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High Plains Ag Lab

Update of Research Conducted in 2017

February 15, 2018

University of Nebraska
High Plains Agricultural Lab
Sidney, Nebraska

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ANNUAL REPORT
2017

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, Jake Hansen**

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2016-2017

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PERSONNEL AT HPAL

2017

Employee	Title	Period Worked
Jake Hansen	Manager	Sept 2016-Dec 2017
Tom Nightingale	Summer Work	Jan 1975-Oct 2017
Paul McMillan	Summer Work	Mar 1983-Dec 2017
Vernon Florke	Crops Technician	May 2007-Dec 2017
Bill Struckmeyer	BQMS Technician	Jan 2014-Dec 2017
Travis Orrell	Crops Technician	July 2015-Dec 2017
James Burford	Crops Technician	June 2016-Dec 2017
David Wills	Summer Work	April 2016-Dec 2017
David Blanke	Summer Work	May 2017-Dec 2017
Duane Nightingale	Summer Work	April 2017-Aug 2017
Tyler Taylor	Graduate Student	May 2016-Aug 2017
Jaidyn Taylor	Summer Work	June 2016-Aug 2017
Braden Troyer	Graduate Student	May 2017-Aug 2017
Nathan Pflueger	Graduate Student	May 2017-July 2017
Luana Simao	Undergraduate Intern	Sept 2017-Dec 2017

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

STAFF MEMBER	TITLE
Dr. Jack Whittier	Director, Panhandle Res & Ext Center
Dr. Cody Creech	Asst. Professor of Agronomy/Horticulture
Dr. Jeff Bradshaw	Assoc. Professor of Entomology
Dr. Dipak Santra	Assoc. Professor of Agronomy/Horticulture
Dr. Karla Jenkins	Assoc. Professor of Animal Science
Dr. Mitch Stephenson	Asst. Professor of Range and Forage
Karen Deboer	Extension Educator
Aaron Berger	Extension Educator
Harrison Boateng	System Support Specialist
Pam Joern	Accounting Associate
Stefanie Cruz	Assistant Business Manager

PROFESSIONAL STAFF OUTSIDE THE PANHANDLE RESEARCH AND EXTENSION CENTER WHO HAD COOPERATIVE STUDIES WITH REGULAR STAFF MEMBERS

NAME	ORGANIZATION
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 Professor of Plant Pathology
Dr. Teshome Regassa	Research Asst. Professor
Dr. Edward Cahoon	Professor of Biochemistry
Dr. Humberto Blanco	Assoc Prof Agronomy
Dr. Daniel Schachtman	Professor and director, Center for Biotechnology

RESEARCH TRIALS CONDUCTED DURING 2017

WHEAT AND BARLEY

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 Study	Creech Orrell	Comparisons of Plow, Subtill, and No Till
Winter Wheat Variety Trial	Santra Regassa Florke	Varieties & exp. Lines
Planting date & variety selection for management of the wheat curl mite complex	Hein McMechan Creech	Evaluation of early and late planting of commercial varieties of winter wheat
Winter Wheat	Creech Orrell	Timing of Gibberellic acid treatments in winter wheat
Winter Barley	Baenziger Santra Florke	Variety Trial
Albaugh Adjuvant Trial	Creech Orrell	Investigate the effects of adjuvants on the efficacy of winter annual control
Albaugh Rye and Jointed Goat Grass Herbicide Trial	Creech Orrell	Evaluate effectiveness of Albaugh technology of winter annual control
Effects Soil Applied Biochar on Organic Matter Content	Creech Humberto Blanco Orrell Nielson	Investigate the effects of soil applied High-carbon char on soil fertility

Wheat Planting Date/Row Spacing/ Seeding Rate Study	Burford Creech Orrell Taylor	Evaluate the effect of planting date, row spacing, and seeding rate on winter wheat yield
Valent Outrider/Maverick study	Burford Creech Orrell	Investigate the residual effects of Outrider and Maverick herbicides on multiple crops
Wheat Residue Study	Burford Creech Orrell	Investigate the effects of wheat residue strength on rotations
Wheat Preventative Fungicide Trial	Burford Creech Orrell	Evaluate preventable fungicides in winter wheat

Forages

Trial	Staff	Description
Winter Triticale	Santra Baenziger Florke	Winter Triticale Varieties
Summer annual inter seeding of Perennial pasture Multistate trial	Stephenson Jenkins Creech	Inter seeding of cool season pasture with legumes
Dryland and Irrigated Forage Sorghum Variety Trial	Creech Stephenson Orrell Burford	Yield and quality of varieties

Oilseed Crops: Sunflower and Winter Canola

Trial	Staff	Description
Sunflower Varieties, oils	Santra Florke	Dryland and irrigated sunflower varieties
Winter Canola	Creech Santra Burford Orrell	Evaluation of no-till, minimum till, and stale seedbeds for winter canola production

Winter Canola	Santra Florke	Winter screening nursery & variety trial
Camelina	Santra Florke	Nursery and variety trial

Legumes

Trial	**Staff**	**Description**
Pea Variety Trial	Santra Florke Hazen	Dryland variety trial
Winfield Extruded Granule Field Pea Herbicide Trial	Creech Orrell Hardt	Evaluation of pre-emergence treatments in field peas
Winfield Section 3 Adjuvant Trial	Creech Orrell	Evaluation of pre-emergence treatments in field peas
FMC Field Pea Herbicide Trial	Creech Orrell Gill	Evaluation of pre-emergence and post treatments in field peas
Herbicide Trial for Nebraska Weed Guide Field Pea Section	Creech Orrell Taylor	Evaluating effectiveness of currently labeled herbicides for publications of The Nebraska Weed Guide
FMC AMTZ Field Pea Herbicide Trial	Creech Orrell	Evaluation of pre-emergence treatment in field peas
Dryland/Irrigated Dry Edible Bean Variety Trial	Creech Orrell Taylor Wills Burford Urrea	Variety Trial

Millet, Sorghum, Corn

Trial	Staff	Description
Proso Millet Variety Trial	Santra Florke	Dryland & Irrigated Varieties
Proso Millet Breeding	Santra Florke Hazen	Bulk selection of proso head rows
Milo Variety Trial	Creech Orrell	Dryland milo varieties
Winfield Armezon Dryland Corn Herbicide Trial	Creech Orrell	Evaluate effectiveness of Armenzon and Armezon pro on dryland corn

Millet, Sorghum, Corn

Trial	Staff	Description
Bioenergy Sorghum Variety Trial	Creech Orrell Schachtman	Variety Trial

Cattle

Trial	Staff	Description
Pasture Trial	Jenkins Troyer	Evaluating the feeding value of field peas as a protein source relative to distillers grains
Cover Crop Grazing	Stephenson Schlitz Troyer PFlueger	Efficiency of including a grazed cool-season annual forage in a dryland crop rotation

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ROT. #1 – Pea-Wheat-Millet
Fields 1E,1C,1W Organic Rotation

Rot. #2-Wheat-Corn-Fallow
Fields 2,3

ROT. #3 – Wheat – Fallow
Fields 4, 5, 14, 15

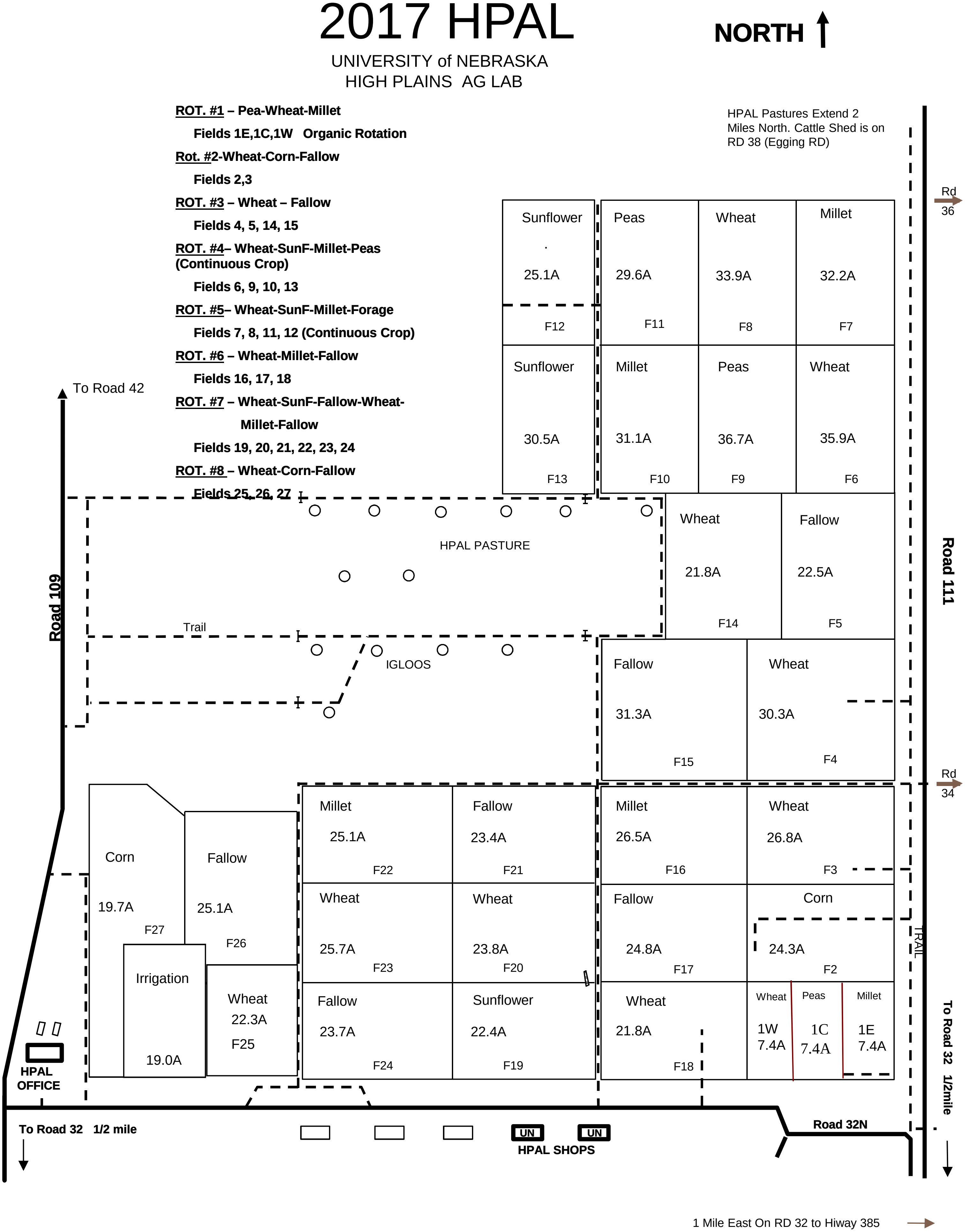
ROT. #4– Wheat-SunF-Millet-Peas (Continuous Crop)
Fields 6, 9, 10, 13

ROT. #5– Wheat-SunF-Millet-Forage
Fields 7, 8, 11, 12 (Continuous Crop)

