The Feasibility of Cover Crops in Dryland Cropping Systems in SW Colorado and SE Utah

Southwest Ag Seminar
December 5, 2015

Colorado State University

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WESTERN SARE
Sustainable Agriculture Research & Education

Colorado State University
COLLEGE OF AGRICULTURAL SCIENCES
Agricultural Experiment Station

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USDA NRCS
U.S. Department of Agriculture
Natural Resources Conservatio

HIGH DESERT
CONSERVATION
DISTRICT

DOVE CREEK
Conservation District

- Project rationale & objectives
- Methodology
- First year results & observations
- March 18th seminar

CHALLENGE

How to make dryland farming more sustainable?

- **Low & erratic** precipitation
- **Short** growing season
- **Low** soil organic matter
- **Significant** risk of water & wind erosion
  - Soil management (conventional tillage, low or no soil cover)


SOLUTIONS – COVER CROPS!

The **main goal** of this project is to **determine** if & *how* **cover crops** can enhance the **sustainability** of **dryland farming** in SW Colorado & SE Utah.

- **Assess** the effects of cover crops on:

Soil moisture

Soil quality & health

Weed control

Cash crop

- **Determine** which **cover cropping strategies** are **profitable**.
- **Outreach**

- **Cover crops** are grown on fallow ground or with winter wheat.
- **Cover crops** are tailored to each farm & cropping system and may include up to nine species.
- **Initial project** is for **three years** (2015-2018)

On-Farm Tests

1. **Wheat-fallow-wheat-wheat**, no-till (UT, Barry)—OFT#1 (three fields)
2. **Wheat-safflower-fallow**, organic, mulch-till (UT, Crowley)—OFT#2
3. **Wheat-fallow**, no-till (CO, Lewis)—OFT#3
4. **Wheat-sunflower-fallow**, conventional tillage (CO, Garchar)—OFT#4
5. **Wheat-fallow-wheat-bean**, organic, mulch-till (CO, Waschke)—OFT#5

Research Center Tests

- Each test will have 3 to 4 replications.
- Test #1 (2015-2018): No-till wheat-fallow
  - Drilled three cover crop mixes on 9/28/15
    - Winter pea, hairy vetch, yellow sweet clover
    - Same + winter rye (Mix #2)
    - Mix #2 + winter canola + Winfred hybrid turnip


Great Plains
606NT

Colorado State University

October 27, 2015

Research Center Tests

- Test #2: Seeded to winter wheat on 9/24/15
- After wheat harvest in 2016, the following treatments will be applied:
  - Wheat-Fallow vs. Wheat-Bean rotations
  - No-till vs. Conventional tillage
  - Up to six cover crop mixes, some of which will be similar to the ones tested on farmers' fields.

