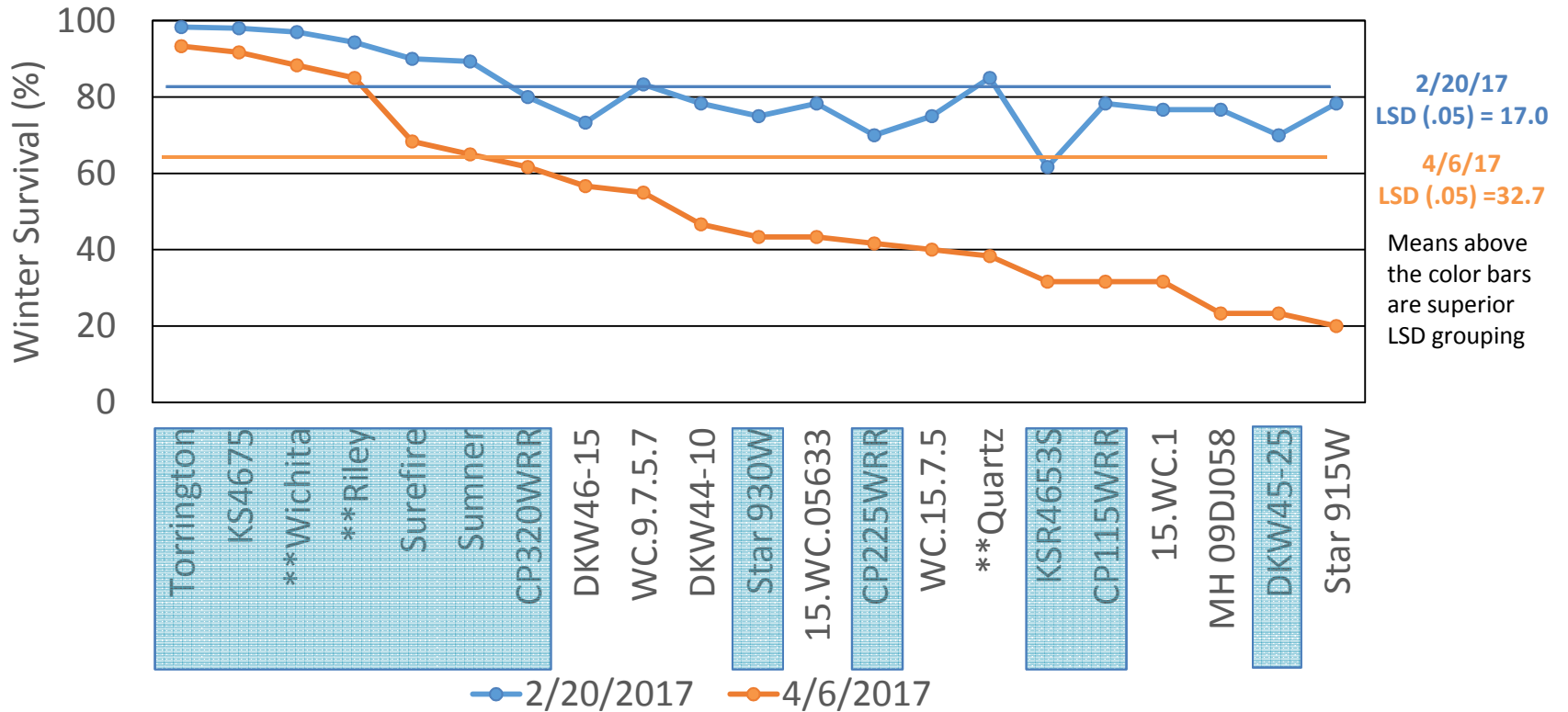
What are the problems?

- Warm, open autumn temperatures promoting overgrowth
- Rapid fluctuation in winter temperatures causing physical damage to overwintering rosettes
- Severely hardened off crops are limited by low biomass in the spring
- Limitations of current OPs and hybrids in “tough” years
- Drought and heat hinder oil production
- Flooding – May 2019 wettest on record for many!
- Inconsistent yield from year to year