ROT. #6 – Wheat-Millet-Fallow
Fields 16, 17, 18

ROT. #7 – Wheat-SunF-Fallow-Wheat-Millet-Fallow
Fields 19, 20, 21, 22, 23, 24

ROT. #8 – Wheat-Corn-Fallow
Fields 25, 26, 27



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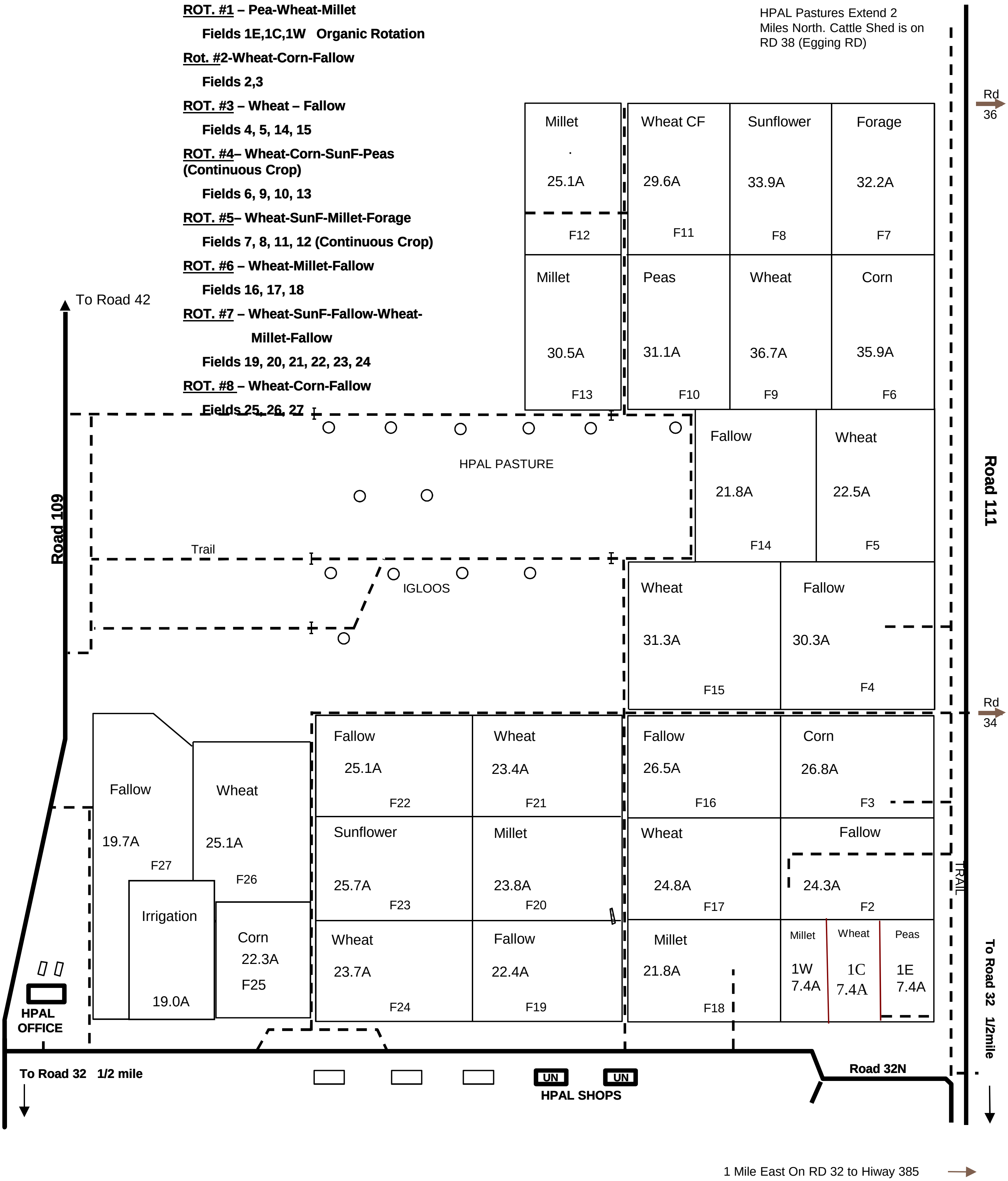

Yield Summaries
2013-2014-2015-2016

ROTATION				
	2014	**2015**	**2016**	**2017**
R#1	**WHEAT-MILLET-FALLOW-WHEAT-SUNFLOWER-FALLOW; ORGANIC**			
F1E	WHEAT-34.6 bu/a	MILLET-36.4 bu/a	Millet -28.2 bu/a	WHEAT 39.7 bu/a
F1C				PEAS 24.3 bu/a
F1W				MILLET 27 bu/a
R#2				
F2	Millet-29.0 bu/a	FALLOW	WHEAT - 43.7 bu/a	CORN 101.4 bu/a
F3	FALLOW	Wheat-51.3 bu/a	Fallow	WHEAT 51.1 bu/a
R#3	**WHEAT-FALLOW**			
F4	FALLOW	WHEAT-32.2 bu/a	FALLOW	SUNF 1306.71 lbs/a
F5	WHEAT-44.8 bu/a	FALLOW	WHEAT - 42.6 bu/a	FALLOW
F14	FALLOW	WHEAT-38.5 bu/a	FALLOW	SUNF 1421.52
F15	WHEAT-44.2 bu/a	FALLOW	WHEAT - 35.44 bu/a	FALLOW
R#4	**WHEAT-SUNFLOWER-MILLET-FALLOW**			
F6	SUNF-1558 lb/a	MILLET-44 bu/a	FALLOW	WHEAT FAILED
F9	WHEAT-31.5 bu/a	SUNF-1005 lb/a	MILLET - 49.96 bu/a	PEAS 23 bu/a
F10	FALLOW	WHEAT 50 bu/a	SUNF - 1583.28 lbs/a	MILLET 25.9 bu/a
F13	MILLET-36.5 bu/a	FALLOW	WHEAT - 36.3 bu/a	SUNF 1341.64 bu/a
R#5	**WHEAT-SUNFLOWER-MILLET-FORAGE/PEAS**			
F7	PEAS-23 bu/a	WHEAT-48.6 bu/a	SUNF - 1734.16 lbs/a	MILLET 33.7bu/a
F8	SUNF-1773 lbs/a	MILLET-48 bu/a	PEAS - 15 bu/a	WHEAT 27.07 bu/a
F11	WHEAT-22.4 bu/a	SUNF-915 lb/a	MILLET - 54.66 bu/a	GRAZED
F12	MILLET-35.8 bu/a	PEAS-37 bu/a	WHEAT - 35.5 bu/a	SUNF 1582.33 lbs/a

Yeild Summaries (con't)

ROTATION				
	2014	**2015**	**2016**	**2017**
R#6	**WHEAT-MILLET-FALLOW**			
F16	MILLET-41.2 bu/a	FALLOW	WHEAT - 43.9 bu/a	MILLET 27.8 bu/a
F17	FALLOW	WHEAT-54.2 bu/a	MILLET - 20.84 bu/a	FALLOW
F18	WHEAT-49.1 bu/a	MILLET-37 bu/a	FALLOW	WHEAT 37.1 bu/a
R#7	**WHEAT-SUNFLOWER-FALLOW-WHEAT-MILLET-FALLOW**			
F19	SUNF-1534 lb/a	FALLOW	WHEAT - 29.8 bu/a	SUNF 1316.96 lbs/a
F20	WHEAT-51.2 bu/a	SUNF-773 lb/a	FALLOW	WHEAT 39.64 bu/a
F21	FALLOW	WHEAT-39.7 bu/a	MILLET - 41.55	FALLOW
F22	MILLET-35.5 bu/a	FALLOW	WHEAT-38.3 bu/a	MILLET 25.7 bu/a
F23	WHEAT-53.9 bu/a	MILLET-41 bu/a	FALLOW	WHEAT 36.8 bu/a
F24	FALLOW	WHEAT-46 bu/a	SUNF - 1602 lbs/a	FALLOW
R#8	**WHEAT-CORN-FALLOW**			
F25	WHEAT-53.8 bu/a	CORN-69 bu/a	FALLOW	WHEAT 38.53BU/A
F26	FALLOW	WHEAT-45.9 bu/a	CORN - 86.88 bu/a	FALLOW
F27	CORN-79.5 bu/a	FALLOW	WHEAT-35.1 bu/a	CORN 74.1 bu/a

CROP	**2014**	**2015**	**2016**	**2017**
WHEAT	43.3 bu/a	45.1 bu/a	37.9 bu/a	38.38 bu/a
MILLET	35.6 bu/a	41.3 bu/a	41.76 bu/a	28.02 bu/a (hail)
SUNF	1621.7 lb/a	898 lb/a	1640 lb/a	1393.83 lbs/a
CORN	79.5 bu/a	69 bu/a	86.88 bu/a	87.75 bu/a

HIGH PLAINS AG LAB WEATHER DATA
OCTOBER 1, 2016 - SEPTEMBER 30, 2017

Month	Precipitation Year	Precipitation Normal	Maximum Temp Year	Maximum Temp Normal	Minimum Temp Year	Minimum Temp Normal
October 2016	0.77	0.92	72.1	64.4	38.7	34.0
November 2016	0.30	0.46	57.0	49.9	28.6	22.0
December 2016	0.70	0.35	37.1	40.8	12.1	14.7
January 2017	0.52	0.29	36.4	39.5	15.8	12.6
February 2017	0.47	0.38	49.8	43.6	21.9	16.4
March 2017	0.96	0.91	59.6	50.6	29.4	22.8
April 2017	1.76	1.68	61.5	59.9	35.4	31.5
May 2017	3.33	2.98	67.3	69.2	42.0	41.6
June 2017	1.17	3.08	83.6	80.0	52.8	51.4
July 2017	1.36	2.52	92.5	88.0	59.4	57.4
August 2017	3.78	2.01	83.6	85.9	53.8	55.5
September 2017	1.65	1.38	77.2	77.0	48.8	45.6
TOTAL PRECIPITATION	16.77	16.96				
YEARLY AVERAGE TEMPERATURE			64.8	62.4	36.6	33.8

Normal = 70 year average

2017 Crop Rotation #1
3 Year Stacked Organic
Field 1E, 1C, 1W
Peas, Wheat, Millet

Operations

Field 1E – 7.4 Acres – Millet – Previous Crop - Wheat

April 19	Disked Cover Wheat
June 5	One Pass
June 12	One Pass
June 13	Planted Huntsman Millet
September 22	Harvested Millet 27bu/a

Field 1C – 7.4 Acres – Peas – Previous Crop – Millet

March 23	Planted Nette Peas 180lbs/A
July 7	Harvested Peas 24.32 bu/a
July 12	Disked
August 23	Disked
August 24	One Pass
September 8	Planted Freeman Wheat 60lbs/a

Field 1W – 7.4 Acres – Wheat – Previous Crop – Peas

September 12	Planted Freeman Wheat 48 lbs/a
July 6	Harvested Wheat 39.75 bu/a
August 22	Disked
August 24	One Pass
September 9	Planted Freeman Wheat 60 lbs/a Cover

2017 Crop Rotation #2
Wheat, Corn, Fallow
Fields 2,3

Field 2 – 24.3 – Corn – Previous Crop – Wheat

April 10	32oz/a Roundup RT3 + 1/100 Class Act
May 2	50 lbs/a Nitrogen Streamer Nozzles
May 8	Planted Corn 14,000/a Croplan 3337
June 16	24oz/a Roundup RT3 + 4oz/a Dicamba + 2qt/100 Class Act
October 19	Harvested Corn 101.4bu/a

Field 3 – 26.8 – Wheat – Previous Crop – Fallow

September 26	Planted Freeman Wheat 48lbs/a
April 14	10 lbs/a Nitrogen + 8oz/a LV6 + 2.56oz/a Lamba Cyhalothria (cut worms)
July 6	Harvested Wheat 51.1 bu/a
August 23	28oz/a Roundup RT3 + 1/100 Class Act + 8 oz/a LV6

2017 Crop Rotation #3
2 Year
Fields 4,5,14,15
Wheat, Fallow

Operations

Field 4 – 30.3 Acres – CL Sunflowers– Previous Crop – Fallow

September 8	Planted Settler CL Wheat 48lbs/a
April 14	10lbs/a Nitrogen + 8oz/a LV6 + 2.56 oz/a Lamba Cyhalothia (Cut worms)
May 24	32 oz/a Roundup RT3 + 1/100 Class Act (Killed For Wheat Streak Mosaic)
June 1	Planted Sunflower 545CL 17,000/a
June 2	24oz/a Roundup RT3 + 2.8oz/a Spartan Charge + 2.2 oz/a Prowl + 2qt/100 Class Act
October 16	Harvested Sunflowers 1306.71 lbs/a

