Publication No. PHREC 15-30

High Plains Ag Lab

Update of Research Conducted in 2014

January 27, 2015

University of Nebraska
High Plains Agricultural Lab
Sidney, Nebraska

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High Plains Ag. Lab. Advisory Committee Annual Meeting
January 27, 2015 at 9:00 AM to 3:30 PM
Sidney campus of the Western Nebraska Community College

AGENDA

Administrative Updates

9:00 AM: Welcome by Keith Rexroth, HPAL Advisory Board Chair *(10 mins)*

9:10 AM: HPAL update by Dr. Jack Whittier, Director, Panhandle Res. & Ext. Center *(30 mins)*

- Faculty position update
- New Building update
- HPAL Future Development

HPAL Research Updates

9:40 AM: HPAL operations, *Tom Nightingale, Farm Manger, HPAL (20 mins)*

10:00 AM: Breeding small grain for western Nebraska, *Dr. Dipak Santra (10 mins)*

10:10 AM: Wheat stem sawfly update from 2014, *Dr. Jeff Bradshaw (20 mins)*

10:30 AM: Proso millet breeding, genetics and genomics, *Dr. Dipak Santra (30 mins)*

11:00 AM: Oil seed crops for western Nebraska: Sunflower, winter canola, brown mustard, *Dr. Dipak Santra (20 mins)*

11:20 AM: Winter canola under different tillage, *Robert Higgins (10 mins)*

11:30 AM: Field research of biotech crops, *Bill Struckmeyer (10 mins)*

11:40 AM: What's new in soil management? *Dr. Gary Hergert (20 mins)*

Noon – 1 PM: Lunch

1:00 PM: Tom Nightingale's career and contributions to the HPAL, *Dr. Gary Hergert (30 mins)*

1:30 PM: Grain legumes for western Nebraska: Pea and fenugreek, *Dr. Dipak Santra (20 mins)*

1:50 PM: Herbicide testing on field peas and fenugreek, *Robert Higgins (20 mins)*

2:10 PM: Field peas & summer annual forage mixtures for beef cattle, *Dr. Karla Jenkins (20 mins)*

2:30 PM: General Discussion (brain-storm session) by All *(60 mins)*

What is being done right?

What is NOT being done right?

What should be done differently?

2015 HPAL Field day in Aug along

Quarterly Newsletter

Advisory Board Business Meeting

3:30 PM: Adjourn

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ANNUAL REPORT

2014

HIGH PLAINS AGRICULTURAL LABORATORY

UNIVERSITY OF NEBRASKA

PANHANDLE RESEARCH AND EXTENSION CENTER

LOCATION: Six miles Northwest of Sidney, Nebraska

This report was prepared by the High Plains Staff

And manager, Tom Nightingale

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2014-2015

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PERSONNEL AT HPAL

2014

Employee	Title	Period Worked
Tom Nightingale	Manager	Jan 75-Dec 14
Paul McMillen	Farm Foreman	Mar 83-Dec 14
Rob Higgins	Crops Technician	May 91-Dec 14
Vernon Florke	Crops Technician	May 07Dec 14
Bill Struckmeyer	BQMS Technician	Jan 14-Dec 14
Justin McMechan	Post Doc Student	May 12-Aug14
Jeremy Riemers	Summer Work	May 13-Aug 14
David Wills	Summer Work	Apr 14-Dec 14
Kali Robb	Summer Work	May 14-Aug14
David Blanke	Summer Work	May 14-Aug 14
Duane Nightingale	Summer Work	Apr 14-Sept 14
Larry Nelson	Summer Work	Apr 14-Sept 14

PROFESSIONAL STAFF OF THE PANHANDLE RESEARCH AND EXTENSION CENTER WHO CONDUCTED EXPERIMENTAL TRIALS OR WERE INVOLVED AT THE HIGH PLAINS AGRICULTURAL LABORATORY

STAFF MEMBER	TITLE
Dr. Jack Whittier	Director, Panhandle Res & Ext Center
Dr. Gary Hergert	Prof of Agronomy/Horticulture
Dr. Jeff Bradshaw	Assoc. Prof of Entomology
Dr. Dipak Santra	Assoc. Prof of Agronomy/Horticulture
Dr. Alexander Pavlista	Prof of Agronomy/Horticulture
Dr. Karla Jenkins	Asst Prof of Animal Science
Karen Deboer	Extension Educator
Aaron Berger	Extension Educator
Karen Schultz	Business Manager, PREC
Harrison Boateng	System Support Specialist

PROFESSIONAL STAFF WITH THE UNIVERSITY OF NEBRASKA WHO CONDUCTED EXPERIMENTAL TRIALS OF WERE INVOLVED AT THE HIGH PLAINS AGRICULTURAL LABORATORY

STAFF MEMBER	TITLE
Dr. Stephen Baenziger	Prof of Agronomy/Horticulture
Dr. Gary Hein	Prof of Entomology & Director of Plant Health Program
Dr. Robert Graybosch	USDA-ARS
Dr. Stephen Wegulo	Assoc Prof of Plant Pathology
Dr. Teshome Regassa	Research Asst. Professor
Dr. Edward Cahoon	Prof of Biochemistry

PROFESSIONAL STAFF OUTSIDE THE UNIVERSTIY OF NEBRASKA WHO HAD COOPERATIVE STUDIES WITH REGULAR STAFF MEMBERS

NAME	ORGANIZATION
Dr. Drew Lyon	Washington State University
Dr. Urszula Norton	University of Wyoming
Dr. David Nielsen	USDA-ARS, Akron, CO
Dr. Maysoon Mikha	USDA-ARS, Akron, CO
Dr. Francisco Calderon	USDA-ARS, Akron, CO
Dr. Joseph Benjamin	USDA-ARS, Akron, CO

RESEARCH TRIALS CONDUCTED DURING 2014

WHEAT

TRIAL	STAFF	DESCRIPTION
Wheat nursery	Baenziger Graybosch Santra	Exp. varieties in comparison with established varieties
Wheat quality	Baenziger Lan Xu	Milling and baking quality of varieties
Long term tillage studies	Hergert Higgins	Comparisons of plow, subtill, and no-till
White wheat nursery	Baenziger Graybosch	Exp. white wheats
Winter wheat variety trial	Santra Regassa Florke	Varieties & exp. lines
2-Gene Clearfield winter wheat	Hergert Higgins	Evaluation of seed treatment combined with fungicide treatments
Clearfield winter wheat	Hergert Higgins	Evaluation of weed control and tolerance of 2-gene CL winter wheat for feral rye control
FMC Fallow Trial	Hergert	Combinations of Authority & Spartan Charge for kochia & broadleaf weed control in fallow
Hail Simulation Study	Hein McMechan Higgins	Window of risk establishment during heading stages of wheat
Over-summering ecology Of the wheat-curl mite	Hein McMechan	Establishing risks for alternative over-summer hosts for wheat curl mites

Impact of rainfall on wheat curl mite population	Hein McMechan	Simulated rainfall at various stages of headed wheat
Planting date & variety selection For management of the wheat	Hein McMechan Higgins	Evaluation of early and late planting of commercial varieties of winter wheat
Weed survey of winter Wheat stubble	Hein McMechan	Weed survey of grassy weeds in tri-state area
Seeding rate, seed treatment, foliar N study on wheat	Regassa Bhatta Baenziger Rose Wegulo Bradshaw Eskridge	Effect of seeding rate, seed treatment for foliar disease control, foliar N application on canopy characteristics, yield and quality

ALTERNATIVE CROPS

TRIAL	STAFF	DESCRIPTION
MILLET		
Proso millet variety trial	Santra Florke	variety testing under dryland, irrigated and organic production
Proso millet breeding	Santra Florke	Elite and preliminary trials, head rows, F3, and F2 nurseries
Proso millet germplasm	Santra Rajput	Germplasm evaluation for agronomic traits
Proso millet genetics and genomics	Santra Rajput	Mapping genes and QTLs for various agronomic traits (lodging & shattering resistance, maturity, plant, height, panicle characteristics, seed size, and color)

SUNFLOWER

Sunflower varieties, oils	Santra Florke	Dryland and irrigated sunflower varieties
Sunflower varieties, confections	Santra Florke	Irrigated confection varieties

WINTER CANOLA

Winter Canola	Santra Hergert Higgins	Evaluation of no-till, minimum till, and stale seedbeds for winter canola production
Winter Canola	Santra Florke	Winter screening nursery & variety trial

PEA (YELLOW PEA OR FIELD PEA)

Pea	Santra Florke	Dryland variety trial
Pea herbicide trial	Hergert Higgins	Evaluation of pre-emerge and post treatments in field peas

FENUGREEK

Fenugreek variety trial	Santra Pavlista Florke	Irrigated variety trial
Fenugreek herbicides	Santra Pavlista Hergert Higgins Florke	Herbicide (pre- & post) screening

WINTER BARLEY

Winter Barley	Baenziger Santra Florke	Variety trial

FORAGES

TRIAL	STAFF	DESCRIPTION
Winter triticale	Santra Baenziger Florke	Winter triticale varieties
Forage production	Jenkins Hergert Lyon Berger Stone Higgins	Comparison of sorghum-sudan, oats, & foxtail millet after winter wheat harvest, under limited irrigation
Cocktail Forage Mix	Jenkins Higgins	Comparison of cocktail mixes for forage production

COVER CROPS

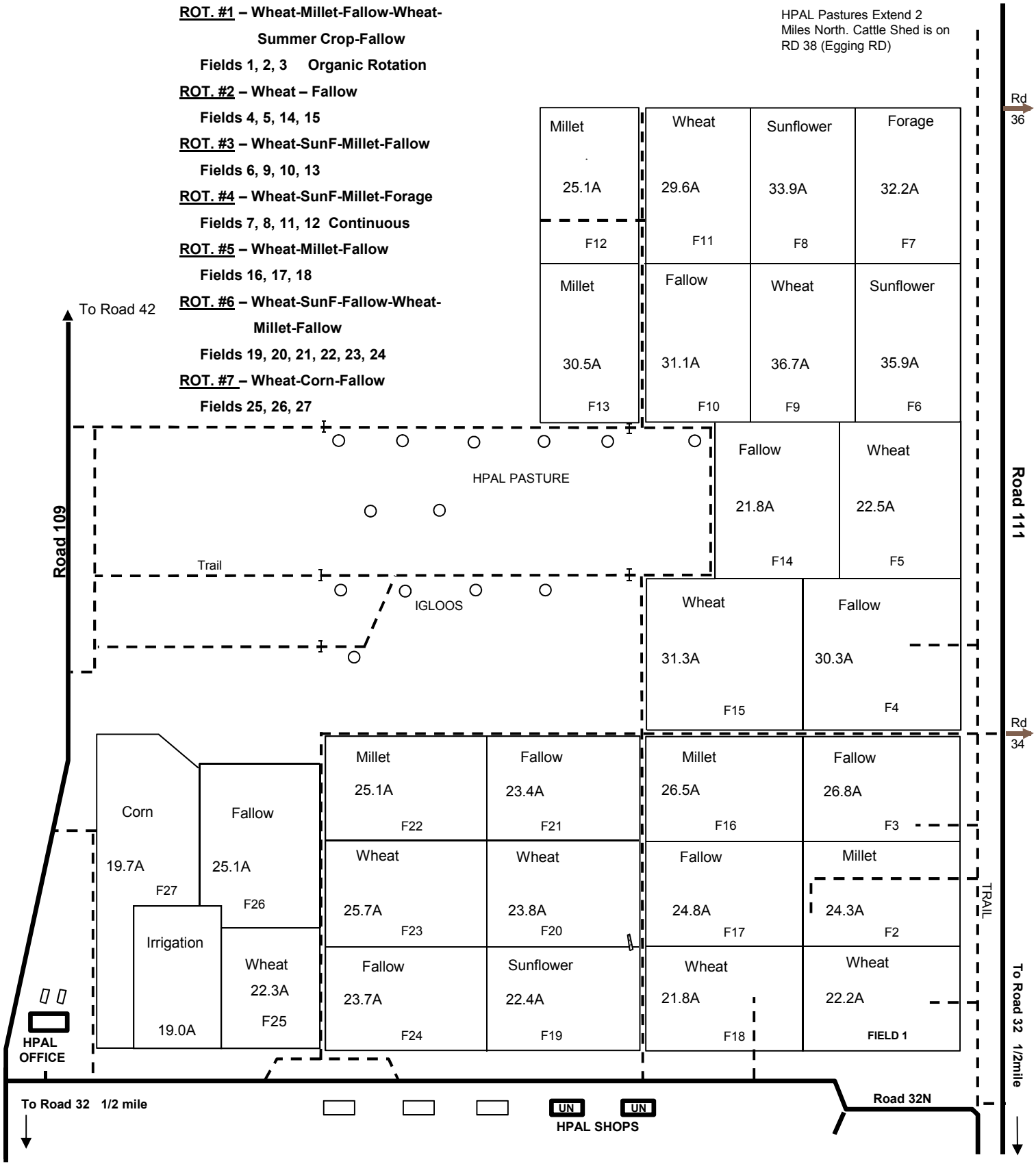
TRIAL	STAFF	DESCRIPTION
Cover crop water use	Lyon Nielsen Hergert Higgins	Evaluation of cover crop water use and impact on following winter wheat crop