Kiowa, KS - 2017 NWCVT

Open-Pollinated Cultivars



= regionally developed ** = OP checks

Kiowa, KS - 2017 NWCVT

Hybrid Cultivars

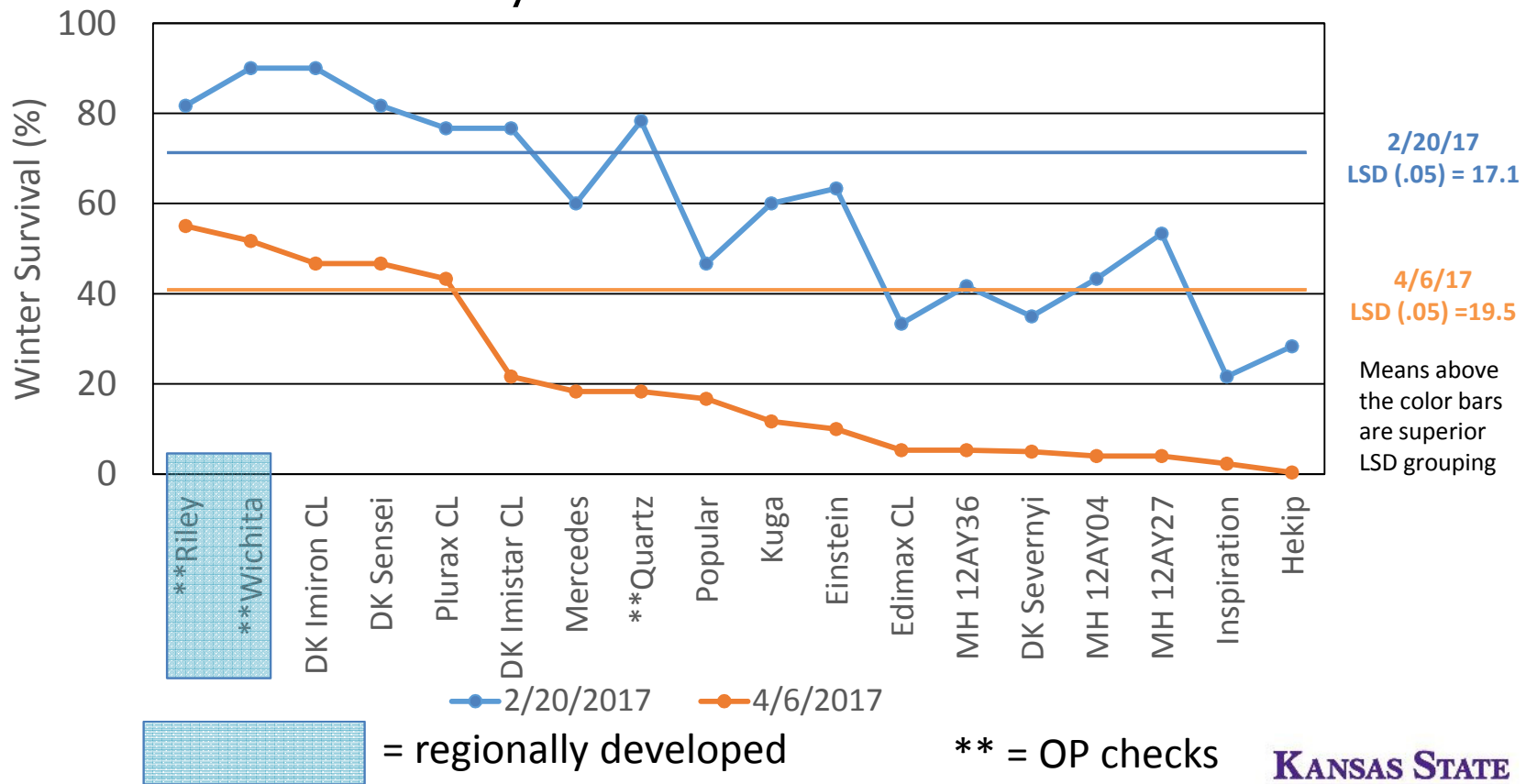


Table 1. Head-to-head comparison of OP and hybrid check cultivars across Great Plains environments tested in the NWCVT, 2012-2015.

Name ^a	Type	Source	Grain yield	Percentage of test-yield avg.	Winter 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	114.5	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

[†]Winter survival rated as the percent of surviving fall stand.

Stamm, M.J. 2016. Hybrid winter canola trends in the southern Great Plains. In Agron. Abs. [Online].

Oil Content Under High Night Temperature, High Day Temperature, and Drought

Pokharel et al., 2017

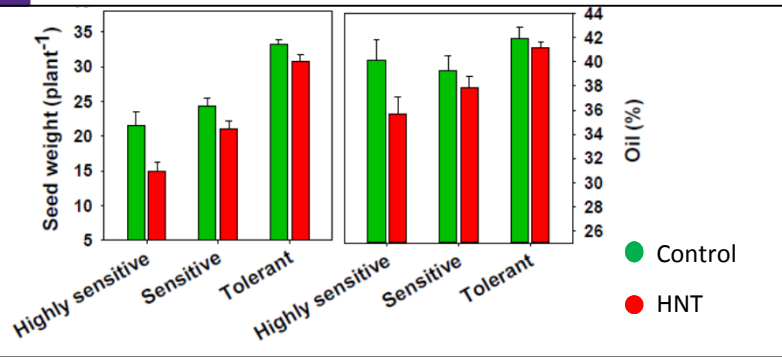
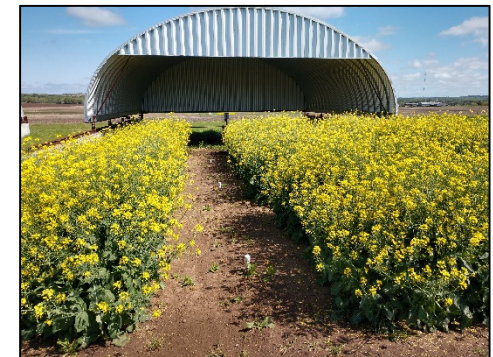


Figure 1. Seed weight and oil content across tolerant, sensitive, and highly sensitive groups of canola cultivars under control and HNT.