Field 5 – 22.5 Acres – Fallow – Previous Crop – Wheat

April 14	32oz/a Roundup RT3 + 8oz/a LV6 + 1/100 Class Act + 4oz/a Spartan Charge
June 30	24oz/a Roundup RT3 + 16oz/a LV6 + 1/100 Class Act
July 12	20oz/a Roundup RT3 + 6.4oz/a Staredown
July 17	Spot Disk to Kill Resistant Kochia
August 14	50 lbs/a Nitrogen Streamer Nozzles
August 22	28oz/a Roundup RT3 + 1.25oz/a Sharpen + 9 oz/a LV6 + 1/100 Class Act
September 9	Planted Freeman Wheat 60lbs/a

Field 14 – 21.8 Acres – CL Sunflowers – Previous Crop – Fallow

September 9	Planted Settler CL Wheat 48lbs/a
April 14	8oz/a LV6 + 2.56oz/a Lamba Cyhalothia (cut worms) + 4oz/a Beyond + 10lbs/a Nitrogen
May 24	32 oz/a Roundup RT3 + 1/100 Class Act (Killed for Wheat Streak Mosaic)
June 1	Planted Sunflower 545CL 17,000/a
June 2	24oz/a Roundup RT3 + 2.8oz/a Spartan Charge + 2.2 pt/a Prowl H2O + 2qt/100 Class Act
October 13	Harvested Sunflowers 1421.52 lbs/a

Field 15 – 22.5 Acres – Fallow – Previous Crop – Wheat

April 14	32oz/a Roundup RT3 + 8 oz/a LV6 + 4oz/a Spartan Charge + 1/100 Class Act
June 30	24oz/a Roundup RT3 + 16oz/a LV6 + 1/100 Class Act
August 14	50lbs/a Nitrogen Streamer Nozzles
August 23	28oz/a Roundup RT3 + 1/100 Class Act + 9oz/a LV6 + 1.25 oz/a Sharpen
September 7	Planted Freeman Wheat 60lbs/a

2017 Crop Rotation #4
4 Year
Fields 6,9,10,13
Wheat, Sunflower, Millet, Fallow

Operations

Field 6 – 35.9 Acres – Wheat – Previous Crop – Fallow

September 9	Planted Settler CL Wheat 48 lbs/a
April 14	10 lbs/a Nitrogen + 8 oz/a LV6 + 2.56 oz/a Lamba + 4oz/a Beyond
May 24	32 oz/a Roundup RT3 + 1/100 Class Act (Kill Mosaic)
June 27	32oz/a Roundup RT3 + 8 oz/a LV6 + 1/100 Class Act
July 26	32oz/a Roundup RT3 + 16oz/a Dicamba + 1/100 Class Act
August 17	1qt/a Gramoxon + 2qt/a Crop Oil + 2oz/a LV6

Field 9 – 36.7 Acres – Peas – Previous Crop – Millet

March 22	Planted Nette Field Peas 180lbs/a
March 23	1.5oz/a Optil Dry + 28oz/a Roundup RT3
July 7	Harvested Peas 23 bu/a
July 12	28oz/a Roundup RT3 + 12oz/a LV6 + 1/100 Class Act
August 3	1qt/a Gramoxon + 2qt/a Crop Oil + 2 oz/a LV6
August 14	50lbs/a Nitrogen Streamer Nozzles
August 23	28oz/a Roundup RT3 + 1.25 oz/a Sharpen +1/100 Class Act + 9oz/aLV6
September 12	Planted Freeman Wheat 60lbs/a

Field 10 - 31.1 Acres – Millet – Previous Crop – Sunflower

April 19	28oz/a Roundup RT3 + 8oz/a LV6 + 1/100 Class Act
May 15	50 lbs/a Nitrogen Streamer Nozzles
June 6	Planted Huntsman Millet 15lbs/a
June 7	28oz/a Roundup RT3 + 2oz/a Sharpen + 2qt/100 Class Act
June 30	6oz/a Starane + 2 oz/a Top Surfactant
September 5	Millet Sprayed out 7qt/100 Level 7 + 32oz/a Crop Smart Plus + Sitka .5gal/100
September 15	Hail and Wind
September 20	Harvested Millet 25.9 bu/a

Field 13 – 30.5 Acres – Sunflower – Previous Crop – Wheat

April 11	32oz/a Roundup RT3 + 1/100 Class Act
May 16	30lbs/a Nitrogen Streamer Nozzles
June 1	Planted Sunflowers 432E 17,000/a
June 2	24oz/a Roundup RT3 + 2.8oz/a Spartan Charge + 2.2 pt/a Prowl H2O + 2qt/100 Class Act
October 11	Harvested Sunflowers 1341.64 lbs/a

2017 Crop Rotation #5
4 Year Continuous
Fields 7,8,11,12
Wheat, Sunflowers, Millet, Peas

<u>Operations</u>

Field 7 – 32.2 Acres – Millet – Previous Crop – Sunflower

April 19	28oz/a Roundup Powermax + 8oz/a LV6 + 1gal/100 Class Act
May 15	50lb/a Nitrogen Streamer Nozzle
June 5	Planted Huntsman Millet 15lbs/a
June 7	28oz/a Roundup RT3 + 2oz/a Sharpen + 2qt/100 Class Act
July 11	12oz/a 2-4D Amine
September 5	Millet Sprayed Out 7qt/100 Level 7 + 32 oz/a Cropsmart Plus + .5gal/100 Sitka
September 15	Hail and Wind
September 20	Harvested Millet 33.7 bu/a

Field 8 – 33.9 Acres – Wheat – Previous Crop – Peas

September 13	Planted Freeman Wheat 60lbs/a
April 14	8oz/a LV6 + 2.56 oz/a Lamba + 10lbs/a Nitrogen
July 5	Harvested Wheat 27.07 bu/a
August 23	28oz/a Roundup RT3 + 1/100 Class Act + 8oz/a LV6

Field 11 – 29.6 Acres – Cover Crop – Previous Crop - Millet

March 17	50lb/a Nitrogen Streamer Nozzles
March 20	Planted Peas 20lbs/a North/South
March 21	Planted Oats 70lbs/a + Brassicas 2lbs/a East/West
June 2	Turned Out Heifers 5 Head/Paddock
July 6	Removed Heifers
July 22	32oz/a Roundup RT3 + 16oz/a Dicamba + 1/100 Class Act
August 14	50lbs Nitrogen Streamer Nozzles
August 23	28oz/a Roundup RT3 + 1/100 Class Act + 9oz/a LV6 + 1.25oz/a Sharpen
September 6	Planted Wheat Settler CL 60lbs/a

Field 12 – 25.1 Acres – Sunflower – Previous Crop – Wheat

April 11	32oz/a Roundup RT3 + 1/100 Class Act
May 16	30lbs/a Nitrogen Streamer Nozzles
May 31	Planted Sunflowers 432E 17,000/a
June 2	24oz/a Roundup RT3 + 2.8oz/a Spartan Charge + 2.2 pt/a Prowl H2O + 2qt/100 Class Act
October 9	Harvested Sunflowers 1582.33 lbs/a

2017 Crop Rotation #6
3 Year
Fields 16,17,18
Wheat, Millet, Fallow

Operations

Field 16 – 26.5 – Millet – Previous Crop – Wheat

April 10	32oz/a Roundup RT3 + 1/100 Class Act
May 16	50lbs/a Nitrogen Streamer Nozzles
June 6	Planted Huntsman Millet 15lbs/a
June 7	28oz/a Roundup RT3 + 2oz/a Sharpen + 2qt/100 Class Act
July 11	10oz/a 24-D Amine
September 5	Sprayed Out Millet 7qt/100 Level 7 + 32oz/a Cropsmart Plus + .5gal/100 Sitka
September 15	Wind and Hail
September 20	Harvest Millet 27.8bu/a

Field 17 – 24.8 Acres – Fallow – Previous Crop – Millet

April 19	32oz/a Roundup RT3 + 16oz/a LV6 + 1/100 Class Act
June 9	20oz/a Roundup RT3 + 8oz/a LV6 + 2qt/100 Class Act
July 10	24oz/a Roundup RT3 + 12 oz/a LV6 + 1/100 Class Act
July 29	1qt/a Gramoxon + 2qt/a Crop Oil + 2oz/a LV6
August 19	50lbs/a Nitrogen Streamer Nozzles
August 22	28oz/a Roundup RT3 + 9oz/a LV6 + 1/100 Class Act
September 10	Planted Freeman Wheat 60lbs/a

Field 18- 21.8 Acres – Wheat – Previous Crop – Fallow

September 15	Planted Freeman Wheat 60lbs/a
April 14	8oz/a LV6 + 2.56 Lamba + 10lbs/a Nitrogen
July 6	Harvested Wheat 37.10 bu/a
August 23	28oz/a Roundup RT3 + 8oz/a LV6 + 1/100 Class Act

2017 Crop Rotation #7
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 10	32oz/a Roundup RT3 + 1/100 Class Act
May 15	30lbs Nitrogen Streamer Nozzles
June 1	Planted Sunflowers Croplan 432E 17,000/a
June 2	24oz/a Roundup RT3 + 2.8oz/a Spartan Charge + 2.2 pt/a Prowl H2O + 2qt/100 Class Act
October 12	Harvested Sunflowers 1316.96 lbs/a

Field 20 – 23.8 Acres – Wheat – Previous Crop – Fallow

September 14	Planted Freeman Wheat 60lbs/a
April 14	8oz/a LV6 + 2.56oz/a Lamba + 10 lbs/a Nitrogen
July 5	Harvested Wheat 39.64bu/a
July 29	28oz/a Roundup RT3 + 8 oz/a LV6 + 1 gal/100 Class Act

Field 21 – 23.4 Acres – Fallow – Previous Crop – Millet

April 19	32 oz/a Roundup RT3 + 16oz/a LV6 + 1/100 Class Act
June 9	20oz/a Roundup RT3 + 8oz/a LV6 + 1/100 Class Act
July 10	24oz/a Roundup Powermax + 12oz/a LV6 + 1/100 Class Act
August 19	50lbs/a Nitrogen Streamer Nozzles
August 22	28oz/a Roundup RT3 + 8oz/a + 1/100 Class Act
September 9	Planted Freeman Wheat 60lbs/a

Field 22 – 25.1 Acres – Millet – Previous Crop – Wheat

April 19	32oz/a Roundup RT3 + 16oz/a LV6 + 1/100 Class Act
May 2	50lbs/a Nitrogen Streamer Nozzles
June 9	28oz/a Roundup RT3 + 2oz/a Sharpen + 2qt/100 Class Act
June 11	Planted Huntsman Millet 15lbs/a
July 11	10oz/a 24D Amine
September 5	Millet Sprayed Out 7qt/100 Level 7 + 32oz/a Cropsmart Plus + .5gal/100 Sitka
September 15	Hail and Wind
September 20	Harvested Millet 25.70 bu/a

Field 23 – 25.7 Acres – Wheat – Previous Crop – Fallow

September 14	Planted Freeman Wheat 60lbs/a
April 14	8oz/a LV6 + 2.56 oz/a Lamba + 10lbs/a Nitrogen
July 5	Harvested Wheat 36.8 bu/a
August 23	28oz/a Roundup RT3 + 8 oz/a LV6 + 1 gal/100 Class Act

Field 24 – 23.7 Acres – Fallow – Previous Crop – Sunflower

April 8	28oz/a Roundup RT3 + 8oz/a LV6 + 1 gal/100 Class Act
June 9	20oz/a Roundup RT3 + 8oz/a LV6 + 1/100 Class Act
July 10	24oz/a Roundup RT3 + 12oz/a LV6 + 1/100 Class Act
August 19	50lbs/a Nitrogen Streamer Nozzles
August 22	28oz/a Roundup RT3 + 9oz/a LV6 + 1/100 Class Act + 1.25oz/a Sharpen
September 19	Planted Freeman Wheat 60lbs/a