2014 HPAL

UNIVERSITY of NEBRASKA
HIGH PLAINS AG LAB

NORTH ↑

ROT. #1 – Wheat-Millet-Fallow-Wheat-Summer Crop-Fallow
Fields 1, 2, 3 Organic Rotation
ROT. #2 – Wheat – Fallow
Fields 4, 5, 14, 15
ROT. #3 – Wheat-SunF-Millet-Fallow
Fields 6, 9, 10, 13
ROT. #4 – Wheat-SunF-Millet-Forage
Fields 7, 8, 11, 12 Continuous
ROT. #5 – Wheat-Millet-Fallow
Fields 16, 17, 18
ROT. #6 – Wheat-SunF-Fallow-Wheat-Millet-Fallow
Fields 19, 20, 21, 22, 23, 24
ROT. #7 – Wheat-Corn-Fallow
Fields 25, 26, 27

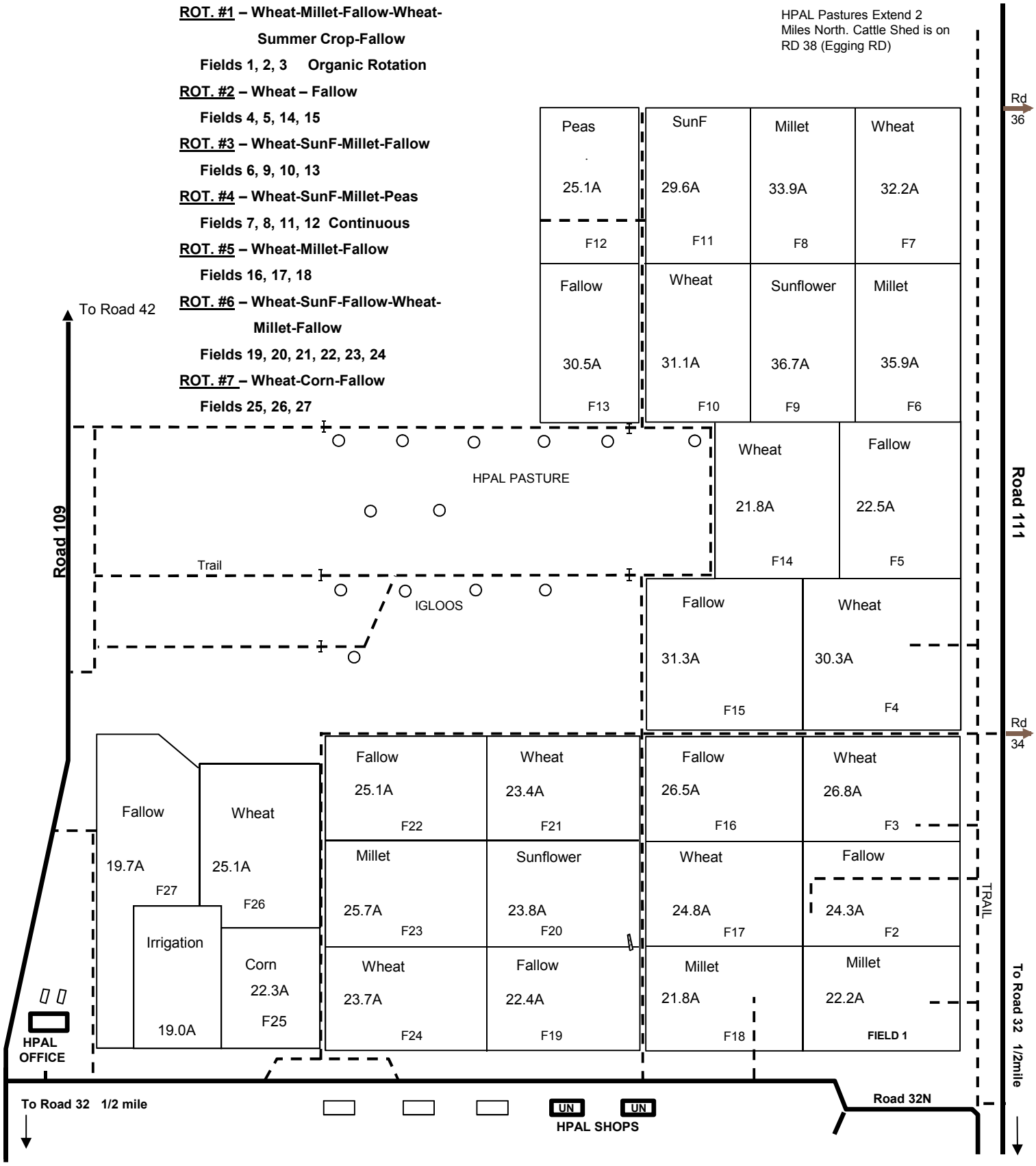


2015 HPAL

UNIVERSITY of NEBRASKA
HIGH PLAINS AG LAB

NORTH

ROT. #1 – Wheat-Millet-Fallow-Wheat-Summer Crop-Fallow
Fields 1, 2, 3 Organic Rotation
ROT. #2 – Wheat – Fallow
Fields 4, 5, 14, 15
ROT. #3 – Wheat-SunF-Millet-Fallow
Fields 6, 9, 10, 13
ROT. #4 – Wheat-SunF-Millet-Peas
Fields 7, 8, 11, 12 Continuous
ROT. #5 – Wheat-Millet-Fallow
Fields 16, 17, 18
ROT. #6 – Wheat-SunF-Fallow-Wheat-Millet-Fallow
Fields 19, 20, 21, 22, 23, 24
ROT. #7 – Wheat-Corn-Fallow
Fields 25, 26, 27



YIELD SUMMARIES
2012, 2013, 2014

ROTATION

	2012	2013	2014
R#1	**WHEAT – MILLET – FALLOW – WHEAT – SUNFLOWER – FALLOW; ORGANIC**		
F1	SunF-473lb/a	Fallow	Wheat-34.6 bu/a
F2	Fallow	Wheat-40.6 bu/a	Millet-29.0 bu/a
F3	Wheat-50.6bu/a	Millet-0 bu/a-hail	Fallow
R#2	**WHEAT – FALLOW**		
F4	Fallow	Wheat-44.3 bu/a	Fallow
F5	Wheat-50.8bu/a	Fallow	Wheat-48.8 bu/a
F14	Fallow	Wheat-47.4 bu/a	Fallow
F15	Wheat-45.1bu/a	Fallow	Wheat-44.2 bu/a
R#3	**WHEAT – SUNFLOWER – MILLET – FALLOW**		
F6	Fallow	Wheat-39.2 bu/a	SunF-1558 lb/a
F9	Millet-2.6bu/a	Fallow	Wheat-31.5 bu/a
F10	SunF-843lb/a	Millet-10.7 bu/a	Fallow
F13	Wheat-46.3bu/a	SunF-710 lb/a	Millet-36.5 bu/a
R#4	**WHEAT – SUNFLOWER – MILLET – FORAGE/PEAS**		
F7	SunF-843lb/a	Millet-0 bu/a-hail	Peas-23 bu/a
F8	Forage-Grazed	Wheat-37.5 bu/a	SunF-1773 lb/a
F11	Millet-2.6bu/a	Fallow	Wheat-22.4 bu/a
F12	Wheat-41.7bu/a	SunF-710 lb/a	Millet-35.8 bu/a

YIELD SUMMARIES (con't)

ROTATION

	2012	2013	2014
R#5	**WHEAT – MILLET – FALLOW**		
F16	Wheat-44.6bu/a	Wheat-23.8 bu/a	Millet-41.2 bu/a
F17	Wheat-50.3bu/a	Millet-10.7 bu/a	Fallow
F18	Millet-42.1bu/a	Fallow	Wheat-49.1 bu/a
R#6	**WHEAT – SUNFLOWER – FALLOW – WHEAT – MILLET – FALLOW**		
F19	Fallow	Wheat-41.9 bu/a	SunF-1534 lb/a
F20	Millet-42.9bu/a	Fallow	Wheat-51.2 bu/a
F21	Wheat-43.6bu/a	Millet-10.7 bu/a	Fallow
F22	Fallow	Wheat-30.3 bu/a	Millet-35.5 bu/a
F23	SunF-843lb/a	Fallow	Wheat-53.9 bu/a
F24	Wheat-43.8bu/a	SunF-969 lb/a	Fallow
R#7	**WHEAT – CORN – FALLOW**		
F25	Corn-41.3bu/a	Fallow	Wheat-53.8 bu/a
F26	Wheat-53.5bu/a	Corn-79.3 bu/a	Fallow
F27	Fallow	Wheat-41.2 bu/a	Corn-79.5 bu/a

CROP

	2012	2013	2014
Wheat	47.0bu/a	34.7 bu/a	43.3 bu/a
Millet	22.6bu/a	5.8 bu/a-hail	35.6 bu/a
Sunflower	843lb/a	783.3 lb/a	1621.7 lb/a
Corn	41.3bu/a	79.3 bu/a	79.5 bu/a

HIGH PLAINS AG LAB WEATHER DATA
OCTOBER 1, 2013 – SEPTEMBER 30, 2014

Month	Precipitation		Avg. Max. Temp.		Avg. Min. Temp.	
	2014	Normal	2014	Normal	2014	Normal
October	1.38	0.91	59.3	64.2	34.2	33.7
November	0.54	0.46	51.4	49.8	23.3	21.9
December	0.04	0.31	39.8	40.9	13.2	14.6
January	0.31	0.29	42.6	39.6	12.1	12.4
February	1.05	0.35	32.9	43.2	7.5	16.1
March	0.49	0.90	52.7	50.1	24.5	22.5
April	0.51	1.60	63.3	59.8	32.4	31.2
May	3.82	2.90	71.1	69.5	42.4	41.6
June	3.17	3.15	79.0	79.8	51.0	51.2
July	0.63	2.58	89.2	87.9	57.5	57.4
August	2.21	1.96	87.6	85.9	55.5	55.5
September	3.42	1.42	80.1	76.9	48.8	45.4
Year	17.76	16.84	63.1	62.3	34.3	33.6

Normal = 67 year average

2014 CROP ROTATION #1
3 Year Stacked – Organic
Fields 1, 2, 3
Wheat, Millet, Fallow, Wheat, Sunflower, Fallow

Operations

Field 1 – 22.2 acres – Wheat – Previous crop, Fallow

July 27	Harvest wheat – Yield 34.6 bu/a
Sept 19	Undercut

Field 2 – 24.3 acres – Millet – Previous crop, Wheat

April 22	Disc
May 28	Chisel
June 26	Finish mulcher
June 27	Seed 15 lb/a Huntsman millet
Sept 8	Swath millet
Sept 25	Harvest – Yield, 29.0 bu/a

Field 3 – 26.8 acres – Fallow – Previous crop, Millet

May 28	Chisel
June 26	Finish mulcher
July 27	Disc
Aug 13	Chisel
Aug 26	Finish mulcher
Sept 7	Finish mulcher
Sept 9	Seed 45 lb/a Pronghorn wheat

2014 CROP ROTATION #2
2 Year
Fields 4, 5, 14, 15
Wheat, Fallow

Operations

Field 4 – 30.3 acres – Fallow – Previous crop, Wheat

April 19	45 lb/a nitrogen
May 27	28 oz/a Roundup PowerMax + 8 oz/a LV6
July 7	22 oz/a Roundup PowerMax + 2 oz/a Sharpen
Aug 2	31 oz/a Roundup PowerMax + 5 oz/a Distinct
Sept 3	28 oz/a Roundup PowerMax + 1.25 oz/a Sharpen
Sept 9	Seed 50 lb/a Settler CL wheat

Field 5 – 22.5 acres – Wheat – Previous crop, Fallow

April 19	45 lb/a nitrogen
May 19	4 oz/a Beyond
July 28	Harvest wheat – Yield, 48.8 bu/a
Sept 2	28 oz/a Roundup RT3 + 1.25 oz/a Sharpen + 9 oz/a LV6

Field 14 – 21.8 acres – Fallow – Previous crop, Wheat

April 19	45 lb/a nitrogen
April 20	28 oz/a Roundup PowerMax + 8 oz/a LV6
June 26	20 oz/a Roundup PowerMax + 2 oz/a Sharpen
Aug 2	31 oz/a Roundup PowerMax + 5 oz/a Distinct
Sept 3	28 oz/a Roundup PowerMax + 1.25 oz/a Sharpen
Sept 8	Seed 50 lb/a Settler CL wheat

Field 15 – 31.3 acres – Wheat – Previous crop, Fallow

April 19	45 lb/a nitrogen
May 19	4 oz/a Beyond
July 25	Harvest wheat – Yield, 44.2 bu/a
Sept 2	28 oz/a Roundup RT3 + 1.25 oz/a Sharpen + 9 oz/a LV6