Soil Measurements

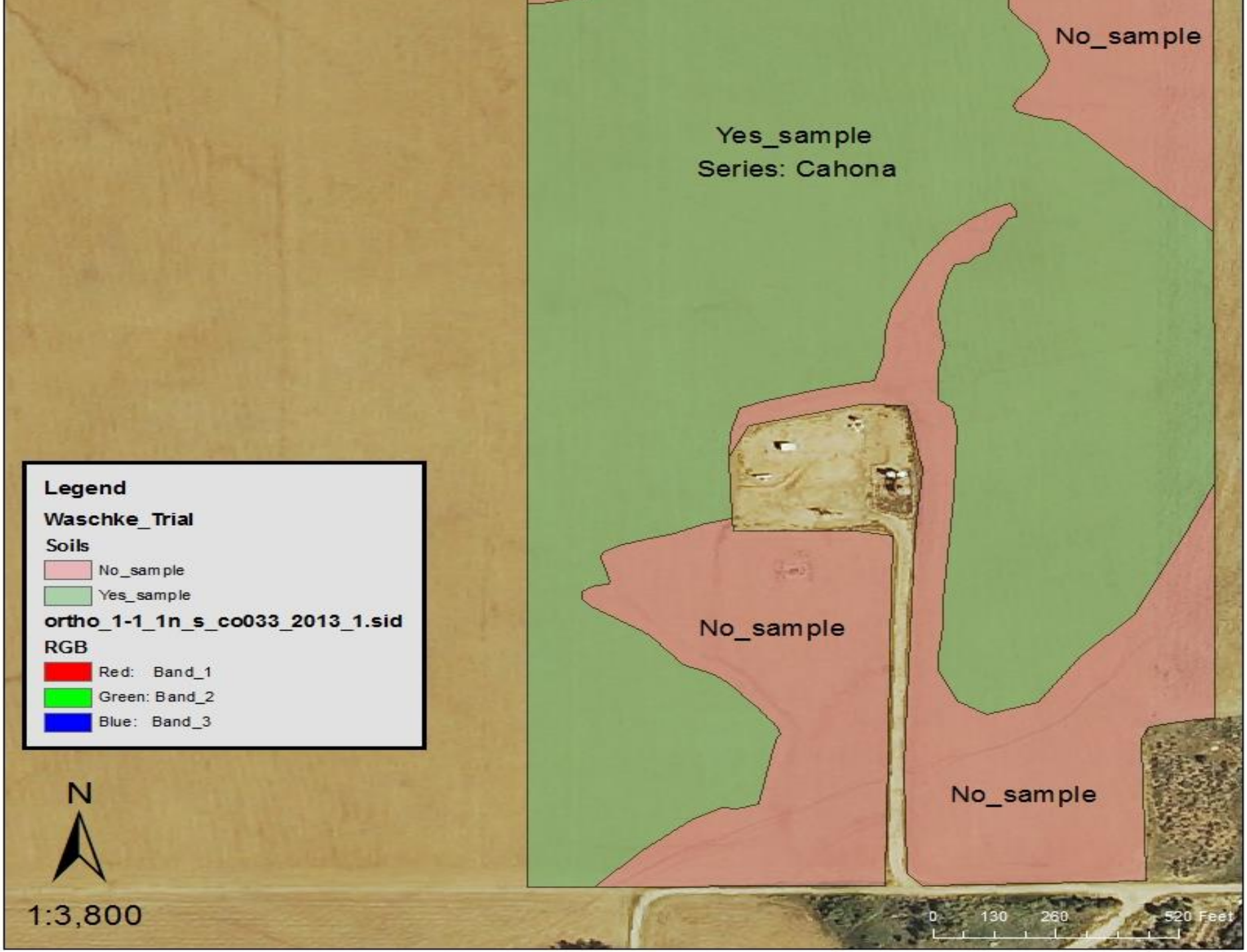
- Soil water content (gravimetric)
- Soil water infiltration rate (Cornell infiltrometer)
- Soil aggregate stability (Cornell infiltrometer)
- Soil erosion (RUSLE)
- Soil fertility (Haney)
- Worm count
- Soil microbial community (PLFA)

Plant Measurements

- Ground cover (transect method)
- Plant biomass (cover crops, weeds, etc.)
- Cover crops species growth stage at termination
- Cash crop yield and quality

Other

- Soil mapping
- Costs & Returns
- Weather data (precipitation & temp.)
- Dates & nature of all field operations
- Qualitative observations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Green: Band_2
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Preliminary Results

- OFT#1/North Field
- Wheat-Fallow, NT

Species	% by weight
Winter pea	25
Yellow sweet clover	5
Berseem clover	10
Sudangrass	10
Nitro radish	5
Turnip purple top	5
Proso millet	10
Buckwheat	20
Sunflower	5
Teff	5
Seeding rate & cost	35 lbs/A @ $18.9/A
Seeding date & method	8/15/2015, NT drill