2017 Crop Rotation #8
3 Year
Fields 25,26,27
Wheat, Corn, Fallow

Operations

Field 25 – 22.3 Acres – Wheat – Previous Crop – Fallow

September 22	Planted Freeman Wheat 60lbs/a
April 14	8oz/a LV6 + 2.56 oz/a Lamba + 10lbs/a Nitrogen
July 5	Harvested Wheat 38.53 bu/a
August 23	28oz/a Roundup RT3 + 8oz/a LV6 + 1/100 Class Act

Field 26 - 25.1 Acres – Fallow – Previous Crop –Corn

April 18	28oz/a Roundup RT3 + 8oz/a LV6 + 1 gal/100 Class Act
June 9	20oz/a Roundup RT3 + 8oz/a LV6 + 2qt/100 Class Act
July 12	20oz/a Roundup RT3 + 12oz/a LV6 + 1/100 Class Act
August 19	50lbs Nitrogen Streamer Nozzles
August 23	28oz/a Roundup RT3 + 9oz/a LV6 + 1/100 Class Act + 1.25oz/a Sharpen
September 9	Planted Freeman Wheat 60lbs/a

Field 27 – 19.7 Acres – Corn – Previous Crop – Wheat

April 11	32oz/a Roundup RT3 + 1/100 Class Act
May 2	50lbs/a Nitrogen Streamer Nozzle
May 8	Planted Corn 14,000/a Croplan 3337
June 16	24oz/a Roundup RT3 + 4oz/a Dicamba
October 20	Harvested Corn 74.1bu/a

Proso Millet Breeding

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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. Objectives in 2017 were to (1) select high yielding advanced breeding lines for dryland/rainfed, organic and irrigated condition, (2) advance and select breeding populations of different generation (F_2, F_4, F_5) under dryland dryland condition.

Material and Methods

Yield trial:

A total of forty entries, which included 10 checks and 30 advanced breeding lines ($F_{6\text{ \& above}}$) selection from elite nurseries (2014-2016) were tested as replicated trial for seed yield potential. The lines were planted in a 25 feet long 8-rows plot with 7.5 inches between rows (i.e. 5’ x 30’) at a seeding rate of 15 lbs/acre under dryland (no-till), dryland organic (tilled), and irrigated condition. Selection was based on uniformity and general agronomic appearance (mainly plant height, flowering (50% of the emerged spikes had extruded anthers), and lodging tolerance.

Results

Variety trial:

Results of the three variety trials (40 entries each) at the HPAL were presented in Table 1 (dryland/rainfed), Table 2 (organic), and Table 3 (irrigated), respectively.

Table 1. 2017 proso millet variety trial under dryland no-till at the High Plains Ag. Lab in Cheyenne Co. Yield is adjusted at 12% grain moisture since grain moisture significantly varied among the plots. Names in **bold** are check varieties. (Planted: June 10 and Harvest: Oct.12).

Variety	Entry	Yield Rank	Yield (lbs/acre)	Yield (bu/acre)	Bushel weight (lbs/bu)	Height (inch)	Heading (days after planting)
HXM-10-29	40	1	4692	78	57	33	56
PMx11.35-3	21	2	3350	56	57	35	57
PMx11.10-82	37	3	3335	56	56	33	54
HXR-1-23	39	4	3176	53	56	34	55
PMx11.26-48	23	5	3118	52	56	33	57

PMx11.35-15	28	6	3074	51	57	34	57
PMx11.3-21	35	7	3072	51	56	34	55
Horizon	**6**	**8**	**3070**	**51**	**57**	**29**	**54**
PMx11.26-20	20	9	2966	49	54	35	54
PMx11.35-11	22	10	2956	49	57	35	58
PMx11.27-79	24	11	2907	48	57	34	56
HXR-2-75	34	12	2893	48	56	34	53
PMx11.10-5	32	13	2874	48	56	33	53
PMx11.32-72	27	14	2839	47	42	33	58
PMx11.35-32	13	15	2834	47	56	34	58
PMx11.35-44	19	16	2811	47	57	34	58
PMx11.35-52	18	17	2748	46	57	35	58
Minco	**8**	**18**	**2709**	**45**	**53**	**31**	**50**
Plateau	**7**	**19**	**2709**	**45**	**52**	**30**	**46**
PMx11.4-16	33	20	2689	45	57	33	55
PMx11.10-61	42	21	2674	45	56	33	54
PMx11.31-101	16	22	2641	44	56	34	58
PMx11.35-12	26	23	2641	44	57	34	56
Sunrise	**5**	**24**	**2636**	**44**	**56**	**31**	**53**
PMx11.14-10	41	25	2600	43	56	32	55
PMx11.35-19	25	26	2594	43	55	35	57
PMx11.23-52	29	27	2586	43	56	34	57
Huntsman	**4**	**28**	**2482**	**41**	**57**	**30**	**56**
PMx11.28-52	17	29	2473	41	57	33	58
PMx11.4-91	36	30	2431	41	57	36	54
HXM-12-127	38	31	2420	40	56	35	54
PMx11.35-27	12	32	2406	40	56	32	57
Snowbird	**9**	**33**	**2396**	**40**	**55**	**31**	**52**
Earlybird	**3**	**34**	**2385**	**40**	**56**	**30**	**54**
PMx11.26-63	15	35	2344	39	56	33	58
PMx11.28-13	14	36	2249	37	56	32	56
FarmerEntry	**10**	**37**	**2235**	**37**	**54**	**32**	**57**
Sunup	**2**	**38**	**2153**	**36**	**55**	**32**	**55**
Dawn	**1**	**39**	**1944**	**32**	**53**	**28**	**45**
PMx11.32-93	11	40	1711	29	57	33	58
Ave. of all entries			**2720**	**45**	**55**	**33**	**55**
Diff. req for sig at 5%			**784**	**13**	**ns**	**2**	**1**

Table 2. 2017 proso millet variety trial under dryland organic field at the High Plains Ag. Lab in Cheyenne Co. Yield is adjusted at 12% grain moisture since grain moisture significantly varied among the plots. Names in **bold** are check varieties. (Planted: June 25 and Harvest: Oct.16).

Variety	Entry	Yield Rank	Yield (lbs/acre)	Yield (bu/acre)	Bushel weight (lbs/bu)	Heading (days after planting)
PMx11.35-19	25	1	2046	34	55	49
PMx11.23-52	29	2	1989	33	55	49
PMx11.35-32	13	3	1955	33	56	50
Earlybird	**3**	**4**	**1937**	**32**	**55**	**47**
PMx11.35-15	28	5	1895	32	56	50
PMx11.27-79	24	6	1852	31	56	47
PMx11.28-13	14	7	1844	31	55	47
Plateau	**7**	**8**	**1829**	**30**	**53**	**38**
PMx11.39-27	30	9	1815	30	56	49
PMx11.35-3	21	10	1775	30	56	49
PMx11.4-16	33	11	1770	29	55	48
HXR-1-23	39	12	1759	29	55	49
HXM-10-29	40	13	1747	29	56	48
Sunrise	**5**	**14**	**1736**	**29**	**55**	**47**
PMx11.26-20	20	15	1736	29	56	47
FarmerEntry	**10**	**16**	**1732**	**29**	**54**	**49**
PMx11.32-72	27	17	1701	28	55	50
Huntsman	**4**	**18**	**1701**	**28**	**56**	**48**
PMx11.35-11	22	19	1698	28	56	50
PMx11.4-91	36	20	1697	28	56	48
PMx11.16-54	31	21	1693	28	55	48
PMx11.10-61	42	22	1692	28	55	46
PMx11.35-52	18	23	1688	28	55	50
PMx11.26-63	15	24	1670	28	56	50
PMx11.10-82	37	25	1643	27	56	48
PMx11.10-5	32	26	1617	27	56	46
PMx11.31-101	16	27	1617	27	55	49
HXM-12-127	38	28	1601	27	55	47
PMx11.35-27	12	29	1593	27	55	50
PMx11.32-93	11	30	1585	26	55	49
PMx11.3-21	35	31	1566	26	56	48
PMx11.14-10	41	32	1564	26	56	47
PMx11.28-52	17	33	1552	26	56	50
PMx11.35-12	26	34	1534	26	56	49
Sunup	**2**	**35**	**1508**	**25**	**54**	**48**
HXR-2-75	34	36	1487	25	55	46

Horizon	**6**	**37**	**1482**	**25**	**56**	**46**
PMx11.35-44	19	38	1438	24	56	50
Dawn	**1**	**39**	**1383**	**23**	**26**	**36**
PMx11.26-48	23	40	1143	19	55	49
Av. of all entries			**1682**	**28**	**55**	**48**
Diff. req. for sig at 5%			**397**	**7**	**2**	**1**

Table 3. 2017 proso millet variety trial under dryland irrigation at the High Plains Ag. Lab in Cheyenne Co. Yield is adjusted at 12% grain moisture since grain moisture significantly varied among the plots. Names in **bold** are check varieties. (Planted: June 19 and Harvest: Oct.17).

Variety	Entry	Yield Rank	Yield (lbs/acre)	Yield (bu/acre)	Bushel weight (lbs/bu)	Height (inch)	Heading (days after planting)
PMx11.26-63	15	1	3052	51	54	39	49
HXM-10-29	40	2	2843	47	55	39	47
PMx11.10-82	37	3	2742	46	53	39	46
HXR-1-23	39	4	2705	45	54	40	46
PMx11.32-93	11	5	2672	45	54	39	49
PMx11.14-10	41	6	2671	45	52	38	47
Sunrise	**5**	**7**	**2646**	**44**	**53**	**37**	**46**
Earlybird	**3**	**8**	**2633**	**44**	**54**	**36**	**47**
PMx11.27-79	24	9	2628	44	54	40	46
Plateau	**7**	**10**	**2625**	**44**	**52**	**36**	**39**
Snowbird	**9**	**11**	**2596**	**43**	**53**	**37**	**43**
PMx11.35-44	19	12	2589	43	54	40	49
PMx11.28-52	17	13	2587	43	54	39	49
PMx11.4-16	33	14	2572	43	54	39	46
Dawn	**1**	**15**	**2571**	**43**	**45**	**34**	**37**
Sunup	**2**	**16**	**2555**	**43**	**52**	**38**	**46**
PMx11.31-101	16	17	2540	42	54	40	49
PMx11.35-19	25	18	2538	42	54	41	47
Huntsman	**4**	**19**	**2518**	**42**	**54**	**36**	**48**
Horizon	**6**	**20**	**2501**	**42**	**53**	**35**	**44**
HXM-12-127	38	21	2462	41	55	41	47
PMx11.10-61	42	22	2432	41	55	39	44
FarmerEntry	**10**	**23**	**2415**	**40**	**51**	**38**	**47**
Minco	**8**	**24**	**2408**	**40**	**52**	**37**	**42**
PMx11.32-72	27	25	2404	40	54	39	49
PMx11.28-13	14	26	2379	40	54	38	47

PMx11.26-20	20	27	2373	40	53	41	45
PMx11.35-52	18	28	2357	39	54	41	48
PMx11.4-91	36	29	2319	39	54	42	46
PMx11.35-27	12	30	2305	38	55	38	49
PMx11.10-5	32	31	2300	38	54	39	44
PMx11.26-48	23	32	2272	38	54	39	49
PMx11.35-12	26	33	2267	38	54	40	47
PMx11.35-15	28	34	2184	36	56	40	48
PMx11.35-32	13	35	2165	36	55	40	49
PMx11.23-52	29	36	2151	36	55	40	49
PMx11.35-11	22	37	2099	35	55	41	49
HXR-2-75	34	38	2086	35	54	40	43
PMx11.35-3	21	39	2070	35	54	41	48
PMx11.3-21	35	40	1974	33	55	40	47
Av. of all entries			**2455**	**41**	**54**	**39**	**46**
Diff. req. for sig at 5%			**495**	**8**	**2**	**2**	**1**

Yield comparison under different conditions:

Lines with seed yield, more than respective trial averages under three conditions (dryland, organic and irrigated) were compared. There are several lines which are common across trials (Table 4).