2014 CROP ROTATION #3
4 Year
Fields 6, 9, 10, 13
Wheat, Sunflower, Millet, Fallow

Operations

Field 6 – 35.9 acres – Sunflower – Previous crop, Wheat

April 18	45 lb/a nitrogen
May 29	28 oz/a Roundup PowerMax + 8 oz/a LV6
June 3	Seed 16,000/a 306 Croplan oil sunflowers
June 4	2.5 pt/a Prowl H2O + 2.8 oz/a Spartan Charge + 16oz/a Roundup
Oct 15	Harvest – Yield 1558 lb/a

Field 9 – 36.7 acres – Wheat – Previous crop, Fallow

July 26	Harvest wheat – Yield, 31.5 bu/a
Sept 3	28 oz/a Roundup RT3 + 1.25 oz/a Sharpen + 9 oz/a LV6

Field 10 – 31.1 acres – Fallow – Previous crop, Millet

April 18	45 lb/a nitrogen
April 20	28 oz/a Roundup PowerMax + 8 oz/a LV6
May 12	20 oz/a Roundup PowerMax + 1 oz/a Sharpen
June 30	Disc
July 31	Finish mulcher
Sept 4	Finish mulcher
Sept 8	Seed 45 lb/a Pronghorn wheat

Field 13 – 30.5 acres – Millet – Previous crop, Sunflower

April 16	45 lb/a nitrogen
May 20	28 oz/a Roundup PowerMax + 8 oz/a LV6
June 5	20 oz/a Roundup PowerMax + 1.2 oz/a Sharpen
June 12	Seed 15 lb/a Huntsman millet
July 3	6 oz/a Starane Ultra
Sept 8	Swath millet
Sept 26	Harvest millet – Yield, 36.5 bu/a

2014 CROP ROTATION #4
4 Year Continuous
Fields 7, 8, 11, 12
Wheat, Sunflower, Millet, Peas

Operations

Field 7 – 32.2 acres – Peas – Previous crop, Millet

April 11	1.5 oz/a Optill + 40 oz/a Bucaneer +
April 12	Seed 180 lb/a Admiral peas
July 29	Harvest peas – Yield, 23 bu/a
Aug 4	25 oz/a Roundup PowerMax + 2 oz/a Sharpen + 8 oz/a LV6
Sept 2	28 oz/a Roundup RT3 + 1.25 oz/a Sharpen
Sept 9	Seed 50 lb/a Pronghorn wheat

Field 8 – 33.9 acres – Sunflowers – Previous crop, Wheat

April 17	45 lb/a nitrogen
May 29	28 oz/a Roundup PowerMax + 8 oz/a LV6
June 3	Seed 16,000/a 306 Croplan oil sunflowers
June 4	2.5 pt/a Prowl H2O + 2.8 oz/a Spartan Charge + 16 oz/a Roundup
Oct 16	Harvest sunflowers – Yield, 1773 lb/a

Field 11 – 29.6 acres – Wheat – Previous crop, Fallow

July 26	Harvest wheat – Yield, 22.4 bu/a
Sept 3	28 oz/a roundup RT3 + 1.25 oz/a Sharpen + 9 oz/a LV6

Field 12 – 25.1 acres – Millet – Previous crop, Sunflowers

April 16	45 lb/a nitrogen
May 23	28 oz/a Roundup PowerMax + 8 oz/a LV6
June 5	20 oz/a roundup PowerMax + 1.2 oa/a Sharpen
June 12	Seed 15 lb/a Huntsman millet
July 3	6 oz/a Starane Ultra
Sept 8	Swath millet
Sept 26	Harvest millet – Yield, 35.8 bu/a

2014 CROP ROTATION #5
3 Year
Fields 16, 17, 18
Wheat, Millet, Fallow

Operations

Field 16 – 26.5 acres – Millet – Previous crop, Wheat

April 18	45 lb/a nitrogen
May 27	28 oz/a Roundup PowerMax + 8 oz/a LV6
June 12	Seed 15 lb/a Huntsman millet
July 3	6 oz/a Starane Ultra
Sept 8	Swath millet
Sept 25	Harvest millet – Yield, 41.2 bu/a

Field 17 – 24.8 acres – Fallow – Previous crop, Millet

April 18	45 lb/a nitrogen
May 27	28 oz/a Roundup PowerMax + 8 oz/a LV6
June 12	20 oz/a Roundup PowerMax + 1 oz/a Sharpen
July 28	20 oz/a Roundup PowerMax + 2 oz/a Sharpen
Sept 2	28 oz/a Roundup RT3
Sept 10	Seed 50 lb/a Pronghorn wheat

Field 18 – 21.8 acres – Wheat – Previous crop, Fallow

April 18	45 lb/a nitrogen
July 21	Harvest wheat – Yield, 49.1 bu/a
Sept2	28 oz/a Roundup RT3

2014 CROP ROTATION #6
6 Year
Fields 19, 20, 21, 22, 23, 24
Wheat, Sunflower, Fallow, Wheat, Millet, Fallow

Operations

Field 19 – 22.4 acres – Sunflower – Previous crop, Wheat

April 16	45 lb/a nitrogen
May 26	28 oz/a Roundup PowerMax + 8 oz/a LV6
June 3	Seed 16,000/a 306 Croplan oil sunflowers
June 4	2.5 pt/a Prowl H2O + 2.8 oz/a Spartan Charge + 16 oz/a Roundup
Oct 10	Harvest flowers – Yield, 1534 lb/a

Field 20 – 23.8 acres – Wheat – Previous crop, Fallow

July 22	Harvest wheat – Yield, 51.2 bu/a
Sept 3	28 oz/a Roundup RT3 + 1.25 oz/a Sharpen + 9 oz/a LV6

Field 21 – 23.4 acres – Fallow – Previous crop, Millet

April 20	45 lb/a nitrogen
May 28	28 oz/a Roundup PowerMax + 8 oz/a LV6
July 7	20 oz/a Roundup PowerMax + 2 oz/a Sharpen
Sept 2	28 oz/a Roundup RT3
Sept 9	Seed 50 lb/a Settler CL wheat

Field 22 – 25.1 acres – Millet – Previous crop, Wheat

April 20	45 lb/a nitrogen
May 28	28 oz/a Roundup PowerMax + 8 oz/a LV6
June 12	Seed 15 lb/a Huntsman millet
July 3	6 oz/a Starane Ultra
Sept 8	Swath millet
Sept 26	Harvest millet – Yield, 35.5 bu/a

Field 23 – 25.7 acres – Wheat – Previous crop, Fallow

July 25	Harvest wheat – Yield, 53.9
Sept 3	28 oz/a Roundup RT3 + 1.25 oz/a Sharpen + 9 oz/a LV6

Field 24 – 23.7 acres – Fallow – Previous crop, Sunflower

April 16	45 lb/a nitrogen
May 26	28 oz/a Roundup PowerMax + 8 oz/a LV6
June 12	20 oz/a Roundup PowerMax + 1 oz/a Sharpen
Aug 2	20 oz/a Roundup PowerMax + 1 oz/a Sharpen
Sept 2	28 0z/a Roundup RT3
Sept 10	Seed 50 lb/a Pronghorn wheat

2014 CROP ROTATION #7
3 Year
Fields 25, 26, 27
Wheat, Corn, Fallow

Operations

Field 25 – 22.3 acres – Wheat – Previous crop, Fallow

July 24	Harvest wheat – Yield, 53.8 bu/a
Sept 3	28 oz/a Roundup RT3 + 1.25 oz/a Sharpen + 9 oz/a LV6

Field 26 – 25.1 acres – Fallow – Previous crop, Corn

April 17	45 lb/a nitrogen
May 29	28 oz/a Roundup PowerMax + 8 oz/a LV6
June 30	Disc
July 31	Finish mulcher
Sept 6	Finish mulcher
Sept 9	Seed 45 lb/a Pronghorn wheat

Field 27 – 19.7 acres – Corn – Previous crop, Wheat

April 16	65 lb/a nitrogen
May 9	Seed 14,000/a Croplan 3533 corn
May 20	28 oz/a Roundup PowerMax + 1 lb/a Atrazine
July 5	22 oz/a Roundup PowerMax
Oct 10	Harvest corn – Yield, 79.5 bu/a

Breeding Small Grains For Western Nebraska

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Background:

Small grains (winter wheat, winter triticale, and winter barley) are important crops in western Nebraska and provide growers with consistent yields and crop choices. While winter wheat is by far the most important small grain in western NE, its uses are evolving and there are opportunities for increasing the acreage of winter triticale and barley. Winter wheat is mainly used as a grain crop, but recently it is also used as a "flex" crop where wheat is planted and then depending upon the economics and wheat crop conditions, it may proceed to grain harvest or used as a cover crop before another crop. With the droughts that have occurred in western Nebraska, forage triticale can provide annual forage crop that can supplement other sources of forage. Winter barley and triticale have a place in cover crops. In addition, winter barley is immune to karnal bunt which could cause serious economic losses and major marketing changes.

Experiments at HPAL:

In 2014, we harvested all of our preliminary observation, intermediate, and elite nursery trials for hard winter wheat, and winter triticale. Winter barley was damaged by the winter and early spring; hence no data was collected on the barley intermediate and elite trial. In addition, Dr. Santra planted a small triticale forage trial that was successfully harvest and provided excellent data on forage potential in western NE (Table 1). We also planted the majority of our F_3 segregating wheat bulks at HPAL so that we could see how they perform under western NE conditions where most of wheat lines are grown and as a back-up should something catastrophic happen for our main breeding site at Mead, NE. The triticale grain data from these trials is reported as part of the State Variety Small Grains Book. The data from the elite trial at Sidney (and form the other testing sites) is on Table 2.

In 2015, we again planted all of preliminary observation, intermediate, and elite nursery trials for hard winter wheat, winter triticale, and winter barley at HPAL. In addition, Dr. Santra planted the 2015 winter triticale forage trials. With the new research farm at Grant, NE, we temporarily moved our F_3 segregating wheat bulks to that location. It remains to be seen if they will stay at Grant, alternate with Grant and Sidney, or return to Sidney.

Table 1. Forage triticale yield of 2014 trial at the HPAL

Entry	Name	DM Yield (lbs/a)	Yield rank
1	NE422T	5920	2
2	NT06427	5594	4
3	NT01451	5030	5
4	NT05421	6325	1
5	NT07403	4844	8
6	NT12403	4693	9
7	NT06422	5631	3
8	NT11406	3696	10
9	NT11428	4884	7
10	NE426GT	4964	6
	Trial Mean	**5158**	
	LSD	**1049**	
	CV	**16.89**	
	Heritability	**0.32**	

Table 2. Result of wheat elite trial at Sidney (and form the other testing sites)