OTF#1 North Field--September 18, 2015

OTF#1 North Field--October 29, 2015

OFT#1, Line-Point Intercept

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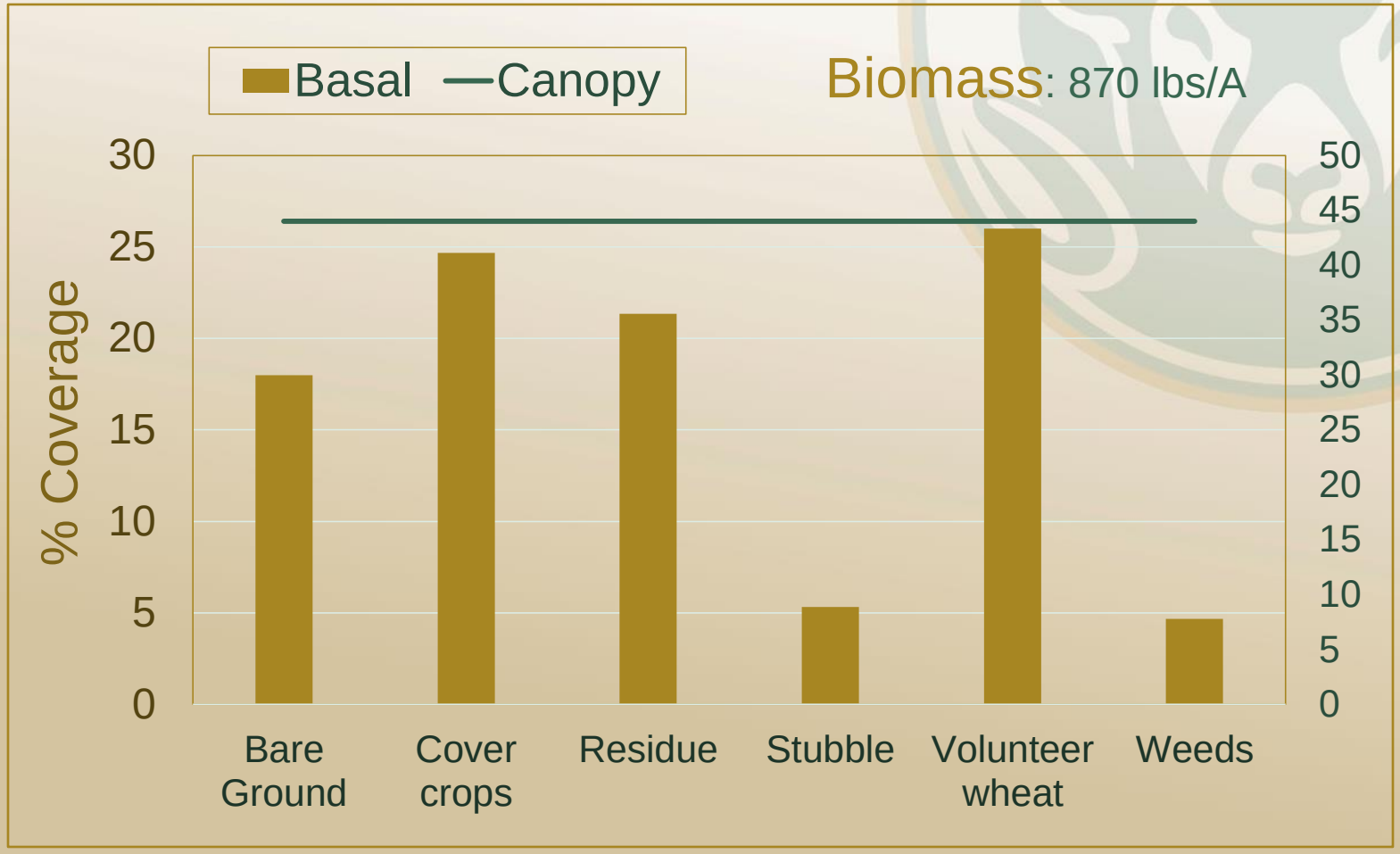


- Haney soil analysis

Test	Value
pH	7.7
O.M. (%)	3.0
Lbs N/acre	28.8
Lbs P_2O_5/acre	37.8
Lbs K_2O/acre	73.5
N value, $/acre	69.93
N savings, $/acre	4.56
Solvita CO_2-C, ppm C	15.4
Soil health calculation	4.3

- Biological activity
  - No worms!
  - PLFA

Microorganism	% of total
Bacteria	45.0
Fungi	11.9
Protozoa	1.2
Undifferentiated	41.9
Total biomass: 2427 ng/g (0.08 oz/ton or 4.9 lbs/ac)	
Group Diversity Index: 1.6 (Very Good)	