- Three common lines produced high yield under all three conditions (conventional dryland, organic dryland, and irrigation)
- Six common lines produced high yield both conventional and organic dryland
- Two common lines produced high yield both dryland and irrigation
- Two common lines produced high yield both organic and irrigation

Table 4. Yield comparison among the lines with above trial average under three conditions (dryland, organic and irrigated).

Dryland			Organic			Irrigated		
Variety	Rank	Yield (lbs/a)	Variety	Rank	Yield (lbs/a)	Variety	Rank	Yield (lbs/a)
PMx11.35-32	15	2834	PMx11.35-32	3	1955			
PMx11.35-44	16	2811				PMx11.35-44	12	2589
PMx11.26-20	9	2966	PMx11.26-20	15	1736			
PMx11.35-3	2	3350	PMx11.35-3	10	1775			
PMx11.35-11	10	2956	PMx11.35-11	19	1698			
PMx11.27-79	11	2907	PMx11.27-79	6	1852	PMx11.27-79	9	2628
			PMx11.35-19	1	2046	PMx11.35-19	18	2538
PMx11.32-72	14	2839	PMx11.32-72	17	1701			
PMx11.35-15	6	3074	PMx11.35-15	5	1895			
			PMx11.4-16	11	1770	PMx11.4-16	14	2572
PMx11.10-82	3	3335				PMx11.10-82	3	2742
HXR-1-23	4	3176	HXR-1-23	12	1759	HXR-1-23	4	2705
HXM-10-29	1	4692	HXM-10-29	13	1747	HXM-10-29	2	2843
Trial Average		**2720**			**1682**			**2455**

Elite and preliminary nursery:

Sixty-five lines (9 checks and 54 F_6 lines) were evaluated for yield under dryland conditions. Seed yield ranged from 2308 lbs/acre to 2739 lbs/acre.

Sixty-five lines were evaluated as unreplicated yield plot for preliminary yield selection. Seed yield ranged from 504 lbs/acre to 2441 lbs/acre.

Breeding populations:

Two thousands F3:4 head rows were tested and 200 lines were selected based on flowering, maturity, standability, and head type. Twenty F_2 populations were advanced in the field and 150 lines were randomly selected based on head type and maturity. These selected lines will be tested in 2018 season for further selection before entering yield evaluation.

Field Pea Variety for western Nebraska

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Goal and objective

Overall goal is to find high yielding, well adapted field pea varieties with different genetics for western Nebraska. Specific objective is to test commercially available varieties for yield, seed protein, flowering, maturity, and important agronomic characters across different sites (Box Butte Co., Scotts Bluff Cheyenne Co., and Perkins Co.) in western Nebraska.

Methods

Trial were planted and managed following standard agronomic recommendation for pea. Seeding rate for dryland was 350,000 live seeds/acre. Seed of each plot for all trials were inoculated with granular inoculum right before planting. Plot design for each trial was random complete block design (RCBD) with four replications. Trials were planted in a 25 feet long 8-rows plot with 7.5 inches between rows (i.e. 5’ x 25’) at a seeding depth of approximately 2 inches. Days to 50% flowering in days counted from date of planting and plant height at harvest were recorded. Trials were harvested using small-plot combine (Winter Steiger Delta). Seed weight/plot, test weight, and moisture at harvest were recorded from the combine. Yield and test weight (bushel weight) were reported at 10% grain moisture since grain moisture significantly varied among the plots. Seed protein was estimated by NIR machine at the North Dakota State University.

Results

Table 1. Nebraska Pea Variety Test - 2017 (Cheyenne Co., Dryland). Trial was planted on April 6, 2017 and harvested on July 11, 2017. Yield at 10% moisture basis and 1 bu = 60 lbs. Flowering days counted from date of planting. Three years average yield of the common varieties are in last column.

Brand	**Variety**	**Entry**	**Yield rank**	**Yield (lbs/a)**	**Test wt (lbs/bu)**	**Protein (% db)**	***50% bloom (days)***	***Height (inches)***	**3-yrs Av Yield**
Great Northern Ag.	Salamanca	20	1	1532	61	27	68	24	**1686**
Pulse USA	Nette 2010	8	2	1496	62	26	66	24	**1558**
Pulse USA	DS-Admiral	7	3	1423	60	27	69	23	**1482**
Pulse USA	SW Midas	9	4	1402	59	27	69	22	**1511**
Great Northern Ag.	Spider	21	5	1401	60	27	69	22	**1650**
Legume Logic	MP 1907	17	6	1389	60	28	71	23	
Pulse USA	Durwood	10	7	1378	61	26	69	25	
Legume Logic	Hyline	18	8	1320	60	26	69	22	**1500**
Legume Logic	Majestic	16	9	1297	60	26	71	25	
Great Northern Ag.	Bridger	22	10	1275	60	26	69	23	**1647**
Pulse USA	Mystique	11	11	1253	59	27	68	23	**1536**
Av. of all entries				**1379**	**60**	**27**	69	**23**	
Diff. req. for sig. at 5%				**254**	**2**	**1**	3	**3**	

Conclusions

- Several varieties consistently produced high yield in Cheyenne Co.
- Yield of these high yielding varieties are not significantly different with each other from yield. However, these varieties were from different companies. Therefore, their genetics are different.
- Always plant 2-3 different varieties from different companies (i.e. different genetics) in order to stabilize yield and minimize production loss.

Sunflower hybrids for western Nebraska

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Goal and Objectives

Goal is to identify high yielding commercial sunflower type hybrids (oil and confection) for both dryland and irrigation in western Nebraska based on yield, oil and other agronomic characteristics from field trials at different Counties (Box Butte Co., Cheyenne Co., Scotts Bluff Co, and Perkins Co) in western Nebraska. In 2017, only oil type hybrids were evaluated under dryland at the HPAL (Cheyenne Co.).

Materials and Methods

In 2017, 15 oil type hybrids (Croplan and Nuseed) were tested at two dryland (Cheyenne Co. and Box Butte Co.) and 21 oil type hybrids (Croplan, Nuseed, and DynaGro) were tested at two irrigated sites (Box Butte Co. and Scottsbluff Co). Trials were planted in a 30 feet long 2-rows plot with 30 inches between rows (i.e. 5’ x 30’) at a plant population of 17,500/acre for dryland oil and 22,000/acre for irrigated oil trials. In order to ensure optimal PPA double amount of seeds were planted. At seedling stage, total number of plants per row was counted. For dryland trial (PPA 17,500), 30 plants/30 feet row were kept and additional plants were removed. For irrigated trials (PPA 22,000), 38 plants/30 feet row were kept and additional plants were removed.

Flowering date was measured as the number of days after planting Jan. 1 to when 50% of the plot had heads with 50% opened flower. Seed weight/plot, test weight, and moisture at harvest were recorded from the combine (Winter Steiger Delta small plot combine). Yield was reported at 10% grain moisture since grain moisture significantly varied among the plots.

Results

Table 1. 2017 Nebraska sunflower hybrid (oil) testing under dryland at the High Plains Ag. Lab (near Sidney, NE) in Cheyenne Co. Planted: June 2, 2017 and harvested: Oct.27, 2017. N= 40 lbs/acre; Prev. crop wheat. For comparison, yield of the same hybrid at Box Butte Co.rainfed was shown in last column.

Hybrid	Brand	Oil Type	Yield rank	Yield (lbs/a)	Bushel wt (lbs/bu)	Flowering (Julian)	Plant height (inches)	PPA (at harvest)	Yld (BB Co)
N4HM354	Nuseed America	NS	1	2242	28	228	61	15464	**1215**
Camaro II	Nuseed America	NS	2	2222	28	227	62	16626	**1064**
CROPLAN 549 CL HO	Croplan by WinField	HO	3	2207	29	227	61	15028	**1080**
CROPLAN 432 E	Croplan by WinField	NS	4	2012	29	227	62	14738	**1118**
Hornet	Nuseed America	HO	5	1989	26	226	61	14883	**710**
CROPLAN 545 CL	Croplan by WinField	NS	6	1909	27	228	64	17497	**861**
N4HM521	Nuseed America	HO	7	1892	28	226	60	15246	**856**
CROPLAN 458 E HO	Croplan by WinField	HO	8	1878	26	227	62	14738	**771**
CROPLAN 450 E HO	Croplan by WinField	HO	9	1877	26	226	61	14665	**630**
CROPLAN 3732	Croplan by WinField	NS	10	1860	29	226	56	15464	**1022**
CROPLAN 7919 CL HO	Croplan by WinField	HO	11	1859	27	227	60	16625	**796**
CROPLAN 558 CL HO	Croplan by WinField	HO	12	1824	27	227	67	15101	**852**
CROPLAN 3845 HO	Croplan by WinField	HO	13	1818	29	227	62	13068	**1061**
Sierra	Nuseed America	HO	14	1813	26	227	62	14520	**537**
CROPLAN 455 E HO	Croplan by WinField	HO	15	1763	27	225	65	16916	**1024**
Av. all entries				**1944**	**27**	**227**	**62**	**15372**	**906**
Diff. req. for sig. at 5%				**183**	**2**	**2**	**7**	**2867**	**200**

Evaluating variable planting rates of oats and peas in a cool-season annual forage crop

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B. Shultz – Forage and Range Research Technician
N. Pflueger – Graduate Student

Objective

Many dryland crop rotations are evaluating options to limit the fallow period prior to planting winter wheat. A crop that has received relatively new interest in western Nebraska is field pea for human consumption, but other options may be viable to consider as a short season annual crop. Oat hay may be an option for production in some dryland situations. The value of this crop is that it can be planted in late-March or early-April and harvested in mid-June to allow soil moisture to recharge prior to the wheat planting. Adding peas to the mix may provide additional quantity and quality of forage for both a hay crop or a crop that can be grazed.

Methods

Two studies were developed to examine the effect of planting rate. In the first study the planting rate of both oats and peas fluctuated while maintaining an even total planting rate. In the second study the oats' planting rate remained steady at 70 lbs/ac while the seeding rate for peas varied. Plots were flagged out at 30 feet by 5 feet and seed was measured into packets for each plot. All plots were seeded on April 6th and fertilized with 60 lbs/ac N and 30 lbs/ac P 28 days later. Plots were harvested on June 19th, 76 days after planting. Harvest was target to when the oats were in soft dough stage and peas had set pods but not started drying yet to optimize both forage yield and quality. Prior to harvesting, two 3 foot long sections along two different planting rows were hand clipped in each plot. Oats and peas were separated, dried, and weighed to estimate actual proportions of each crop in the different seeding rates. All plots were then harvested with a Carter flail forage harvester. Bulk harvest weight was measured, then grab samples were taken to determine moisture content and calculate dry matter production.

Results and Conclusions

Oat alone at a seeding rate of 70 lbs per acre produced the greatest amount of forage in Study one. There were no differences between the varying rates of oats and peas (See figure 1). In Study 2 there were minimal differences in yields between oats alone and the mixtures of oats and peas. The next steps of this study will be to quantify the nutrient content of these mixes and conduct an economic analysis of producing oat hay as a cool-season dryland forage crop in western Nebraska. Overall, the oats alone produced a greater amount, or similar amount, of forage at the lowest seed costs with everything else being held constant. The potential benefit of adding a legume to the mix will likely be offset by the higher cost of the seed without substantial improvements in forage production.