		Mead	Linc.	ClayCen	Nplatte	Sidney	Alliance	McCook	Average	
		Yield	Yield	Yield	Yield	Yield	Yield	Yield	Yield	Rank
entry	name	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	bu/a	
1	WESLEY	25.7	70.0	51.5	58.3	56.2	66.9	87.6	59.5	41
2	OVERLAN	34.1	71.9	60.7	56.9	70.8	68.3	82.8	63.6	16
3	NE01481	26.7	68.3	49.0	56.4	73.8	50.5	87.2	58.8	49
4	NI04420	33.0	71.2	53.1	53.8	74.3	70.2	83.0	62.7	20
5	NE06430	31.4	72.1	47.5	54.6	64.0	59.6	82.5	58.8	50
6	NE06545	30.9	72.6	56.4	51.6	74.5	72.2	70.6	61.3	30
7	NE07486	33.2	73.9	50.8	49.5	70.4	62.8	81.4	60.3	34
8	NE07531	27.9	74.7	52.9	52.2	72.5	68.9	81.5	61.5	27
9	NE08499	34.7	72.7	56.9	45.4	66.9	61.2	80.4	59.7	39
10	NE09517	33.5	72.7	59.2	54.9	79.5	67.3	86.3	64.8	8
11	NE09521	31.9	69.4	55.0	55.1	71.3	57.9	80.5	60.2	37
12	NE10478	30.8	79.1	52.6	54.2	62.6	56.4	87.5	60.5	32
13	NE10507	34.1	76.2	53.4	56.9	77.2	52.7	87.8	62.6	21
14	NE10589	26.2	77.9	63.5	54.5	77.7	71.8	85.6	65.3	4
15	NE10683	35.6	73.2	59.5	60.5	73.0	61.9	91.9	65.1	7
16	NH11489	31.2	78.7	56.2	61.4	76.9	62.1	90.5	65.3	5
17	NH11490	31.3	79.1	62.9	57.0	70.3	65.1	91.9	65.4	3
18	NHH11569	43.9	77.9	68.4	56.5	77.0	64.7	86.2	67.8	1
19	NI09710H	21.9	70.1	45.6	62.1	61.7	64.3	89.9	59.4	42
20	NW03666	32.5	67.9	54.3	53.1	69.8	53.7	86.3	59.7	40
21	NW07505	36.9	73.8	58.0	53.7	72.8	61.2	94.1	64.4	12
22	NW09627	33.3	68.3	48.7	47.3	72.1	68.6	76.2	59.2	46
23	NW11511	29.3	69.6	51.3	58.0	68.2	71.7	85.6	62.0	26
24	NI12702W	30.2	73.0	58.6	57.0	68.3	67.1	84.0	62.6	23
25	NI12709	31.2	77.0	57.6	56.3	70.3	60.1	89.5	63.1	17
26	NI13703	30.3	67.6	48.3	54.9	64.1	55.7	92.3	59.0	48
27	NI13706	36.9	75.1	56.3	55.0	81.3	64.9	97.3	66.7	2
28	NI13708	32.8	67.6	50.6	57.1	69.6	54.3	88.4	60.1	38
29	Camelot	35.3	75.7	58.7	51.6	76.5	68.1	83.6	64.2	13
30	NI04421	28.3	69.4	56.2	59.6	78.5	58.3	95.4	63.7	15
31	Settler CL	25.9	69.3	46.6	57.9	70.5	54.8	90.0	59.3	45
32	NI13717	24.8	70.6	47.9	56.8	66.9	71.1	84.2	60.3	33
33	NI13720	34.2	70.8	55.5	56.9	65.0	64.2	87.9	62.1	25
34	NE12408	32.4	69.0	55.6	53.2	71.5	51.8	62.3	56.5	56
35	NE12409	26.7	58.4	39.1	47.1	61.9	58.8	76.3	52.6	58
36	NE12429	32.0	73.0	58.2	59.3	75.8	63.5	89.2	64.4	11
37	NE12430	29.3	74.0	49.4	53.6	69.1	59.7	76.6	58.8	51
38	NE12438	37.9	72.4	57.1	58.2	76.0	62.8	87.1	64.5	10
39	NE12439	40.6	72.0	57.2	58.2	75.7	69.7	83.6	65.3	5
40	NE12443	29.9	71.6	56.0	54.4	71.7	70.6	67.1	60.2	35
41	NE12444	24.7	60.1	51.0	48.0	76.7	71.8	82.0	59.2	47
42	NE12461	25.4	70.2	49.9	54.5	69.4	56.8	89.0	59.3	44
43	NE12464	21.9	68.3	47.0	59.5	74.8	68.6	81.0	60.2	36
44	NE12483V	33.2	71.4	45.3	45.5	68.9	61.5	83.3	58.4	52
45	NE12488	30.2	69.2	52.2	57.4	72.9	71.2	85.2	62.6	21
46	NE12510	22.9	73.9	59.2	30.5	55.2	51.9	81.8	53.6	57
47	NE12518	19.7	73.6	56.3	48.3	69.2	62.5	72.7	57.5	54
48	NE12524	31.3	71.2	42.5	41.5	68.6	66.1	81.2	57.5	53
49	NE12561	31.8	79.2	54.1	57.6	74.3	63.5	87.3	64.0	14
50	NE12571	26.8	75.2	57.4	48.6	72.2	63.7	95.4	62.8	19
51	NE12580	27.4	67.6	46.6	47.1	67.3	52.1	90.0	56.9	55
52	NE12589	35.3	76.7	59.0	52.5	70.4	71.5	86.6	64.6	9
53	NE12630	38.5	69.5	55.4	48.2	70.9	68.3	76.8	61.1	31
54	NE12637	27.4	67.6	60.4	54.5	72.9	70.2	84.8	62.5	24
55	NE12662	37.4	72.4	56.5	44.2	64.9	61.2	78.7	59.3	43
56	NE12686	23.9	70.2	56.9	53.4	68.7	67.3	99.6	62.9	18
57	NE05548	30.3	68.9	54.6	52.7	75.3	65.3	82.4	61.4	28
58	GOODSTR	39.1	74.8	50.5	46.6	73.3	60.0	84.9	61.3	29
59	SCOUT66	32.0	57.3	36.5	40.4	60.1	37.1	67.3	47.2	60
60	CHEYENN	25.8	52.2	42.1	44.9	54.6	47.5	70.0	48.2	59
0	GRAND M	30.9	71.3	53.5	53.1	70.5	62.6	84.2	60.9	
0	LSD	7.8	7.4	6.8	10.0	7.4	9.6	10.5	8.5	
0	Error d.f.	85.0	133.0	85.0	85.0	85.0	118.0	37.0	89.7	
0	CV	15.5	7.5	7.9	11.6	6.5	9.5	6.1	9.2	
0	Heritability	0.4	0.4	0.6	0.4	0.6	0.5	0.6	0.5	

Understanding the Wheat-mite-virus Complex in Wheat

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Window of risk for volunteer wheat establishment during the heading stages of wheat.

Wheat is the mainstay of dryland cropping systems in the western Great Plains. The wheat-mite-virus complex is the second largest cause of disease loss in winter wheat production in this region. This complex consists of three viruses, Wheat streak mosaic, Wheat mosaic, and Triticum mosaic viruses. All of these viruses are transmitted by the wheat curl mite. Widespread outbreaks of this complex are often linked to pre-harvest volunteer wheat that enables mites/virus survival through the summer. A study was conducted to determine the germination of wheat at different stages of head development and the ability of wheat curl mites to immediately colonize this volunteer wheat. Wheat heads were collected from four varieties (Camelot, Mace, Millennium, and Pronghorn) at two separate locations during the 2011-12, 2012-13 and 2013-14 growing seasons. Heads were collected every five to seven days during head development. Each wheat head was staged, and placed on sterilized greenhouse soil in separate containers. After 21 days, wheat heads were evaluated for germination, plant height and mite presence. Results indicate that wheat can germinate during the early milk stage and that germination potential increases after this stage. Mites were able to directly colonize the germinating plants from the seeds during the later heading stages (i.e. after early dough stage). Simulated hail studies in the field on Camelot and Pronghorn wheat at early, soft and hard dough stages showed a significant impact of variety and hail date (i.e. wheat stage) on volunteer establishment. Additionally, germination under field conditions was heavily influenced by environmental conditions.

Figure 1. Percent germination for individual wheat heads for four varieties; Pronghorn (susceptible), Millennium, Mace, and Camelot (resistant) for all stages of head development over 21 days during 2011-12, 2012-13, 2013-14 growing season.

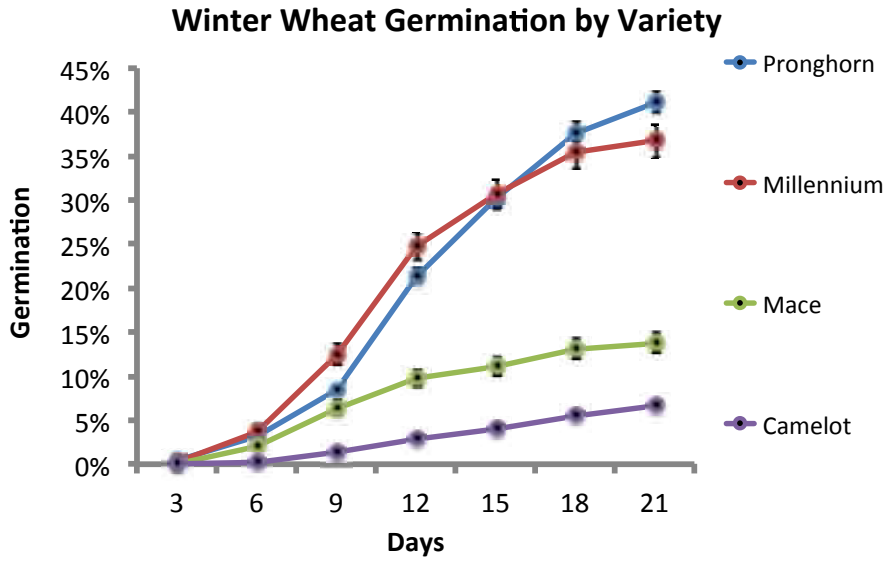
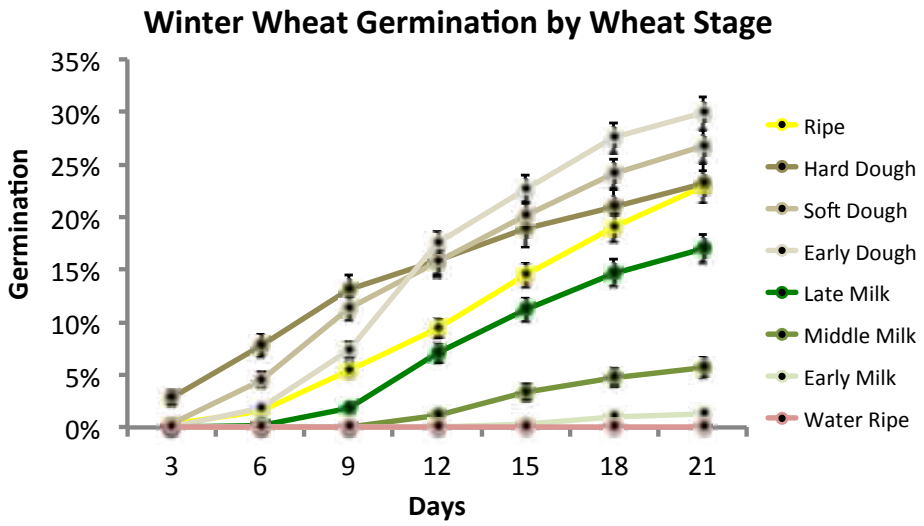


Figure 2. Percent germination for individual wheat heads for the eight stages of head development across four varieties of wheat over 21 days for 2011-12, 2012-13 and 2013-14.



Establishing risk for alternative over-summering hosts for wheat curl mites and associated viruses.

Wheat is grown on more land than any other crop around the world and it is the mainstay of dryland cropping systems in the western Great Plains. The wheat-mite-virus complex is the second largest cause of disease loss in winter wheat production in this region. This complex consists of three viruses, *Wheat streak mosaic*, *Wheat mosaic*, and *Triticum mosaic virus*. All of these viruses are transmitted by the wheat curl mite. Widespread outbreaks of this virus complex are often linked to pre-harvest volunteer wheat. However, situations have occurred where management tactics were not conducive to volunteer wheat and significant losses of winter wheat still occurred, indicating that other grass species may serve as a host for wheat-mite-virus complex.

A study was conducted to determine the potential for wheat curl mites to survive on alternate hosts during the summer under field condition and establish their potential as a source for mites and virus on fall planted winter wheat. Five hosts were used in this study. The primary host (pre-harvest and post-harvest volunteer wheat) and secondary hosts (corn, foxtail millet, barnyardgrass, and green foxtail) were seeded in small plots in a randomized complete block design with six replications. With the exception of post-harvest volunteer wheat, hosts emerged prior to winter wheat harvest. The pre-harvest volunteer plots became heavily infested with mites each year and were destroyed early after harvest to prevent mite contamination across all the plots. In 2013, post-harvest volunteer was planted into the same plots after the pre-harvest volunteer was destroyed, but in 2014 separate plots were used for pre- and post-harvest volunteer. Post-harvest wheat was planted one week after the destruction of pre-harvest wheat (two-weeks after winter wheat harvest).

To monitor mite movement within the plots, four trap pots were placed around the study. Trap pots consisted of three cone-tainers with each cone-tainer containing three wheat plants

grown in plastic cylindrical cages for 14-days under Lumigrow LED lights. Cages were removed and plants were then exposed in the field for one-week intervals. After seven days of exposure, plants were cut at soil level, placed in plastic bags, and stored until mites were counted. One week after winter wheat harvest, trap pots were placed in the center of each plot. These trap pot plants were collected after a one-week exposure and new plants were added every two weeks. The plant stage of each plot was determined during each trap pot collection. During peak mite movement periods, four cone-tainers (three plants/cone-tainer) were placed in each trap pot. Plants from two cone-tainers were inspected for mites, and the other half were reared in cages for an additional month after field exposure and then tested for virus presence via ELISA. Winter wheat was seeded around the plots in the fall to enable us to determine virus spread potential the following spring.

Figure 3 and 4 indicate that there are significant differences between hosts for mite presence throughout the summer, with the highest mite presence occurring in barnyardgrass plots followed by foxtail millet. Pre-harvest volunteer wheat plots was heavily infested with mites each year (>90% infested) one-week after harvest and were destroyed to reduce the likelihood for contamination with other treatments. In contrast, post-harvest volunteer had very low mite presence throughout the summer (<5%). The difference in mite presence between pre-harvest and post-harvest volunteer wheat indicates the importance of risk for this complex relative to when volunteer wheat emerges with wheat emerging prior to harvest having the highest risk. Virus presence assays on trap pots during peak mite movement periods showed a significantly higher presence of the WSMV in barnyardgrass. A smaller number of foxtail millet cone-tainers test positive for WSMV. No positive samples were found for all other hosts and either time period. Data from the additional sampling done in the surrounding wheat in the spring is still being analyzed.