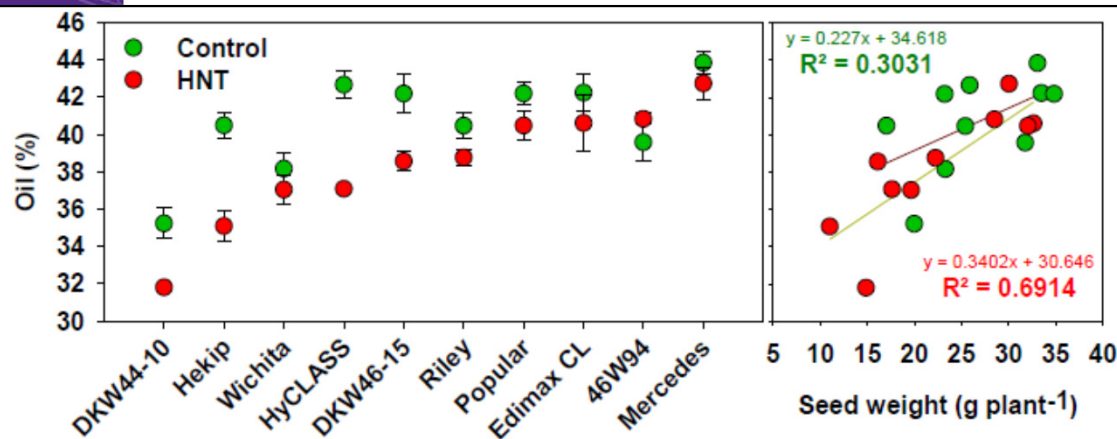
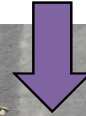


Figure 2. Variation in oil content and its association with seed weight under control and HNT.



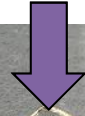
Semi-dwarf



Wichita



Hybrid



Winter Plant Types



Semi-Dwarf Rosettes



Semi-dwarf Benefits

- Prostrate growth habit
 - Low, well-anchored to the soil
- Less tendency for fall stem elongation
- Greater winter hardiness than most conventional hybrids
- Stiff stalk and reduced plant height
- Higher yield potential in challenging environments



NWCVT Yields (t/ha)	2017			2018		
	Hutchinson KS	Chickasha OK	Scottsbluff NE	Manhattan KS	Norwich KS	Clovis NM
Name						
CWH189D (SD)	3.9	6.5	3.8	2.6	1.9	3.4
DGC173D (SD)	3.9	6.1	3.9	2.1	1.9	3.8
Edimax CL	3.6	5.5	2.8	2.3	1.4	3.6
Mercedes	3.5	5.0	3.2	2.3	2.0	4.2
Mean	3.5	5.1	2.9	2.1	1.8	3.8
LSD (0.05)	0.4	1.1	0.9	0.5	0.4	0.5
Precipitation (7/1-6/30) (mm)	765.0	754.1	389.6	460.8	557.0	537.4
Normal Precipitation (mm)	771.6	936.7	402.3	885.4	771.6	450.6
Departure from Normal (mm)	-6.6	-182.6	-12.7	-424.6	-214.6	86.8
Irrigation (mm)	na	na	72.3	na	na	287.0
Elevation (m)	496.8	330.7	1125.9	324.3	455.9	1352.4

Semi-dwarf Female (SDF) x K-State Germplasm Winter Survival (%)

Name	Pedigree	Type	Manhattan		Belleville	
Griffin	---	OP	95.8	a	12.8	ab
Plainsman	---	OP	81.5	b	0.5	b
Torrington	---	OP	96.5	a	25.0	a
17KSH001	SDF/Griffin	Hyb	89.5	ab	4.0	b
17KSH002	SDF/Plainsman	Hyb	94.8	a	2.0	b
17KSH003	SDF/Torrington	Hyb	93.3	a	26.3	a
SDF	---	CMS	82.3	b	0.0	b