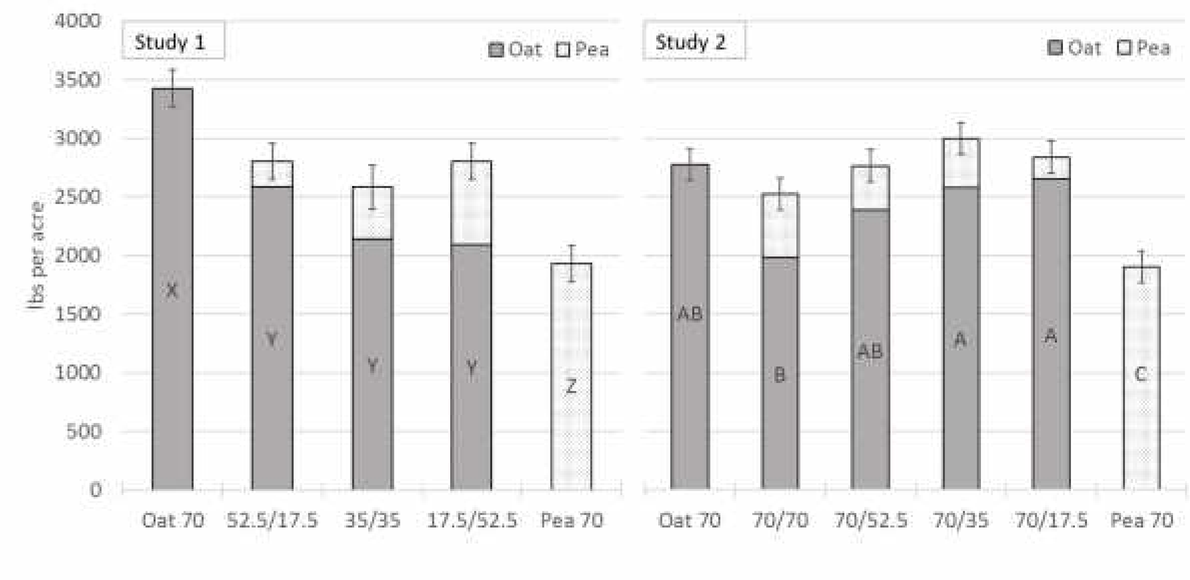

Figure 1. Yields of oats alone, pea alone, or variable seed mixes of oats and peas. Number represent the lbs of oat seed in the mix (first number) and the amount of pear seed in the mix (second number). Difference letters represent significant statistical differences between the seed mixes.

Stripe Rust – a Summary of a Wheat Disease in Western Nebraska

Robert M. Harveson, Extension Plant Pathologist, University of Nebraska,
Panhandle REC, Scottsbluff

Summary of Stripe Rust

Stripe rust is a serious disease of wheat worldwide, and caused by the fungal pathogen (*Puccinia striiformis* f. sp. *tritici*). Over the last decade, the incidence and severity due to stripe rust has increased dramatically. In fact, damage to wheat production has been so widespread and severe in Nebraska that it appears that this disease has now displaced the virus disease, wheat steak mosaic, as the most important and economically damaging disease of wheat in the state.

The disease has occurred historically wherever wheat is grown under cool moist environmental conditions during the season. Thus it has been regarded as a low temperature disease and problematic only during cool weather. Since 2000, the disease has emerged to consistently induce severe economic losses in Nebraska under very warm conditions that were previously thought to be impossible. Prior to this date, it was primarily restricted to the cool and damp Pacific northwest and California. After 2000, it began to appear nationwide on all forms of wheat, causing significant losses in new locations where it rarely ever was present - including more than 20 states from coast to coast and throughout the entire Great Plains from Texas to North Dakota.

The formation of new pathogen races is being proposed now to explain the high levels of yield loss and widespread nature of its recent appearance. These races have been demonstrated to cause disease more rapidly and be more aggressive at higher temperatures than previously observed. Furthermore, they have seemingly displaced the old isolates across the expanded geographic ranges, suggesting that the new isolates were more fit than older ones. In doing so, they have additionally overcome the most effective genetic resistance used in the United States wheat crop, converting previously resistant cultivars to susceptible ones.

These remarkable changes indicate that the old pathogen races occurring in cooler climates (before 2000), are distinct from the invasive new isolates occurring in warmer climates after 2000. This suggests that the ‘new’ races were likely recently introduced into the United States from a still unknown location rather than arising as a genetic modification (mutation) from older existing, native isolates.

Managing this disease will require several new concepts. First we need to realize now that this pathogen is now capable of causing disease under conditions not previously considered. We also need to accept the fact that it will take an integrated approach to successfully control stripe rust, consisting of multiple control measures, including both fungicide applications and use of resistant cultivars.

New Research Planned

Due to the severe stripe rust epidemics in Nebraska wheat crops over the last decade, we began studies in 2016-2017 attempting to help producers better manage this disease. The first step is to accept the fact that this disease appears to be an endemic problem that we will have to consistently face each year now. Thus we need to establish a system that will predict when the disease may be more problematic and base the management decisions on this model. This model will be referred to tentatively as the Stripe Rust Disease Management Decision Model. Although not a true disease forecasting model, it will allow growers to estimate disease potential in their own fields based on a series of factors which need to be present for disease to cause damage. These factors, among several others, include: level of genetic resistance in cultivars, crop stage at time of infection, 10-14 day weather forecast, time of the season infection occurs, incidence of disease in fields, and yield expectations/inputs in crop.

These studies were conducted at several sites throughout the Panhandle and with additional sites in North Dakota. The idea is to estimate the risk of disease development based on the factors mentioned above occurring at each site, and make fungicide applications based on the model. We began with a resistant and susceptible variety planted at each site and will compare several fungicide treatments (first sign of disease, first appearance of flag leaf) with an application based on the predictive model's characteristics. They are also done in collaboration with Dipak Santra (UNL alternative crops breeder), and Andrew Friskop (North Dakota State University extension plant pathologist).

Five Pre-Plant Steps for Reducing Disease Problems in Wheat

Robert M. Harveson, Extension Plant Pathologist, Panhandle REC, Scottsbluff and
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Nebraska growers have been severely affected by stripe rust in our wheat crops for the last decade, particularly in the western half of the state. Stripe rust is not necessarily a new disease but it has become much more prevalent and problematic than the other wheat rust disease (leaf rust), which has historically been our major rust disease. It was less damaging in 2017 than in some of the previous seasons, but still emerged late in the season in some isolated areas of the Panhandle. Unfortunately, when it did appear, it was too late to apply any fungicides for management. The extent of the damage in these areas right now is unknown.

Furthermore, 2017 was a horrendous year for growers with the virus disease called wheat streak mosaic. Numerous fields throughout the Panhandle were severely diseased with many being completely abandoned and not harvested. We have not seen this extent of damage from wheat streak mosaic in a number of years.

In the effort to try to reduce a repeat in 2018 from these problems, there are some steps that could be taken (or at least considered) before you plant your wheat in the next few weeks. These steps will not only help manage stripe rust and wheat streak mosaic, but can also assist in achieving a good stand and a healthy vigorously-growing crop prior to winter and going into dormancy. Many of the problems on our wheat are due to stresses such as root diseases, resulting in overall weaker crops, allowing a greater degree of susceptibility when other biotic stresses arrive the following spring. The quicker the stands become established in the fall, the healthier they are before going into dormancy. This also allows better responses to additional stresses the following spring.

5 Steps to consider for a producing a healthy wheat crop

1) Planting date
2) Recommended cultivars with tolerance to stripe rust or other biotic stresses
3) Planting into a firm but yet mellow seed bed
4) Control wheat volunteers from recently harvested fields and weeds in summer fallow
5) Treat seeds with an appropriate fungicide

1. Planting Date – research years ago by UNL personnel indicated that planting date recommendation should be made in relation to elevation. For areas of western Nebraska, the "rule of thumb" for planting to minimize stress and early infection of plants was to use 4,000 ft as a baseline and Sept. 10 as a base date with each 100 foot difference in elevation being one day difference in planting time. The lower the elevation the later the best planting date. For example, Banner County (3800 ft) would have an optimal planting date of Sept. 25. Box Butte or Cheyenne County (4,000) would be Sept. 10, and Kimball County (5100 ft) a date of Sept 1.

2. Tolerant Cultivars - planting cultivars with some resistance to a disease wherever possible (stripe rust and/or wheat streak mosaic) will assist in avoiding or at least delaying infection. In general, plants that become infected later also lower their chance of suffering severe damage. Disease tolerance may also delay infection enough that a fungicide application will not be necessary, depending upon environmental conditions.

3. Planting into a firm, mellow seed bed – chances of infection by pathogens causing the crown and root rot disease are increased by planting in a loose seedbed or one that is compacted. This puts another stress on affected plants, predisposing them to other problems later.

4. Control weeds and wheat volunteers in wheat fields and summer crops– these plants remove soil moisture resulting in greater drought stress to plants, which in turn predisposes plants to other later stresses (rot and crown infection, stripe rust, etc).

Volunteers also can serve as a reservoir for both curl mites and the wheat streak mosaic virus pathogen (green bridge) which then move into newly planted crops in the fall. Early infection by this virus will cause greater damage in spring when plants come out of dormancy and temperatures begin to rise. This is the primary factor in the high incidence and severity of virus problems in 2017. The majority of the problem fields in 2017 were associated with or near fields damaged by hail storms during 2016, without volunteer wheat control.

5. Treat seeds with an appropriate fungicide – the pathogens causing root rots (*Fusarium, Rhizoctonia, Bipolaris*) are naturally-occurring residents in the soil, and do not ever go away once established. When they infect early after planting in the fall, they do not always kill the plants, but can cause a subtle, often unnoticed yield drag that provides another stress predisposing plants to other problems the following spring. Fungicide treatments help the plants avoid early infection, and establishing healthy stands.

Economics of Field Pea Supplementation for Cattle Grazing Crested Wheat Grass

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Justification

Field peas are grown in the western part of Nebraska in a wheat production rotation because they offer benefits for wheat production in subsequent years such as adding nitrogen to the soil and breaking up weed and pest cycles. Field peas are commonly used in human diets and as a component of pet food diets due to the protein content and amino acid profile. Field peas have also been shown to increase tenderness in beef and pork when included in finishing diets. Field peas are an acceptable binder for distillers based range cubes, and improve gains when supplemented on pasture. Recent data at the University of Nebraska suggests field peas improve gains on cool season pastures which experience a summer slump in growth and quality in this region. While it is a sustainable crop with positive environmental impacts, a feed value has not been established for beef cattle relative to distillers grains which is a commonly used protein supplement in western Nebraska. A feeding value must be determined so that the marketing value of field peas can be assessed by producers when conducting farm management plans. If the peas are damaged or cannot be accepted for human food consumption or are not needed for pet food markets, a value for livestock use is needed. Producers must also be able to compare field peas to other protein and energy sources. To incorporate this crop into their farming operations, producers must have a way to reduce marketing risks of the crop. Therefore, the objective of this study was to determine the feeding value of field peas relative to DDGS as a protein supplement for cattle grazing crested wheatgrass pastures.

Methods and Materials

In year 1, 112 heifers (647 lb ± 76) and in year 2, 114 spayed heifers (673 lb ± 36 lb) were used in a 2*2 factorial treatment design. The factors were two levels (0.4% BW and 0.8% BW) of whole field peas or DDGS. Cattle grazed crested wheatgrass from mid-May until mid-September. Seven days of supplement was prorated into 6 days of feeding and all supplement was fed in bunks. Pasture was the experimental unit and cattle were rotated every two weeks to remove any effects due to pasture. Body weights were collected on 2 consecutive days and averaged for both beginning and ending BW. A 1-d interim BW was also collected to adjust the amount of supplement offered. Each treatment was replicated six times (3/yr) over the two year study.

Results

Effects of weight block and year were not significant ($P \geq 0.26$) and were removed from the model. There was also no interaction between type and level of supplement ($P = 0.27$). Level of supplement was not statistically significant ($P = 0.20$), cattle fed field peas at 0.4 or 0.8% of BW gained 2.13 and 2.16 lb/d, respectively. Cattle fed DDGS gained 2.24 and 2.53 lb/d for the 0.4 and 0.8% of BW levels, respectively. There was a significant difference in ADG due to type of supplement ($P = 0.03$). Field pea supplemented heifers had 10% lower ADG compared to DDGS supplemented heifers. Therefore if DDGS is priced at $125/ton as if was this summer, then field peas used for protein supplement of pasture cattle should be priced at $3.75/bu. If DDGS is priced at $150/ton as it is currently, then field peas would be priced at $4.05/bu.