Figure 3. Average percentage of trap plants infested with mites after one-week exposure every other week from late July to late October 2013.

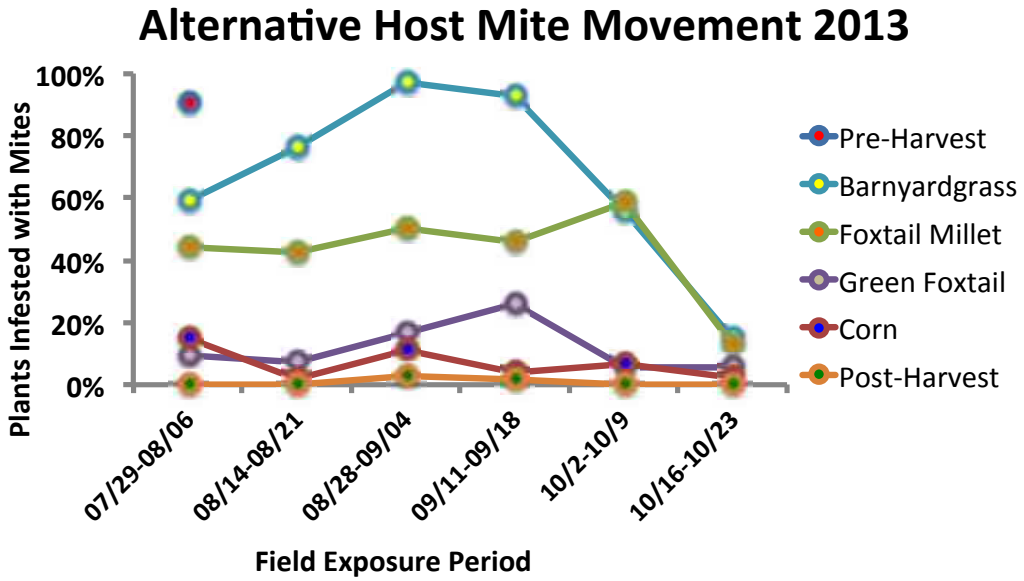
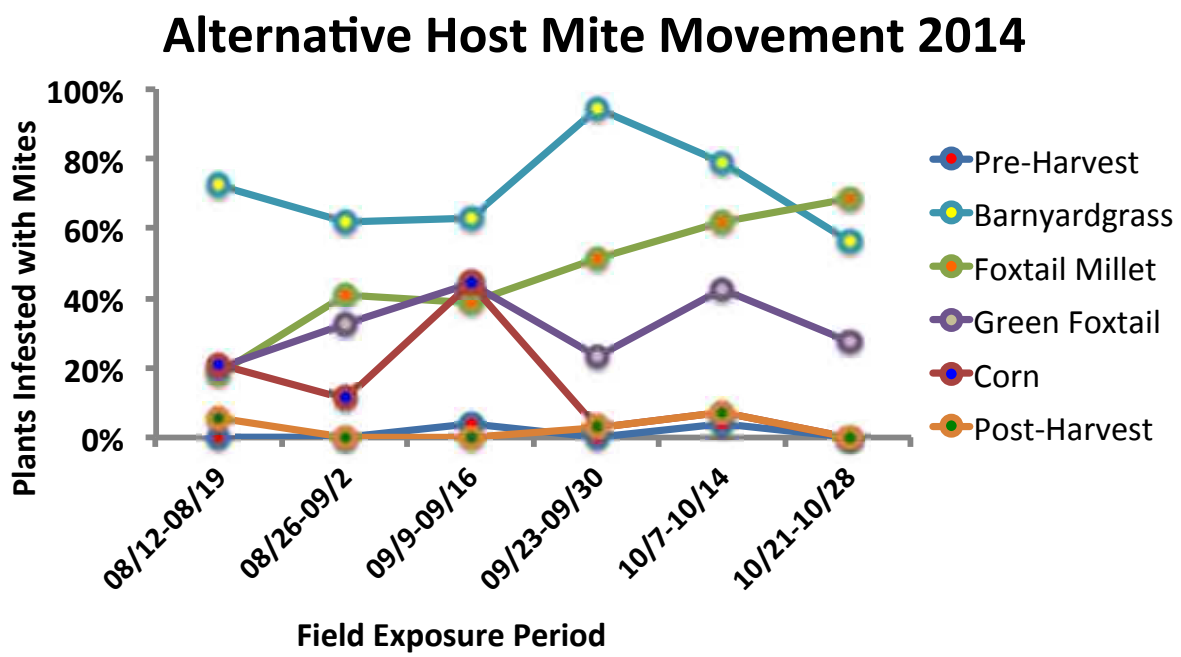


Figure 4. Average percentage of trap plants infested with mites after one-week exposure every other week from late July to late October 2014.



Impact of simulated rainfall on wheat curl mite populations in headed wheat

The wheat curl mite is the only known vector of *Wheat streak*, *Wheat mosaic* and *Triticum mosaic virus*. Mite movement is critical to the spread of these viruses and their potential to cause widespread yield losses. Previous studies have indicated that secondary spread of mites increases as the mite population density increases. Rainfall was considered to have a poor correlation with mite movement; however, no studies have used sampling techniques that adequately test the impact of rainfall on mite movement.

To determine the impact of rainfall on mite populations a rainfall simulator was used to evaluate the effect of rainfall on mite populations at the High Plains Agricultural Lab near Sidney, Nebraska. Treatments (no rain, rain at soft dough (Z85), rain at hard dough (Z87), rain at soft and hard dough (Z85+87)) were arranged as a randomized complete block with six replications. The rainfall machine was calibrated prior to field application to apply ¾-1 inch of rain. Mite populations were supplemented to insure good mite populations in the plot areas. Five wheat heads were taken from each plot and four collection periods were made during the season. The development stage of each individual wheat head was determined, and then placed on high definition tape to determine mite populations. Mite samples from the tapes are still being evaluated and data summarized.

Proso Millet: Breeding, Genetics and Genomics

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Goal and objective

Goal of this project was to develop high yielding proso millet cultivars for western Nebraska and other regions of the central High Plains of the USA following conventional and modern breeding approaches. Objectives in 2014 were (1) testing proso millet breeding population at different nurseries (early generation, preliminary, elite and variety trial), (2) evaluation of germplasm for desired agronomic traits and (3) evaluation of segregating populations for mapping genes and QTLs of various traits of economic importance (e.g. lodging & shattering resistance, maturity, plant, height, panicle characteristics, seed size, and color)

Approach

In 2014, the following proso millet breeding nurseries were evaluated at the High Plains Ag. Lab (HPAL):

F_2 and F_3 nursery:

In the field, 40 F_2 and 12 F_3 populations were advanced. Bulk heads from these plots were harvested for testing next year.

Head-rows (F_4):

A total of 300 head rows were selected based on field evaluation of 1040 $F_{3:4}$ head rows and the selected lines are being evaluated for seed quality traits.

Preliminary yield trial of F_5 and F_6 lines:

One hundred seventy six lines were tested for preliminary yield potential as unreplicated trial. Seed yield based on single plots of 5 ft x 25 ft ranged from 122 lbs/a to 4719 lbs/a. Selected lines from this trial will be tested as elite nursery in 2015.

Elite nursery:

Thirty four elite breeding lines (including checks) were tested as replicated trial for seed yield potential. The result is presented below in Table 1 (planted: 6/18/'14 and harvested 10/10/'14)

Variety trial:

Thirty-two advanced breeding lines (including check cultivars) were tested under both conventional and organic production conditions at HPAL. In addition, these lines were also evaluated at co-operative farmer's field in Cheyenne Co., Akron, CO; Lingle, WY and Walls, SD. The results from Cheyenne Co. conventional (combined results of both HPAL and farmer's field) and organic production conditions are presented in Table 2 and 3, respectively.

Table 1. Proso millet elite nursery - 2014 (HPAL, Dryland)

Variety Name	Yield (lbs/a)	Test Weight (lbs/bu)	Plant Hieght (inches)
Panhandle	2149	46	36
Snowbird	2134	50	33
Dawn	1987	52	28
Minco	2150	50	40
Cope	2419	49	38
Rise	2628	49	26
Sunup	2513	51	30
Earlybird	1671	52	32
Huntsman	3006	50	29
Sunrise	2559	50	27
Horizon	2983	51	30
Plateau	2636	49	27
NE1	2149	53	29
5001	2023	48	38
5008	2685	50	37
5017	2169	47	38
5019	1987	47	40
5024	2654	47	32
5026	2164	48	33
5027	2224	47	32
5031	2432	49	38
5032	2380	49	41
5052	2511	49	42
5087	2064	47	41
5090	2409	49	39
5091	1744	45	37
5095	2353	49	41
5098	3157	54	31
5099	2274	50	41
5103	2333	51	42
5083_Tall	2304	51	38
5025_Tall	2367	51	42
5045wx	2205	48	44
5029wx	1729	47	38
Mean	**2327**	**49**	**35**
LSD (0.05)	**544**	**4**	**5**

Table 2. Proso millet variety trial results – 2014 (Cheyenne Co.), conventional dryland (planted 6/20/'14 and harvested 10/6/'14). *Yield is 10% moisture basis.

Variety	Entry	Yield rank	*Yield (lbs/a)	*Yield (cwt/a)	Bushel weight (lbs/bu)
Rise	8	1	1859	19	50
5002wx	23	2	1792	18	49
5061wx	28	3	1785	18	50
5104wx	31	4	1710	17	50
Plateau	14	5	1706	17	48
Sunrise	12	6	1706	17	52
5059wx	27	7	1676	17	51
177-8	19	8	1654	17	50
177-9-13	20	9	1648	16	51
5106wx	32	10	1624	16	50
5087wx	29	11	1623	16	50
Earlybird	10	12	1622	16	52
5034wx	26	13	1617	16	51
Huntsman	11	14	1587	16	51
5016	25	15	1581	16	51
Sunup	9	16	1575	16	53
Cope	6	17	1568	16	52
Horizon	13	18	1557	16	52
5100	30	19	1539	15	50
172-2-B	16	20	1495	15	50
Abarr	3	21	1489	15	51
5014	24	22	1479	15	51
177-3-13	18	23	1469	15	52
182-4-24	21	24	1461	15	49
174-7-13	17	25	1444	14	51
Minco	5	26	1416	14	52
NE1	15	27	1398	14	50
Snowbird	2	28	1243	12	50
Panhandle	1	29	1208	12	50
Minsum	7	30	1184	12	50
Dawn	4	31	1100	11	50
182-5-18	22	32	1097	11	50
Mean			**1528**	**15**	**50**
LSD (0.05)			**628**	**6**	**3**

Table 3. Proso millet variety trial results – 2014 (HPAL), organic dryland (planted 6/26/'14 and harvested 10/15/'14). *Yield is 10% moisture basis.

Variety	Entry	Yield rank	*Yield (lbs/a)	*Yield (cwt/a)	Bushel weight (lbs/bu)
Rise	8	1	2470	25	50
5059wx	27	2	2204	22	51
5104wx	31	3	2158	22	50
Plateau	14	4	2128	21	46
5002wx	23	5	2065	21	47
5034wx	26	6	2056	21	51
Earlybird	10	7	2055	21	53
Sunup	9	8	2055	21	56
177-8	19	9	2043	20	49
5061wx	28	10	2014	20	50
177-9-13	20	11	1934	19	52
Huntsman	11	12	1898	19	51
5106wx	32	13	1875	19	50
5016	25	14	1870	19	52
177-3-13	18	15	1858	19	53
5100	30	16	1858	19	49
5087wx	29	17	1843	18	50
182-4-24	21	18	1842	18	47
Horizon	13	19	1823	18	53
172-2-B	16	20	1822	18	50
Sunrise	12	21	1810	18	54
Cope	6	22	1678	17	53
174-7-13	17	23	1676	17	51
NE1	15	24	1641	16	50
Minco	5	25	1618	16	53
Abarr	3	26	1600	16	52
5014	24	27	1534	15	51
Panhandle	1	28	1270	13	50
Snowbird	2	29	1182	12	50
Minsum	7	30	945	9	50
Dawn	4	31	856	9	50
182-5-18	22	33	812	8	50
Average of all entries			**1765**	**18**	**51**
LSD (0.05)			**390**	**4**	**3**

Germplasm evaluation:

Sixty-six PI lines (previous years' selections) were further evaluated for important agronomic traits. A few lines with some levels of tolerance to lodging and seed shattering were identified. Lines with super early and extreme late maturity were found. Several lines with different panicle shape and sizes were also identified. These lines will be used as parents in future crossing for understanding genetics of these important traits and developing better cultivars. The lines showed good shattering tolerance in previous year were consistent in their performance in year 2014 too.