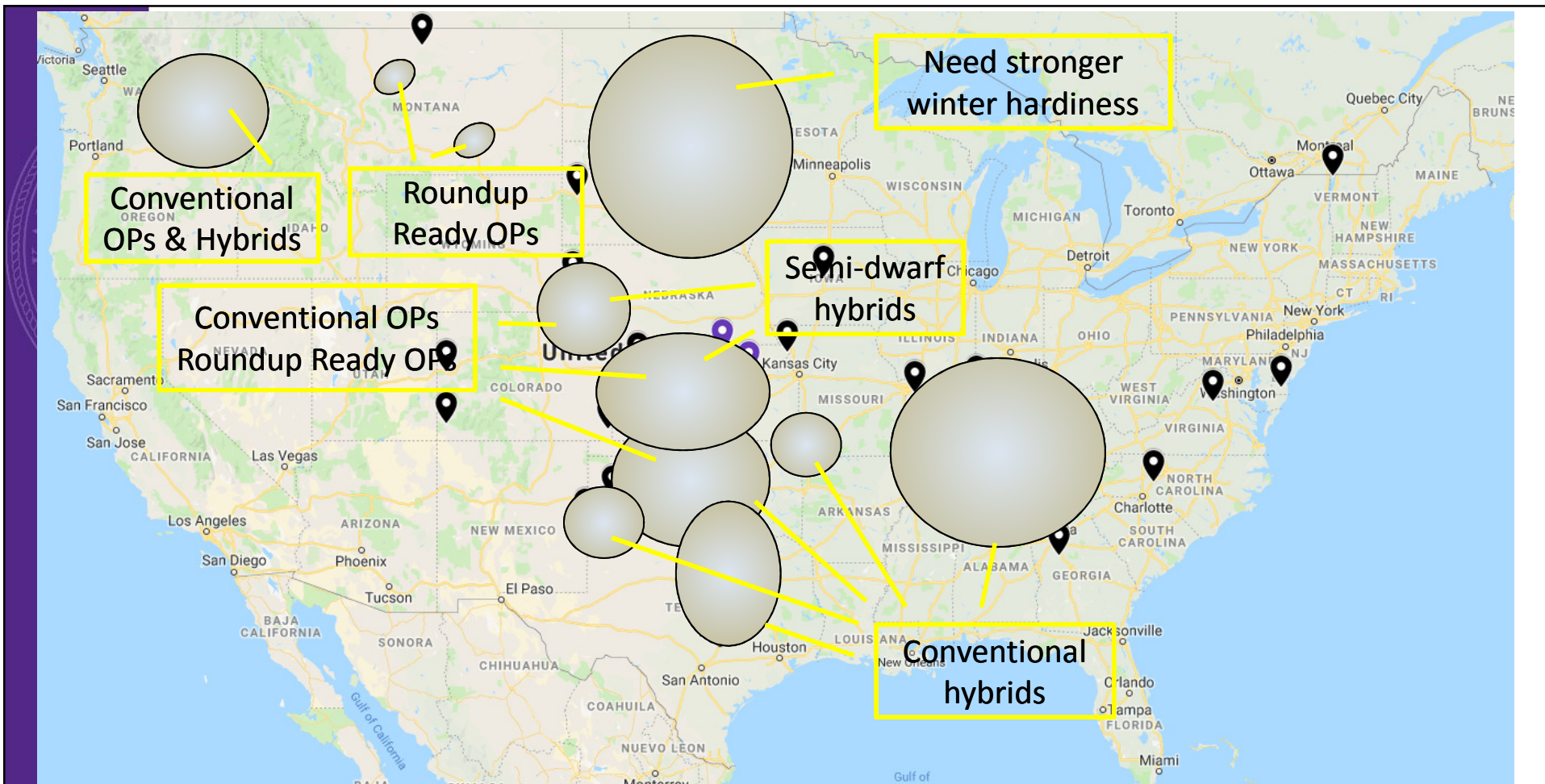
Means followed by the same letter in a column are not statistically significant at $P < 0.05$.

Hybrid Parent Line Development at K-State

- OGURA-INRA system
- Male sterile lines
 - Completing BC4 and first field evaluation
 - Increasing promising A/B combinations for testcross production
 - Introgressing TruFlex™ Roundup Ready® Technology into male sterile lines
- Restorer lines
 - F1s created and ready for DH production



Manhattan, KS Breeding Nursery
A/B Observation Block
January 9, 2019



Fitness of Current Cultivars



Future Challenges and Opportunities

Technology gaps

- Adapted hybrids
- Adequate herbicides for conventional canola
- Improved herbicide resistance trait options
- No labelled plant growth regulators

What is needed?

- Hybrid transition will continue over the next 5-15 years
- The U.S. Southern Great Plains provides a unique environment for semi-dwarf hybrids to excel
- Excellent weed control, consistent overwintering, yield, and oil contents, and pod shatter tolerance will revolutionize the southern Great Plains canola industry

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