Conclusion

Previous research indicated supplementing field peas to cattle grazing crested wheatgrass improved gain over not supplementing. The current study indicated similar gain between cattle supplemented field peas at 0.4 or 0.8% BW suggesting the added expense of the higher supplementation rate was not warranted. This research suggests that the price paid for field peas for livestock supplementation should be approximately 10% less that of buying and transporting DDGS.

Dry Bean Drought Tolerance Variety Trial

C. F. Creech – Assistant Professor, Dryland Cropping Systems Specialist
J. Burford – Dryland Crops Research Technician

Justification

Pulse crops continue to be an enticing option for dryland crop production because of their many benefits and favorable market. With the continued improvement in direct harvest methods and improved upright dry bean varieties and drought/heat tolerance, dryland dry bean production could become a suitable crop to include in a rotation.

Objective

The objective of this study was to compare different dry bean varieties under different irrigation regimes. Yield and seed size would be measured to determine the feasibility of dryland dry bean production in the NE Panhandle.

Methods

The plots were arranged underneath our lateral irrigation system at the High Plains Ag Lab to enable supplemental irrigation as required. The experiment was blocked by irrigation treatment arranged as a latin square design. Plots were two 30 inch rows wide by 15 feet long. Ten dry bean varieties were subjected to four treatments which included a pre-irrigated only, no irrigation, limited irrigation, and full irrigation. Plots were hand harvested when the dry beans matured and machine threshed and cleaned.

Results

These results are preliminary and will be evaluated further in coming years before recommendations are provided. Stand issues were very common as the experiment was seeded into heavy wheat residue. Overall, the beans demonstrated drought tolerance and satisfactory yield potential. In the coming years, beans will be direct harvested to simulate harvest methods necessary for dryland production. Furthermore, the entire plot will be harvested providing a better representation of expected yields. At this point, all yield data should be used with caution. Dryland dry bean production is not a recommended practice at this time.

Dryland Edible Dry Bean Yields 2017, Sidney, NE

Entry	Type	Yield ------------- Irrigation ------------- Pre-water	None	Limited	Full	Avg
		--------------------- Lbs/acre				----------------------
Matterhorn	Great Northern	1769	1435	1914	1560	**1669**
NE1-09-19	Great Northern	2247	1821	2253	1585	**1976**
NE1-09-20	Great Northern	1401	1776	1903	2084	**1791**
NE1-09-22	Great Northern	1114	1467	1397	1516	**1373**
Panhandle Pride	Great Northern	1423	1768	1820	1661	**1668**
Croissant	Pinto	1297	1259	1530	1586	**1418**
NE2-09-4	Pinto	1611	1137	1074	820	**1161**
PT11-13	Pinto	1877	1590	1621	2651	**1935**
PT9-5-6	Pinto	1933	1796	1733	1862	**1831**
UI35	Pinto	1881	1949	1486	1694	**1752**

Pre-watered for full soil water profile, **NOT** watered after
Never watered
Not pre-watered but watered with a **limited** amount
Not pre-watered but watered with a **full** amount

Dryland Edible Dry Bean Seeds Per Pound 2017, Sidney, NE

Entry	Type	Seeds/lb. ------------------- Irrigation ------------------- Pre-water	None	Limited	Full	Avg
		------------------------ Seeds/lb.				------------------------
Matterhorn	Great Northern	1514	1646	1406	1370	**1484**
NE1-09-19	Great Northern	1417	1440	1545	1442	**1461**
NE1-09-20	Great Northern	1376	1530	1389	1400	**1424**
NE1-09-22	Great Northern	1538	1567	1399	1457	**1490**
Panhandle Pride	Great Northern	1322	1494	1342	1436	**1399**
Croissant	Pinto	1909	1713	1644	1774	**1760**
NE2-09-4	Pinto	1227	1274	1266	1384	**1288**
PT11-13	Pinto	1427	1472	1398	1395	**1423**
PT9-5-6	Pinto	1628	1762	1402	1626	**1604**
UI35	Pinto	1503	1564	1539	1509	**1529**

Dryland Soybean Variety Trial

C. F. Creech – Assistant Professor, Dryland Cropping Systems Specialist
J. Burford – Dryland Crops Research Technician

Justification

Soybeans are able to fix atmospheric nitrogen and move it into the soil. Soybeans also have advanced genetics for herbicide resistance allowing many post emergence herbicide options. Both of these benefits make dryland soybean production an attractive option for producers in the Nebraska panhandle. However, very limited information is available regarding dryland soybean production in this area. The lack of data has also limited the availability of crop insurance for soybean producers.

Objective

The objective of this trial was to generate soybean yield data under dryland production in the NE Panhandle. Data will be used to inform producers on yield possibilities and provide baseline data for crop insurance.

Materials and Methods

Soybeans were planted near Rushville and Sidney on May 26 and May 27, respectively. Soybean varieties were planted 1.5 inches deep at 140,000 seeds per acre on 30 inch rows. The experimental design was a randomized complete block with four replications. Plots were 4 rows wide and 30 feet long. Glyphosate was applied as a pre-plant burndown for weed control with a pre-emergent herbicide for residual control. Hand weeding and spot spraying was performed throughout the growing season as needed.

Results and discussion

The soybean trial in Sidney was grazed by deer and other animals which limited the overall growth and yield. Rainfall at Sidney was near the 70 year average. Weed pressure limited yields in Rushville. At both locations, pre-harvest seed shatter was an issue with all varieties but was more severe with the early maturity group soybeans. Overall, the results from 2017 would suggest that with proper management and normal precipitation, average dryland soybean yields would be around 20-25 bushels per acre. Recommendations for the Panhandle would be to use soybean in no-till productions to maximize soil moisture. Select soybeans with maturity groups from 1.7 to 2.4 with good tolerance to iron chlorosis which is common in high pH soils. To prevent loss to shatter, harvest soybeans when they reach 12-14% moisture.

Sidney Dryland Soybean Results 2017

Variety	Company	Maturity	Yield (bu/a)
AG1733	Asgrow	1.7	12.8
1008NR2	Hoegemeyer	1.0	10.2
1926NR	Hoegemeyer	1.9	9.5
1511NR	Hoegemeyer	1.5	11.8
U12-904114R	Husker Genetics		11.6
U12-926115R	Husker Genetics		11.8
U12-924117 SDR	Husker Genetics		11.6
U03-825124	Husker Genetics		11.2
CZ1845LL	Bayer	1.8	12.0
CZ2101LL	Bayer	2.1	12.7
CZ2312LL	Bayer	2.3	10.6
CZ2510LL	Bayer	2.5	12.6
CZ2810LL	Bayer	2.8	10.9
CZ2188BGT	Bayer	2.1	10.6
P19T39R2	Pioneer	1.9	11.2
RS175NR2	Renk	1.7	10.6

Rushville Dryland Soybean Results 2017

Variety	Company	Maturity	Height (in)	Yield (bu/a)
AG1733	Asgrow	1.7	20.5	14.9
1008NR2	Hoegemeyer	1.0	18.5	12.7
1926NR	Hoegemeyer	1.9	23.3	18.8
1511NR	Hoegemeyer	1.5	22.3	16.4
U12-904114R	Husker Genetics		22.3	14.0
U12-926115R	Husker Genetics		19.5	15.7
U12-924117 SDR	Husker Genetics		21.3	15.1
U03-825124	Husker Genetics		22.3	17.6
CZ1845LL	Bayer	1.8	21.5	20.8
CZ2101LL	Bayer	2.1	21.5	21.1
CZ2312LL	Bayer	2.3	23.3	17.9
CZ2510LL	Bayer	2.5	22.5	19.5
CZ2810LL	Bayer	2.8	24.0	13.6
CZ2188BGT	Bayer	2.1	21.8	16.0
P19T39R2	Pioneer	1.9	21.3	17.6
RS175NR2	Renk	1.7	25.0	13.9

Wheat Planting Date and Population

C. F. Creech – Assistant Professor, Dryland Cropping Systems Specialist
J. Burford – Dryland Crops Research Technician

Justification

Wheat planting recommendation remain relatively unchanged since the 1960's for Nebraska. Since that time, production practices, wheat genetics, and climate has changed. New recommendations are needed to provide wheat producers with the best recommendations to maximize yield.

Objective

Evaluate wheat planting recommendations and provide new updates for the 2018 planting season.

Methods

Wheat was planted in five locations across western NE. At each location, wheat was planted approximately two weeks before, on-time, and two weeks late when using the current recommendations. Wheat was planted on 7.5 and 10 inch rows at populations of 12, 14, 16, and 18 seeds per foot of row. Three varieties were chosen based on their seed size. Plots were five feet wide and 30 feet long. Experimental design was a split-split plot design.

Discussion and Results

An additional year is needed to provide appropriate statistical results. Early averages for Sidney are presented below. At Sidney in during the 2016-2017 growing season, seeding wheat early resulted in the greatest yields. Early seeded wheat also had the greatest amount of lodging due to wheat stem sawfly based on visual observations. However, the dry fall of 2016 limited establishment of the later planting dates and reduced the subsequent yield. Although it is still early, 16 seed per foot of row typically produced the greatest yield and 10 inch rows yielded slightly greater than 7.5 inch rows. Updated recommendations will be available for the 2018 planting season.

Planting date impact on yield in Sidney, NE.

Variety	Planting timing	Yield (Bu/A)
Goodstreak	Early	42.8
Goodstreak	On-time	38.4
Goodstreak	Late	35.1
Robidoux	Early	47.6
Robidoux	On-time	42.8
Robidoux	Late	37.1
Wesley	Early	47.2
Wesley	On-time	41.3
Wesley	Late	29.9

Wheat yield as influenced by seeding rate, planting timing, and variety.

Variety	Planting timing	14 seeds/ft	16 seeds/ft	18 seeds/ft	20 seeds/ft
Goodstreak	Early	40.0	45.4	43.3	42.4
Goodstreak	On-time	40.0	40.7	35.6	37.2
Goodstreak	Late	35.1	34.6	33.9	36.7
Robidoux	Early	47.8	51.1	43.6	47.5
Robidoux	On-time	45.0	40.6	41.7	44.1
Robidoux	Late	38.9	33.3	39.3	36.6
Wesley	Early	50.7	44.3	48.0	45.5
Wesley	On-time	41.2	40.9	40.8	42.5
Wesley	Late	32.3	32.7	24.8	29.9

Row spacing impact on yield.

Variety	Yield (Bu/A) @ 7.5 inches	Yield (Bu/A) @ 10 inches
Goodstreak	38.3	39.4
Robidoux	41.6	43.4
Wesley	38.9	40.0

Forage Sorghum Variety Trial

C. F. Creech – Assistant Professor, Dryland Cropping Systems Specialist
M. Stephenson – Assistant Professor, Forage and Range Specialist
J. Burford – Dryland Crops Research Technician
B. Shultz – Forage and Range Research Technician

Objective

Forage sorghum is an attractive crop for farmers to grow due to its low input costs and drought tolerance. It also has the ability to achieve yields comparable or greater than corn silage yields. Sorghum uses far less water than corn, so it can be a better option in dryer climates or in a dryland setting. Since forage sorghum is cheaper to produce than corn and similar in crude protein, total digestible nutrients, and other beneficial nutrients, it is a viable option for both crop and beef producers alike.