Mapping genes and QTLs:

I advanced the two mapping populations are (i) 250 F6:7 lines (termed 'RILs') from cross 'Huntsman'/'Minsum', which is segregating for maturity, plant height, inflorescence type, lodging tolerance, seed shattering; (ii) 150 F6:7 RILs from cross 'Huntsman'/'Rise', which is segregating for seed size and plant height. The populations were phenotyped at HPAL and Scottsbluff in 2014 for the traits mentioned previously. Most of the traits are multigenic in nature. Based on the field data from two years it is found that, heading days, seed shattering and lodging have significant genotype x environment interactions. Even, there is significant variation in the data from year to year. Therefore it is needed to conduct these trials for two more years. New elite breeding material (RILs) from these populations will be used as new lines to make the crosses as well as direct release. Developed ~10,000 sequence-based DNA markers (GBS) and 1500 were polymorphic between 2 pairs of mapping parents. The genetic linkage map (DNA marker-based map of proso millet genome) thus developed will be used to map gene(s) and finding linked DNA markers for the traits of interest for future molecular breeding. In future, this will identify line with suitable grain quality traits for specific uses.

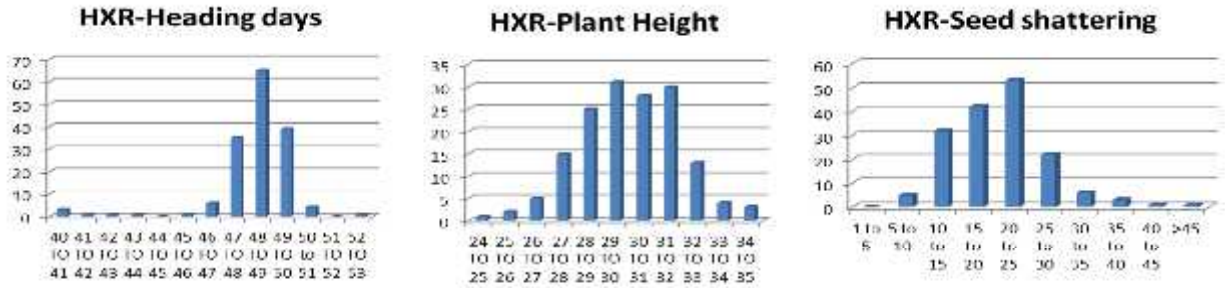

Fig 1A: Showing representative traits segregating in Huntsman x Rise Population

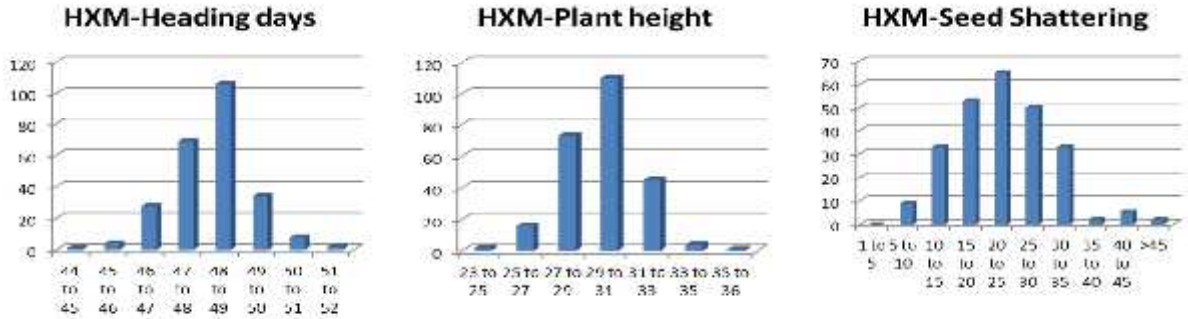

Fig 1B: Showing representative traits segregating in Huntsman x Minsum population

Oil Seed Crops for western Nebraska: Sunflower, Winter Canola and Brown Mustard

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Objective

Objectives of this project were to identify high yielding (1) Sunflower hybrids, (2) winter canola cultivars, (3) study winter canola establishment under different tillage treatments, and (4) testing brown mustard hybrids for seed yield and adaptability in western Nebraska.

Sunflower

In 2014, 17 hybrids of oil type and 15 hybrids of confection types from four and three different seed companies, respectively, were tested at eight different trials (dryland and irrigated production conditions) throughout western Nebraska. Results of the trials at the HPAL are presented here. At the HPAL, three sunflower trials, which were conducted in 2014 are: (1) oil type under dryland –Table 1, (2) oil type under irrigation – Table 2, and (3) confection type under irrigation – Table 3 and the results were presented in Tables 1, 2 and 3, respectively. Plant population of 17,500/acre was used for dryland oil and irrigated confection; and 22,000/acre was for irrigated oil trial.

Table 1. Nebraska Sunflower Variety (Oil) Test - 2014 (Cheyenne Co., Dryland)

Brand	Hybrid	Oil Type*	Yield** (lbs/a)	Bushel wt (lbs/a)	Flowering (DAP)	Plant Height (inches)
Syngenta	3845 HO	HO	1159	25	67	48
CROPLAN	545 CL	NS	1084	25	67	54
Syngenta	3732 NS	NS	1078	25	65	47
CROPLAN	13-652 CL	HO	1067	24	65	42
CROPLAN	432 E	NS	1026	25	65	51
CROPLAN	14-572 CL	HO	1022	25	67	48
Syngenta	7111 HO/CL/DM	HO	1008	24	65	49
CROPLAN	559 CL	NS	1005	24	68	54

Syngenta	3845 HO	HO	1159	25	67	48
CROPLAN	545 CL	NS	1084	25	67	54
Syngenta	3732 NS	NS	1078	25	65	47
CROPLAN	13-652 CL	HO	1067	24	65	42
CROPLAN	432 E	NS	1026	25	65	51
CROPLAN	14-572 CL	HO	1022	25	67	48
Syngenta	7111 HO/CL/DM	HO	1008	24	65	49
CROPLAN	559 CL	NS	1005	24	68	54
Mean			1056	24	66	50
LSD§ (0.05)			ns	ns	ns	10

**Adjusted for 10% moisture; DAP = Days after planting*
***NS = NuSun; HO = High Oleic; T = Traditional*
§ *Least Square Difference. Two varieties are different if the trait value differs by the LSD*
Planted: 06/3/2014; Previous crop: Winter wheat; Fertilizer: 50 lbs N/acre; Herbicide: 2 Pints Prowl H_2O, 2.5 oz Spartan; Harvested: 1020/2014

Table 2. Nebraska Sunflower Variety (Oil) Test - 2014 (Cheyenne Co., Irrigated)

Brand	Hybrid	Oil Type*	Yield** (lbs/a)	Bushel Weight (lbs/bu)	Plant height (inches)
Syngenta	3732 NS	NS	1322	26	49
CROPLAND	545 CL	NS	1269	23	50
Mycogen	8H859CL	HO	1214	30	51
CROPLAND	432 E	NS	1185	25	47
Syngenta	7111 HO/CL/DM	HO	1112	20	54
Mycogen	8H449CLDM	HO	1100	28	56
Mycogen	8H570CL	HO	1093	18	53
NUSEED AMERICAS	CAMARO II	NS	1084	24	44

NUSEED AMERICAS	HORNET	HO	1061	20	51
NUSEED AMERICAS	FALCON	NS	1047	24	47
CROPLAND	13-652 CL	HO	1042	23	48
Syngenta	3845 HO	HO	1040	18	49
Mycogen	8N668S	NS	1025	26	52
CROPLAND	14-572 CL	HO	1024	22	50
CROPLAND	559 CL	NS	-	-	-
Syngenta	3732 NS	NS	1322	26	49
CROPLAND	545 CL	NS	1269	23	50
	Mean		1114	23	15
	LSD§ (0.05)		4	1	3

**Adjusted for 10% moisture*;
** *C=Confection; NS = NuSun; HO = High Oleic; T = Traditional*
§ *Least Square Difference. Two varieties are different if the trait value differs by the LSD*
Planted: 06/25/2014; Previous crop: Winter wheat; Fertilizer: 50 lbs N/acre; Herbicide: 2 Pints Prowl H_2O, 2.5 oz Spartan; Harvested: 11/18/2014

Table 3. Nebraska Sunflower Variety (Confection) Test - 2014 (Cheyenne County, Irrigated)

Brand	Hybrid	Yield* (lbs/a)	Bushel Wt (lbs/bu)	Plant Ht. (inches)	Seed Size >22/64 %	Seed Size >20/64 %
Nuseed Global	NHW 12759	1100	17	72	89	8
Nuseed Global	X4334	1032	17	72	74	18
Nuseed Global	PUMA X98578	997	17	68	83	13
CHS	14EXP02	996	17	70	85	8
Nuseed Global	5009	978	17	68	81	13

Nuseed Global	JAG	959	17	70	81	13
CHS	14EXP03	956	17	74	87	9
Nuseed Global	X5334	918	17	70	85	11
Nuseed Global	JAG II	914	17	67	76	16
CHS	12EXP01	891	17	68	85	10
Nuseed Global	NHW 12734	872	17	73	88	7
Nuseed Global	NHW 12985	849	17	69	87	9
CHS	14EXP01	782	17	69	73	12
Nuseed Global	NHW 12759	1100	17	72	89	8
Nuseed Global	X4334	1032	17	72	74	18
Nuseed Global	PUMA X98578	997	17	68	83	13
CHS	14EXP02	996	17	70	85	8
Nuseed Global	5009	978	17	68	81	13
Nuseed Global	JAG	959	17	70	81	13
	Mean	**942**	**17**	**70**	**82**	**11**
	LSD§ (0.05)	**256**	**ns**	**5**	**14**	**8**

**Adjusted for 10% moisture*

§ *Least Square Difference. Two varieties are different if the trait value differs by the LSD*

Planted: 06/25/2014; Previous crop: Winter wheat; Fertilizer: 50 lbs N/acre; Herbicide: 2 Pints Prowl H_2O, 2.5 oz Spartan; Harvested: 11/19/2014

Winter Canola

Winter canola breeding

The winter canola research at the HPAL is part of the Great Plains Winter Canola Project lead by Kansas State University. A total of 105 lines (advanced breeding lines from public institutes, cultivars from seed companies and check cultivars) were planted in two different trials (GPCVT – Great Plains Canola Variety Testing and EGSN – Early Generation Screening Nursery). The GPCVT had 29 entries and EGSN had 66 entries. Both trials were planted on August 31 as RCBD with 3-replications at the High Plains Ag. Lab. (near Sidney, NE). Plot size was 5' x 25' with 7.5" row spacing and planting depth was ¾" depth using seeding rate of 5 lbs/acre. Soil conditions were dry prior to planting. 1" of pre plant irrigation was applied a week prior to planting. Following planting we received several heavy rains (8-9" in 72 hours) prior to emergence. Stand was very poor late in the fall of 2013.

Establishing winter canola under different tillage treatments

The field trial was designed with three tillage treatments. The field was sprayed on 8/17/'13 with Roundup 32 oz/a on wheat stubble. Winter canola 'Riley' was planted 10' x 30' plot, 12" row spacing with 4 replications @ 6lbs/acre using John Deere 1560 no-till drill on 8/22/'13, followed by Treflan (2.5 pt/a) as pre-emergence herbicide and 60 lbs/a urea. To aid incorporation and uniform emergence 0.5" water was applied on 8/22/'13 after planting. After emergence 1" on 8/26 and 1" of 8/27 water was applied because of high temperature and strong dry wind. Stand count was recorded using two one meter of row from each plot on 10/15/'13. Overall good stand in the late fall mainly due to timely irrigation in August, lots of precipitation in September which produced high volume of volunteer winter wheat in plots visual stand in the fall appears better in no-till plots (Fig.1). No significant difference in stand count was observed. Both trials were lost due to 100% winter kill. Both these trials have been planted again in Fall, 2015.

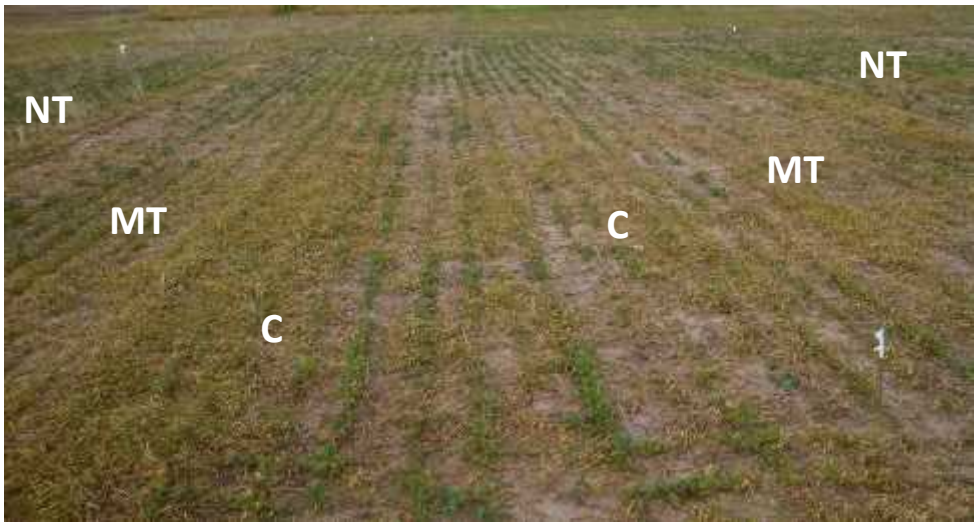

Fig.1: 2014 winter canola tillage trial at HPAL, Sidney, NE. Winter canola cv. 'Riley' was planted on wheat stubble on Aug.22, 2013. Three inches of water was applied between 8/22 and 8/27 because of extremely dry soil, high temperature and strong wind. NT = No-till; MT = Minimum-Till, and CT = Conventional –Till.