Methods

In this study, we looked at how well several varieties of forage sorghum performed in both dryland and irrigated systems. The study was planted on June 7, 2017 using a four row research planter. The plots were five feet wide and 30 feet long. They were planted on 30 inch rows and planting depth was 1.25 inches. Our target population was 60k for dryland and 80k for the irrigated treatments. For the dryland part of the trial, 19 hybrids were tested along with a corn control. As for the irrigated portion, we used 24 different hybrids and a corn control. The irrigated plots were irrigated once a week with an inch of water except for when we received adequate precipitation. We harvested the plots with a Carter forage harvester on September 21, 2017.

Results

In the dryland setting, the varieties evaluated produced between 0.9 and 1.7 tons per acre. Top producing varieties were the NK300, NUTRI-CANE II, and 1st Choice BMR. Many of the varieties had crude protein contents of greater than 8% and total digestible nutrient values over 63%. Under irrigation, many varieties produced greater than 6.0 tons per acre and still maintained relatively good protein (i.e., greater than 7% CP) and total digestible nutrients (i.e., greater than 55% TDN) compared to the corn silage control. Top producing varieties under irrigation included NK300, GW 400 BMR, and Sweet Forever BMR. Each of these varieties produced over 7.9 tons of forage per acre with comparable total nutrient content to other varieties and the corn silage control.

Conclusions

There are many different varieties of forage sorghum available for producers. Our results from 2017, indicated that production yields of 1.2 to 1.7 tons per acre on dryland and over 6.0 tons per acre under irrigation can be reasonably expected. However, there is variability in yield and quality based on the variety selected. Compared to corn silage, many of the forage sorghum varieties were viable alternatives to corn in our systems.

Dryland Forage Sorghum 2017, Sidney, NE

Variety	Height (in)	Tons/A Dry Matter	Crude Protein (%)	ADF % Dry Basis	NDF% Dry Basis	RFV	TDN % Dry Basis
1st Choice BMR	64	1.5	7.0	34	55	108	64
Honey Graze V	69	1.2	7.5	34	58	101	64
Silo Mor II BMR	50	1.4	7.9	33	57	103	65
NK300	48	1.7	6.7	36	59	95	61
SP2774	66	1.3	6.3	34	56	104	64
SP4555	58	1.2	6.0	32	54	111	66
SP4105	46	1.5	8.3	34	58	100	64
NUTRI-CANE II	61	1.6	8.1	33	58	100	64
SWEETLEAF II	77	1.4	4.9	43	66	79	54
GW 400 BMR	60	1.5	6.8	33	54	109	65
GW 2120	45	1.2	8.3	33	57	103	65
Sweet Forever BMR	56	1.2	6.3	34	56	103	64
Nutri King BMR	63	1.3	7.0	35	55	103	62
Super Sugar DM	64	1.2	8.2	34	59	99	64
AF7101	72	1.4	6.7	34	58	100	63
AF7102	52	1.4	9.5	35	57	102	64
AS6402	42	0.9	8.0	34	58	100	64
AS9302	61	1.1	9.5	35	60	96	63
ADV6504	58	1.3	5.5	34	58	100	63
Corn Silage Control	68	0.5	7.3	36	58	98	61

Irrigated Forage Sorghum 2017, Sidney, NE

Variety	Height (in)	Tons/A Dry Matter	Crude Protein (%)	ADF % Dry Basis	NDF % Dry Basis	RFV	TDN % Dry Basis
BlackHawk 12	97	6.0	6.8	40	58	93	57
Nighthawk 6	78	6.0	10.1	39	59	93	58
Pelican BD 6	95	6.5	6.7	42	58	90	55
SeaHawk 6	124	6.5	4.5	46	61	81	50
NK300	74	8.5	5.8	39	54	101	58
SP2774	112	5.6	5.8	41	55	98	56
SP4555	98	6.1	5.7	37	52	107	60
SP4105	83	6.1	7.5	42	59	88	54
NUTRI-CANEII	112	6.8	5.9	36	52	110	62
SWEETLEAF II	110	6.2	5	46	65	77	50
X5063	122	3.0	4.5	39	51	107	58
X50712	93	3.9	6.4	36	53	108	62
X50644	76	5.2	8.5	42	59	89	55
X50610	69	7.7	7.9	43	60	86	54
X51423	80	5.2	10.9	37	54	104	60
X54243	133	4.6	4.2	40	59	91	57
GW 600 BMR	91	7.1	8.5	40	57	95	57
Silo Pro BD BMR	66	6.7	9.3	36	55	102	62
GW 400 BMR	102	8.3	6.9	38	53	105	59
GW 475 BMR	109	4.9	6.9	40	57	95	57
GW 2120	94	5.4	7.1	36	53	108	62
Sweet Forever BMR	111	7.9	6.3	38	58	96	59
Nutri King BMR	86	5.1	4.5	42	56	94	55
Super Sugar DM	108	6.2	5.3	40	55	99	57
Corn Silage Control	98	5.7	9.5	41	59	90	56

Using high-carbon char as an amendment to improve soil and crop yields

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Introduction

Application of soil amendments with high carbon (C) concentration may improve soil quality and crop production. Particularly in semiarid regions such as in western Nebraska, soils are generally low in soil organic matter. Crops are often grown in intensively farmed croplands, which are affected by wind and water erosion. This leads to low soil organic matter. Intensively cultivated soils across the Great Plains have lost 30 to 50% of the original C level.
Soil C is key to manage soil quality or health because it affects all the soil physical, chemical, and biological processes and properties. Increased soil C concentration reduces soil crusting, rapid soil surface drying, and compaction, and improves soil structure, water infiltration, water holding capacity, cation exchange capacity, and microbial activity. Soil C loss can be particularly large in coarse-textured soils such as those in western Nebraska. Restoring the soil C lost from intensively farmed lands is thus a high priority to enhance grain production and soil quality. Carbon-enriched amendments that increase yields and soil quality in these crop production systems are therefore needed.

Objective

This project evaluated the impacts of the high-Carbon char produced by the Western Sugar Cooperative in Scottsbluff, NE on seed emergence, stand, crop yields, weed response, and soil properties on two soil types at HPAL.

Methods

High-C char was applied to a highly eroded site and a higher quality site (degraded and non-degraded sites, henceforth) in different stages of a three-year crop rotation of wheat-corn-field peas at HPAL. A randomized complete block design with six char treatments and 4 replications was used. Plot size was 10 by 30 feet. Best agronomic practices including fertilization, irrigation, and insect scouting were used. Char is coal combustion residue from sugar factory in Scottsbluff, NE. The char treatments included: a control (no char), 5, 10, 15, 20, and 30 tons acre^{-1}. Char was applied in the spring of 2016 before crop planting and disked into the top 6 inches of soil.

Soil samples were collected in the spring of 2017 from both sites and analyzed for physical properties such as bulk density, gravimetric water content, penetration resistance, and shear strength and pH, macro and micro nutrients and C. Crop yield was estimated by harvesting the two center rows of each plot.

Results

For the degraded soil, total carbon (Figure 1) content increased by 90% with 15 t/ac and 149% with 30 t/ac of char application. Bulk density, gravimetric (volumetric) water content and shear strength showed insignificant results at $p<0.05$ for both sites. The non-degraded soil showed a significant trend in reduction for penetration resistance following char application at the 0-10 cm depth (Figure 2).

Pea yield was significantly increased by char treatment in non-degraded site in 2017 (Table 1). All char treatments had greater pea yield compared to the control. Corn and wheat yield at degraded site are not reported because of combine data errors. Corn and wheat yields at non-degraded site averaged around 110 and 63 bushels/ac respectively but they did not differ by treatments.

Conclusion

Yields and soil response to the char treatments is expected to increase in the coming years. High C did not negatively impact yield even when applied at high rates which may suggest fertilizer is not or marginally impacted by high-C applications.

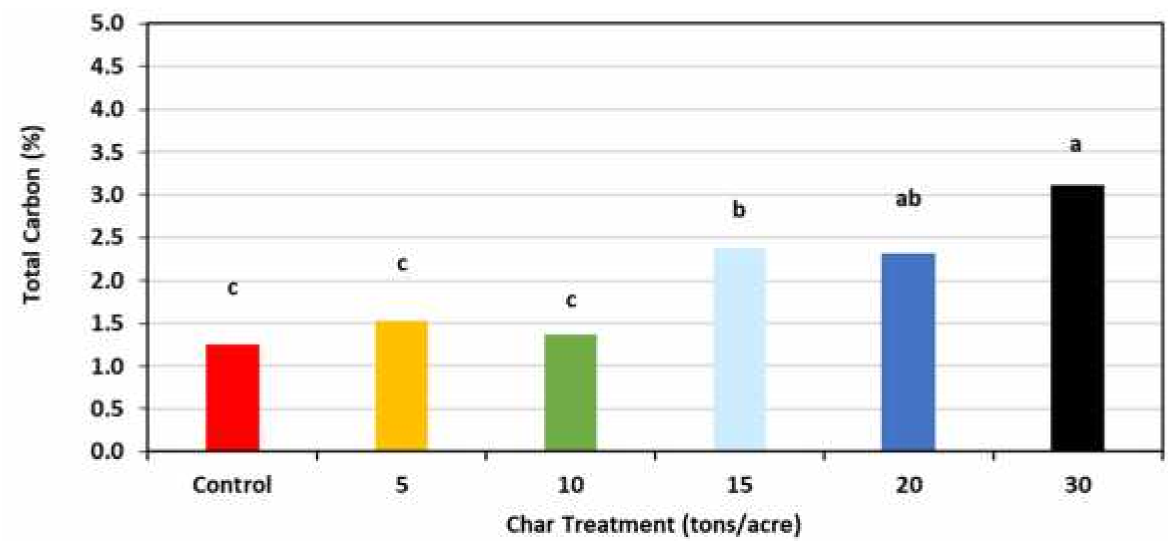

Figure 1. Total Carbon by char rate treatments at degraded site. Mean value with different letters are significantly different at $p=0.05$.

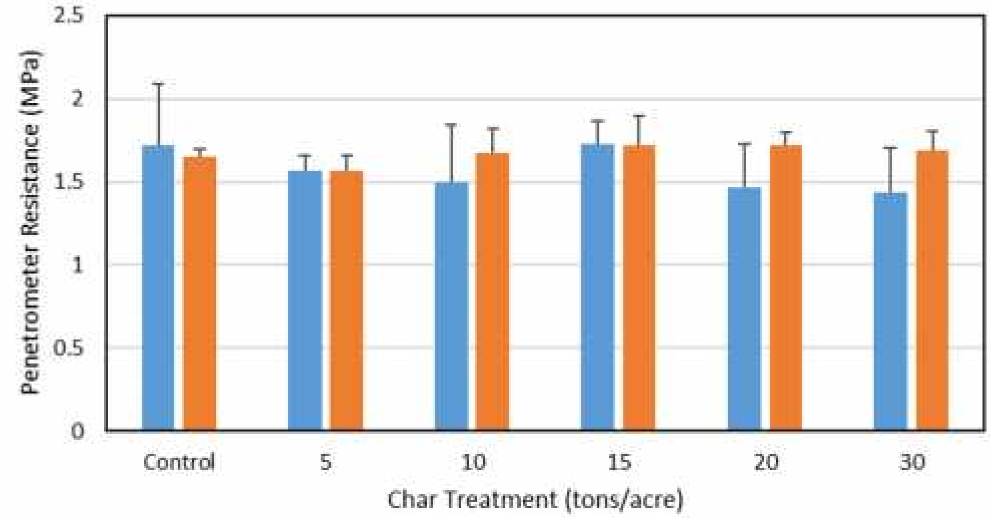

Figure 2. Penetrometer resistance by different treatments at both degraded (orange bars) and non-degraded (blue bars) sites.

Table 1. 2017 Pea yield by different treatments. §Mean value with different letters are significantly different at p=0.05.

Char, tons/ac	**Pea Yield, lbs/ac**		
	Non-degraded soil§		Degraded soil
0	1487.6	c	1275.8
5	2247.3	ab	1384.7
10	2091.3	b	1278.0
15	2300.8	ab	1434.1
20	2323.0	ab	1208.5
30	2383.2	a	1254.0