Brown mustard

In 2014, 16 hybrids of brown mustard (from Bayer Crops Science) was planted on 4/18/14 at HPAL for testing their seed yield potential under dryland condition. The plot was planted into tilled ground. Pre-emergence herbicide: 1.5 pint of Sonalan/acre. Weather conditions were we not ideal for spring crops. We have a cold and windy spring. The field experienced soil erosion due to high winds during emergence. This affected germination and stand of the Brown Mustard plants. The trial was lost due to unusual spring weather during seed germination and seedling emergence. The same trial was also planted at Scottsbluff under non-irrigated condition and a representative picture from the Scottsbluff trial is in Fig.2.

Fig. 2: A representative picture of brown mustard trial at Scottsbluff without any irrigation.

BQMS Proceedings

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Introduction:

The BQMS project was initiated in 2012 when 25 acres of native pasture were blade plowed to eliminate native forbs and grasses. A linear move pivot and a fence were then installed. The east half of the irrigatable ground had phosphorus, sulfur, zinc, and a little nitrogen fertilizer applied in the fall of 2012 and was planted to a cover crop in spring 2013. In the spring of 2014 the east half of the plot was prepared for research by applying sufficient nitrogen for corn production and tillage to make a good seed bed. Additionally, the west half received phosphorus, sulfur, zinc, and a little nitrogen to improve the background fertility for future research. The soil was lightly tilled and planted to oats as a cover crop.

In 2014, corn research was initiated within the confines of the BQMS plot. This proprietary research was conducted for a private company and discussion of the research would not be prudent.

In 2014, a small plot of Camelina (*Camelina sativa*) was planted within our plot to assess the growth pattern of this oil crop. Due to the small size of the plot, the Camelina was hand harvested, threshed, and the grain used for oil research.

Grain Legume Crops for western Nebraska: Pea and Fenugreek

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Objective

Objectives of this project was to (1) test commercially available pea cultivars for yield potential and (2) developing high seed yielding fenugreek cultivars for production in western Nebraska.

Pea (also called field pea or yellow pea)

Pea has known as adapted alternative crop for rotating with winter wheat in western Nebraska. However, no significant pea production happened because of lack of market until recently. There has been new interest for pea production due to new international export market in for human food. In 2014, 22 pea cultivars from five different commercial seed companies were tested under dryland condition at the High Plains Ag. Lab. (HPAL) and at Scottsbluff both with and without irrigation. Results of the trial at the HPAL are presented here (Table 1).

Table 1. Nebraska Pea Variety Test - 2014 (Cheyenne Co., Dryland)

Brand	Variety	*Yield (bu/a)	*Bushel weight (lbs/bu)	1000 seed weight (g)	Protein (%)	Flowering (DAP)	Plant height (inches)
Great Northern Ag	Salamanca	56	56	264	26	25	28
Legume Logic	Spider	54	58	283	26	27	27
ProGene Plant Res.	Carousel	53	61	260	25	25	24
Meridian Seeds	Agassiz	53	59	264	25	25	26
Pulse USA, ND	Mystique	52	60	273	25	26	27
Legume Logic	Bridger	52	61	266	25	26	23
Great Northern Ag	Greenwood	50	59	227	24	26	19
Meridian Seeds	Earlystar	49	59	262	24	26	24
Pulse USA, ND	Viper	49	58	267	25	26	25
ProGene Plant Res.	Pro 133-6243	48	59	286	25	26	21
Legume Logic	NE Hyline	48	60	267	25	26	23
Pulse USA, ND	DS Admiral	47	58	254	26	25	23
Great Northern Ag	K2	47	59	251	25	26	21
ProGene Plant Res.	Pro 103-7402	46	60	261	24	21	23
Great Northern Ag	Navarro	45	60	279	25	26	22
Pulse USA, ND	Nette 2010	45	59	252	24	25	22
Pulse USA, ND	Korando	41	56	253	26	26	24

Pulse USA, ND	SW Midas	41	57	243	25	26	21
Meridian Seeds	Jetset	40	58	264	25	25	23
Pulse USA, ND	Abarth	39	58	284	23	26	24
ProGene Plant Res.	Pro 133-6242	38	59	277	25	27	19
Pulse USA, ND	CDC Striker	37	57	254	27	27	22
Mean		**47**	**58**	**263**	**25**	**26**	**23**
LSD at 5%		**11**	**4**	**26**	**1**	**1**	**2**

§ *Least Square Difference. Two varieties are different if the trait value differ by the LSD*
Yield was adjusted for 10% moisture
DAP = Days after flowering
Planted: 04/08/2013; Previous crop: winter wheat; Plant population: 350,000 live seeds/acre; and Harvested: 08/01/2013.

Fenugreek as potential medicinal crop

Goal of the project is to establish fenugreek as a new alternative crop in western Nebraska. Fenugreek belongs to legume and is capable of nodule formation for fixing biological N into soil. It seems that Rhizobium bacteria present in western Nebraska crop field is capable of nodule formation in fenugreek (Fig.1).

Fig.1: Healthy nodules on roots of fenugreek plants from the trial at Scottsbluff.

In 2014, 21 germplasm lines from nine different countries were tested both as the HPAL (Fig. 2) and Scottsbluff under irrigation. The result from the HPAL trial is presented below (Table 2).

Fig.2: Fenugreek variety trial at the HPAL. The entries varied in maturity.

Table 2. Evaluation of selected fenugreek germplasm for seed yield potential in western Nebraska under irrigation - 2014 (HPAL). Planted: 05/21/2014; Harvested: 10/04/2014.

Variety	Country of origin	Seed Yield (lbs/a)	Flowering (days after flowering)	Plant Height (inch)
PI141724	Iran	1674	46	17
PI138954	Iran	1653	46	16
PI302449	India	1552	43	16
PI628790	Jordon	1503	41	14
L3068	Canada	1413	43	16
F18	India	1257	43	17
L3708	Canada	1251	43	15
PI141728	Iran	1250	47	16
F70	India	1231	41	15
Tristar	Canada	1224	42	16
Amber	Canada	1223	40	17
PI567879	Turkey	1208	41	18
PI543073	Pakistan	1205	42	19

PI141725	Iran	1204	47	15
L3375	Canada	1190	41	16
PI141726	Iran	1163	47	15
L3308	Canada	1146	43	16
PI426970	Pakistan	1080	41	18
PI557489	Turkey	999	35	20
PI251640	Ethiopia	958	43	14
PI181814	Syria	875	35	17
Mean		**1269**	**43**	**16**
LSD (0.05)		**420**	**3**	**3**

§ *Least Square Difference. Two varieties are different if the trait value differ by the LSD*

2014 Herbicide Evaluations at HPAL in Field Pea

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Gary W. Hergert, Professor, Agronomy-Horticulture PREC

Evaluation of Broadaxe Herbicide in Field Pea

Materials and Methods

A field study was initiated at the High Plains Agricultural Laboratory near Sidney, NE in 2014 to evaluate crop injury and efficacy of several herbicides labeled for use in dry pea production. The experimental design was a randomized complete block with four replications. Plots were 10 feet wide by 25 feet long. The study was located on Duroc loam with a 1.8 % organic matter and a pH of 7.2.

Herbicide treatments were applied with an ATV-mounted sprayer set to deliver 15 gallons/acre at three miles/hour and 25 psi. On April 9, 2014 Roundup UltraMax was applied at 24 oz. /a to the entire plot area. Early pre-plant (EPP) treatments were applied on April 10, 2014. On April 12, 2014 dry yellow pea (cv. Admiral) was planted at a rate of 180 lbs. /acre (no-till) into proso millet residue with a John Deere 1560 no-till drill. On April 19, 2014 preemergence (PRE) treatments were applied.

Due to weather constraints we were not able to apply our EPP treatments as early as intended. On April 13, 2014 we received a blanket of snow to the plot area and very cold temperatures remained the rest of the month of April 2014. The field peas did not germinate until April 18, 2014 and were still below the ground surface until April 26, 2014 when they first started to emerge. On June 18, 2014 a post-application (Post) of Select at a rate of 12 oz. /acre was made to the entire plot area. Peas were 10 -12 inches in height and nodules were just forming. Weeds present at the Post application included witchgrass, volunteer proso millet, lanceleaf sage and foxtail. Peas were harvested July 28th, 2014. All treatments in this study are labeled for dry pea production in Nebraska.

Results and Discussion

Herbicide effects on different weeds and crop yield are shown in Table 1. Crop injury was not observed with any of the treatments applied. Within this study three main weed species were rated (tumble pigweed, lance leaf sage, volunteer proso millet). Any herbicide formulation that consisted of two different modes of herbicide action provided greater control within the weed species. The EPP treatments had a slight yield advantage over the PRE treatments. Herbicide timing might possibly be more critical in pea production. Broadaxe provided good to excellent control compared to other formulations tested.

Table 1. Evaluation of Broadaxe Herbicide in Field Pea 2014 at Sidney, NE 2014

			Crop Injury	Tumble pigweed	Lanceleaf sage	Vol. Proso millet	Tumble pigweed	Lanceleaf sage	Vol. Proso millet	Witchgrass	Yield (Bu/ac)
Treatment	Rate	Timing	June 6, 2014 Crop Injury & Weed Control				July 18, 2014 Weed Control				July 28, 2014
BROADAXE	20 oz/a	EPP	0	88	76	100	84	71	100	100	37
BROADAXE	24 oz/a	EPP	0	85	91	100	85	70	100	100	32
SHARPEN	2 oz/a	EPP	0	55	65	0	74	60	100	100	32
OPTILL	1.5 oz/a	EPP	0	95	95	100	95	95	100	100	37
PROWL H2O	2 pt/a	EPP	0	61	69	90	56	73	100	100	33
PROWL H2O SHARPEN	2 pt/a 2 oz/a	EPP	0	46	84	100	39	83	100	100	32
SPARTAN CHARGE	5 oz/a	EPP	0	80	84	88	76	86	100	100	31
SPARTAN CHARGE PROWL H2O	5 oz/a 2 pt/a	EPP	0	76	91	100	74	94	100	100	33
BROADAXE	20 oz/a	Pre	0	84	78	70	84	79	100	100	32
BROADAXE	24 oz/a	Pre	0	85	80	100	84	83	100	100	34
OPTILL	1.5 oz/a	Pre	0	91	89	78	91	94	100	100	33
SHARPEN	2 oz/a	Pre	0	74	83	0	79	80	100	100	34
CHECK			0	0	0	0	0	0	100	100	30
lsd (5%)			0	15.7	15.7	18.4	18.9	30.4	0	0	7.2

Evaluation of Early Preplant and Preemergence Treatments for Grass and Broadleaf Weed Control in Field Pea

Materials and Methods

A field study was initiated in 2014 at the High Plains Agricultural Laboratory near Sidney, NE to evaluate crop injury and efficacy for grass and broadleaf control in dry pea production. The experimental design was a randomized complete block with four replications. Plots were 10 feet wide by 25 feet long. Herbicide treatments were applied with an ATV-mounted sprayer set to deliver 15 gallons/acre at three miles/hour and 25 psi. The study was located on Duroc loam with a 1.8 % organic matter and a pH of 7.2.

On April 10, 2014 early pre-plant (EPP) treatments were applied. Dry yellow pea (cv. Admiral) was planted at a rate of 180 lbs. /acre (no-till) into proso millet residue with a John Deere 1560 no-till drill on April 12, 2014. One pre-emergence (PRE) treatment was applied on April 19, 2014. Weeds present at the time of EPP and PRE treatments were volunteer winter wheat, downy brome, blue mustard, and tall hedge mustard. All treatments provided excellent control of the early grassy weed and mustard weed pressure. The cold weather after mid-April also had the same environmental effects on this study. On June 18, 2014 post treatments (Post) were applied. Peas were 10 -12 inches in height with 8 to 9 nodes present. The weeds at the time of the Post application were volunteer proso millet, tumble pigweed and prickly lettuce. Pea harvest was conducted on July 28, 2014.

Results and Discussion

Crop injury was observed only with the Varisto (Post) treatment (Table 2). Injury consisted of leaf chlorosis and some slight height reduction. The dry peas did recover from the injury but it did reduce yield. The combination of Roundup, Prowl & Sharpen provided good early season weed control and assisted in slowing down the flushes of volunteer proso millet that developed throughout the growing season. There was visually better weed control with the combination of Prowl and Sharpen which translated into increased yield due to increased weed control. With the increase of pea acres in the NE panhandle, more research will be needed to assist producers on timing and application of effective herbicides.

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Table 2. Evaluation of Early Preplant and Preemergence Treatments for Grass and Broadleaf Weed Control in Dry Pea at Sidney, NE 2014

			Tumble pigweed	Prickly lettuce	Vol. Proso millet	Marestail	Crop injury	Tumble pigweed	Prickly lettuce	Vol proso milllet	Marestail	Yield (Bu/ac)
Treatment	**Rate**	**Timing**	**% Weed Control June 6, 2014**				**% Crop Injury and Weed Control July 19, 2014**					**July 28,2014**
Roundup	32 oz/a	EPP	71	91	93	93	0	100	85	100	100	33
SHARPEN	1.5 oz/a											
PROWL H2O	1.5 pt/a											
Mso	1%v/v											
Ams	15 lb/a											
Rezult 3.2 pt/a	3.2 pt/a	Post										
COC 1 pt/a	1 pt/a											
Ams 1 lb/a	1 lb/a											
Roundup	32 oz/a	EPP	81	90	90	93	0	100	91	100	99	34
SHARPEN	2 oz/a											
PROWL H2O	2 pt/a											
Mso	1% v/v											
Ams	15 lb/a											
Rezult	3.2 pt/a	Post										
COC	1 pt/a											
Ams	1 lb/a											
Roundup	32 oz/a	Pre	80	74	70	91	8	100	90	100	98	27
SHARPEN	1.5 oz/a											
MSO	1% v/v											
Ams	15 lb/a											
Varisto	16 oz/a	Post										
NIS	0.25% v/v											
Ams	17 lb.s/100 gal											
Untreated			0	0	0	0	0	100	0	0	0	27
lsd (5%)			10.7	11	8.5	3.3	2.3	0	8.5	0	3.8	3.17

Evaluating the Feeding Value of Field Peas for Growing and Finishing Cattle in a Western Nebraska Production System

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With almost every farm input increasing in cost, livestock producers are looking for alternative feed sources. These alternative feeds are most effective when they are plentiful, locally sourced, and most importantly, competitively priced. Field peas have gained popularity in recent years among farmers and cattle feeders in the Northern Plains. Historically, in western Nebraska, there has not been an established human food consumption market established for field peas so the entire crop has gone to pet and animal feed. Recently, State Line Bean Producers Cooperative has announced they will be accepting field peas for the human consumption market. This development has increased the acres devoted to field pea production and State Line Bean is projecting more acres in the future. Those peas not suitable for human consumption; and not sold for pet food will increase the bushels of field peas available to cattle feeders. Establishing a market or use for the cull peas is critical to the establishment of the field pea acres for human consumption because producers need the security of knowing the crop will have some value to some sector before they will commit to the investment. The fact that field peas are a legume, thus fixing nitrogen in the soil, provides an extra incentive for farmers to plant them for agronomic benefits to the fields. Field peas are also convenient to incorporate into a farming operation, as they utilize common grain planting and harvesting equipment.

Previous research at the University of Nebraska has determined that field peas can replace 20-30% of the diet dry matter usually supplied by corn without negatively impacting finishing cattle performance Field peas have also been shown to increase tenderness when fed to finishing cattle They also make a good binder for distillers grains cubes for supplementing pasture cattle, but other work supplementing field peas to grazing cattle is limited. However, field peas are high in rumen degradable protein which is important for the rumen microbial population of cattle grazing medium to low quality grass and the overall crude protein ranges from 18-26%. The starch content is approximately 30% lower than corn. So, although the energy content is lower, negative associative effects of starch on fiber digestion may be reduced when supplementing field peas rather than corn. Furthermore, supplemental feeds such as distillers grains and corn must be transported long distances to reach western Nebraska and eastern Colorado and Wyoming. Therefore it may be economically advantageous to use locally grown field peas to improve grazing cattle performance rather than more costly imported supplements.

Previous research determined that cattle supplemented dry rolled corn while grazing wheat pasture were more efficient during the feedlot finishing phase than cattle supplemented dried distillers grains or unsupplemented cattle. Field peas also contain starch, but it is unknown whether field peas produce this same effect. Producers have also questioned whether feeding field peas in the grazing phase of the system will impact carcass tenderness in the way that

feeding field peas in the finishing phase does. Additionally, very little is known about the impacts of field pea supplementation on the digestibility of forage based diets. Therefore, the objectives of this current field pea research are to 1) evaluate field peas as a supplement for grazing cattle relative to corn, 2) determine if the impact of field peas on tenderness can be realized by supplementation in the growing phase, and 3) to evaluate the impact of field peas on digestibility of low quality forage as well as better quantify the degradable intake protein content of field peas.

Performance Study

This study will be arranged in a 2*3 factorial design. One hundred fourteen crossbred steers (762 lb) were allotted randomly to one of twelve pastures (10 head/pasture in 9 pastures; 8 head/pasture in 3). Pastures were assigned to treatments. The treatments on the grazing segment were the first part of the factorial design with treatments being 1) no supplement, 2) field peas, or 3) dry-rolled corn + urea and solubles to equal the degradable protein of the field peas supplemented at 0.5% of body weight. The cattle grazed the crested wheatgrass pastures at the High Plains Ag Lab near Sidney, NE. The second half of the factorial includes feeding the cattle a dry-rolled corn based finishing diet with or without field peas. Cattle performance and carcass characteristics will be measured. This experiment will be conducted over two years to improve statistical power and account for environmental variation of grazing conditions.

Meat Science Analysis

Loins from all 114 steers in year 1 will be bought back from the packing plant and tested for tenderness using the Warner Bratzler Shear Force method. Additionally, how field peas affect the fatty acid profile in meat is not well identified. Therefore, fatty acid analysis will be conducted as well. Retail display will be conducted to determine if field peas impact discoloration in the meat counter. Oxidation (which impacts color and shelf life) will be measured 0, 4, and 7 days after retail display.

Metabolism Study

A metabolism study will be conducted evaluating the effects of field peas on digestion characteristics in both low and high quality forage diets to determine how supplementing field peas on cool season grasses in the Nebraska Panhandle might impact forage digestion.

Initial Results

The grazing segment of the first year is all that is completed at the time of this publication. Cattle will be harvested in January. The metabolism trial will be initiated in January as well. Cattle supplemented with peas or corn plus urea and solubles had greater final body weight and gained more than nonsupplemented cattle during the grazing phase (Table 1). Cattle supplemented with corn+ urea and solubles weighed more and gained more than cattle supplemented with peas. Cattle supplemented with peas had acceptable pasture gains. Peas were fed whole and supplemented in bunks. Cattle fed the corn + urea and solubles were also fed in bunks. It is surprising the cattle on the corn treatment gained better than the cattle on the pea treatment as the negative associative effects of starch were expected to suppress fiber digestion. However, rains and cool temperatures kept the cool season grass vegetative and fiber digestion may have not been the issue it would have been in other years.

Table 1. Performance of grazing cattle supplemented field peas or corn+ urea and solubles

	Initial Wt, lb	SE	Final Wt, lb	SE	Daily gain, lb	SE
No Supplement	762	36.4	887[a]	24.2	0.99[a]	0.11
Field Peas	762	36.4	941[b]	24.2	1.42[b]	0.11
Corn + urea and solubles	761	36.4	968[c]	24.2	1.64[c]	0.11

[abc] Columns with differing superscripts differ $P < 0.01$

Summer Cocktail Forage Research in the Panhandle of Nebraska

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Rob Higgins, Research Technician, Josh Buttle, Research Technician

The Nebraska Panhandle is in a unique environment in that it has low rainfall (12-14" annually) and also a high elevation (3800-just over 5000 ft.). The challenge this creates is that most permanent pastures are cool season predominate and therefore have a summer slump resulting in low quality and quantity. The additional challenge is in planting annual forages to supplement the permanent pastures. The high elevation prolongs soil warm up and the lack of moisture can make emergence a challenge.

Across the Midwest forage cocktail mixtures have been gaining popularity in crop rotations. Typically at least three components are included in these mixtures: an annual grass for biomass production, a legume to add nitrogen to the soil, and a brassica or some deep rooted crop to alleviate soil compaction. While it is important to leave some residue of these crops to prevent erosion and capture moisture, if at least some utilization of the crop could be realized for cattle production, it would reduce grazing pressure on permanent pastures that often need relief from drought.

Six treatments were evaluated as forage options for beef cattle in western Nebraska. The forages planted were 1) a monoculture of brown mid-rib sorghum sudangrass, 2) a monoculture of German foxtail millet, 3) BMR sudangrass, soybeans, and a forage collard, 4) German foxtail millet, soybeans, a forage collard, 5) BMR sudangrass, cowpeas, and a forage collard, or 6) German foxtail millet, cowpeas, and a forage collard. The objective of the study was to compare the mixtures to the monocultures and evaluate any differences in tonnage produced, and the quality (crude protein and total digestible nutrients (TDN), acid detergent fiber (ADF)). Each treatment was replicated three times and the study will be conducted again next year to add an additional three replications. The forages were planted June 27, 2014 and harvested September 9, 2014. The soybeans did not appear to come up but the cowpeas did very well. The tons of dry matter produced, crude protein (CP), TDN, and ADF are shown in Table 1. The addition of other forage species to the BMR sudangrass and German Foxtail millet did not impact the tonnage produced although there was a tendency for the tonnage in the millet/soybean/collard mix to be reduced. Most likely this was due to the reduced seeding rate of the millet to accommodate for the soybeans which then did not come up. Crude protein was improved in the cocktail mixtures compared to the monocultures. Total digestible nutrients and ADF were not significantly impacted when comparing monocultures to cocktails, but the millet/soybean/collard mix (which did not contain soybeans at harvest) was higher in TDN and lower in ADF than the BMR sudangrass.

This study did not look at agronomic impacts of planting cocktails, only the quality of the forage mixtures for beef cattle. As previously mentioned, the crops were planted the last week of June. Possibly, more summer growth would have occurred if the crops had been planted the second week of June. Previous research at the High Plains Ag Lab near Sidney, NE has indicated that the window of opportunity for planting summer annuals in the Panhandle is fairly narrow.

With the later planting date, and a lack of moisture in July, this study did not experience a lot of growth in July and would have been difficult to graze at that time. Rainfall returned to the area the very end of July and in early August and the forages grew rapidly. Again, for producers trying to manage summer annuals for grazing, this would have been challenging. However, if a producer wanted the forages in this experiment for fall windrow grazing or winter hay, it did produce acceptable tonnage and quality by early September.

A second year on this study will be conducted to better understand how complementary forages fit in this region.

	Tons/acre DM*	CP, %DM	TDN, % DM**	ADF, % DM**
BMR Sudangrass	2.17	8.8^{a}	62.1	36.2
Foxtail Millet	1.84	11.4^{af}	64.2	34.6
Sudan/soybeans/collards***	1.97	9.8^{ad}	62.7	35.8
Millet/soybeans/collards***	1.42	15.8^{b}	68.7	30.3
Sudan/cowpeas/collards	1.94	12.2^{cdef}	66.9	31.7
Millet/cowpeas/collards	1.69	14.5^{be}	63.9	34.4

*BMR Sudangrass vs. Millet/soybeans/collards had a tendency (P =0.06) to be different.
Means with unlike superscripts differ ($P < 0.05$).
** BMR Sudangrass vs. Millet/soybeans/collards were different $P < 0.05$.
***Soybeans did not contribute any dry matter production in this study.

High Plains Ag Lab Field Day

Thursday, June 19, 2014, Sidney, NE

8:00 Registration and Refreshments - Compliments of Points West Bank

8:15 Welcome and Administrative Update

- **Keith Rexroth,** Chair, High Plains Ag. Lab Advisory Board
- **Thomas Nightingale**, Farm Manager, High Plains Ag. Lab
- **Jack Whittier**, Director, Panhandle Research and Extension Center

8:45 Research Plot Tour

- **Oil seed crops research** - Dipak Santra (15 min)
- **Wheat variety testing** - Stephen Baenziger (45 min)
- **An update concerning insect resistance research in dryland crops** - Jeff Bradshaw (15 min)
- **Update on winter wheat diseases** - Stephen Wegulo (15 min)
- **Evaluating the risk of alternative over-summering hosts** - Justin McMechan (15 min)
- **Timing of virus infection and impact of wheat planting date and variety selection -** Everlyne Wosula (15 min)

10:45 Break - Compliments of Wheat Belt Public Power District

11:00 Research Plot Tour, continued

- **Field pea as new alternative crop** - Dipak Santra (15 min)
- **Field pea as potential supplement feed** - Jack Whittier (15 min)
- **Weed management in field pea** - Rob Higgins (15 min)
- **Soil research** - Gary Hergert (15 min)

12:00 - 12:30 New HPAL Building Dedication

12:30 Lunch