- Functional Group Diversity Index

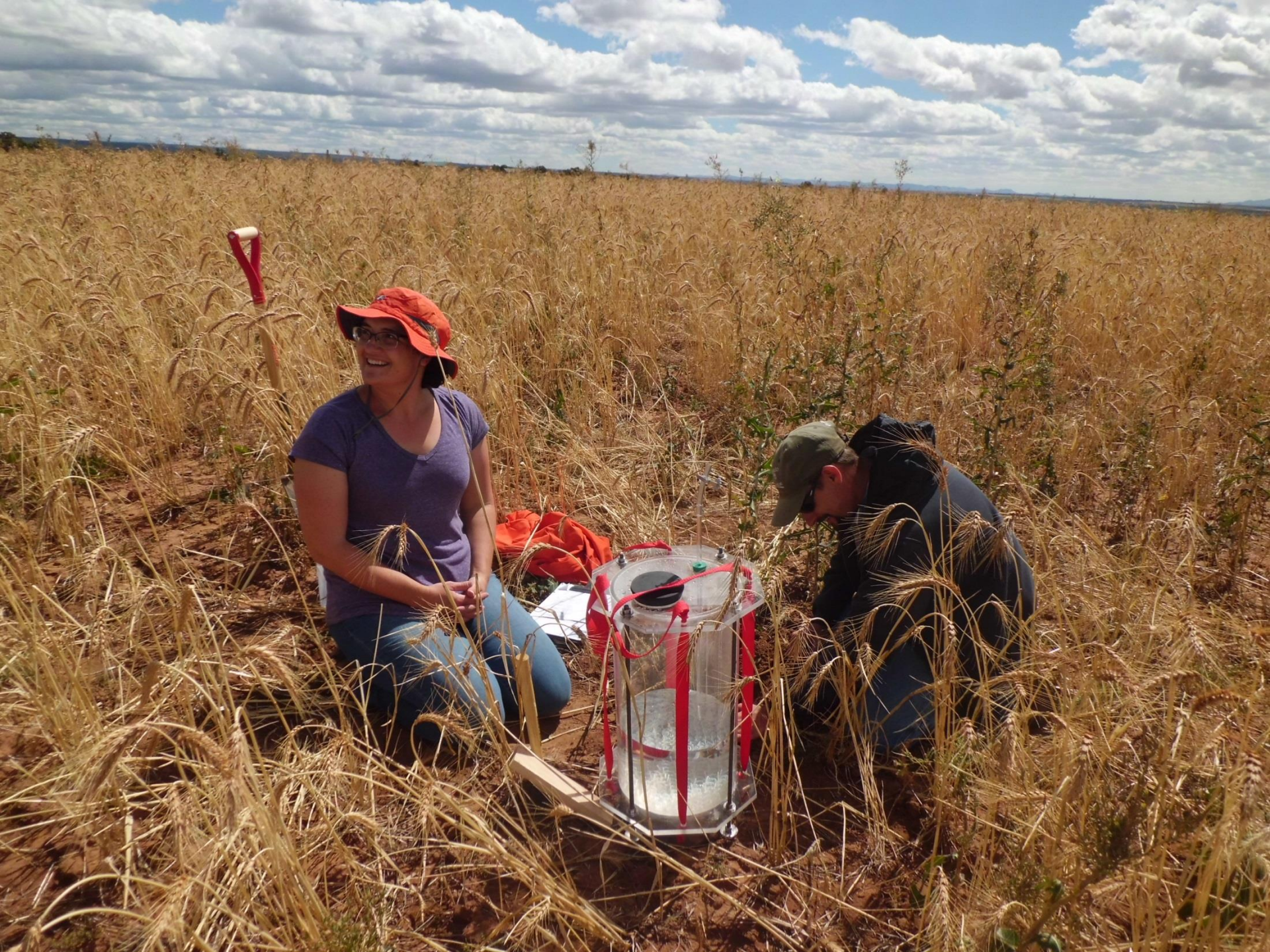
Total Biomass	Diversity	Rating
<500	< 1.0	Very poor
500 - 1000	1.0 – 1.1	Poor
1000 - **1500**	1.1 – 1.2	Slightly < average
1500 - **2500**	1.2 – 1.3	Average
2500 - 3000	1.3 – 1.4	Slightly > average
3000 - 3500	1.4 – 1.5	Good
3500 - 4000	**1.5 – 1.6**	Very good
> 4000	> 1.6	Excellent

- OFT#2
- Wheat-Safflower-Fallow, CT, Organic

Species	Variety	% by weight
Winter lentil	Morton	22
Winter pea	Austrian	44
Nitro radish		7
Rapeseed	Trophy	5
Impact forage collards		4
Flax	Selby	18
Seeding rate & cost: 25 lbs/acre @ $30/acre		
Seeding date & method: 09/10/2015 with JD 455 double disk drill		


11/23/2015
11/23/2015

Test	SOM %	C:N	Health Index	Microbial Biomass (lbs/A)	Diversity Index
OFT 1N	3.0	12.4	4.3	4.9	1.6
OFT 1SW	2.3	10.1	4.3	2.6	1.4
OFT 1F	2.1	12.6	2.6	4.1	1.6
OFT #2	1.6	15.0	1.9	2.9	1.6
OFT #3	2.3	9.0	4.4	2.2	1.5
OFT #4	1.8	11.3	2.2	5.2	1.4
OFT #5	1.4	9.5	2.0	2.8	1.4
RC #1	1.9	6.4	5.1	1.7	1.4
RC #2	2.0	7.2	7.0	1.7	1.2



Soil Infiltration Rate

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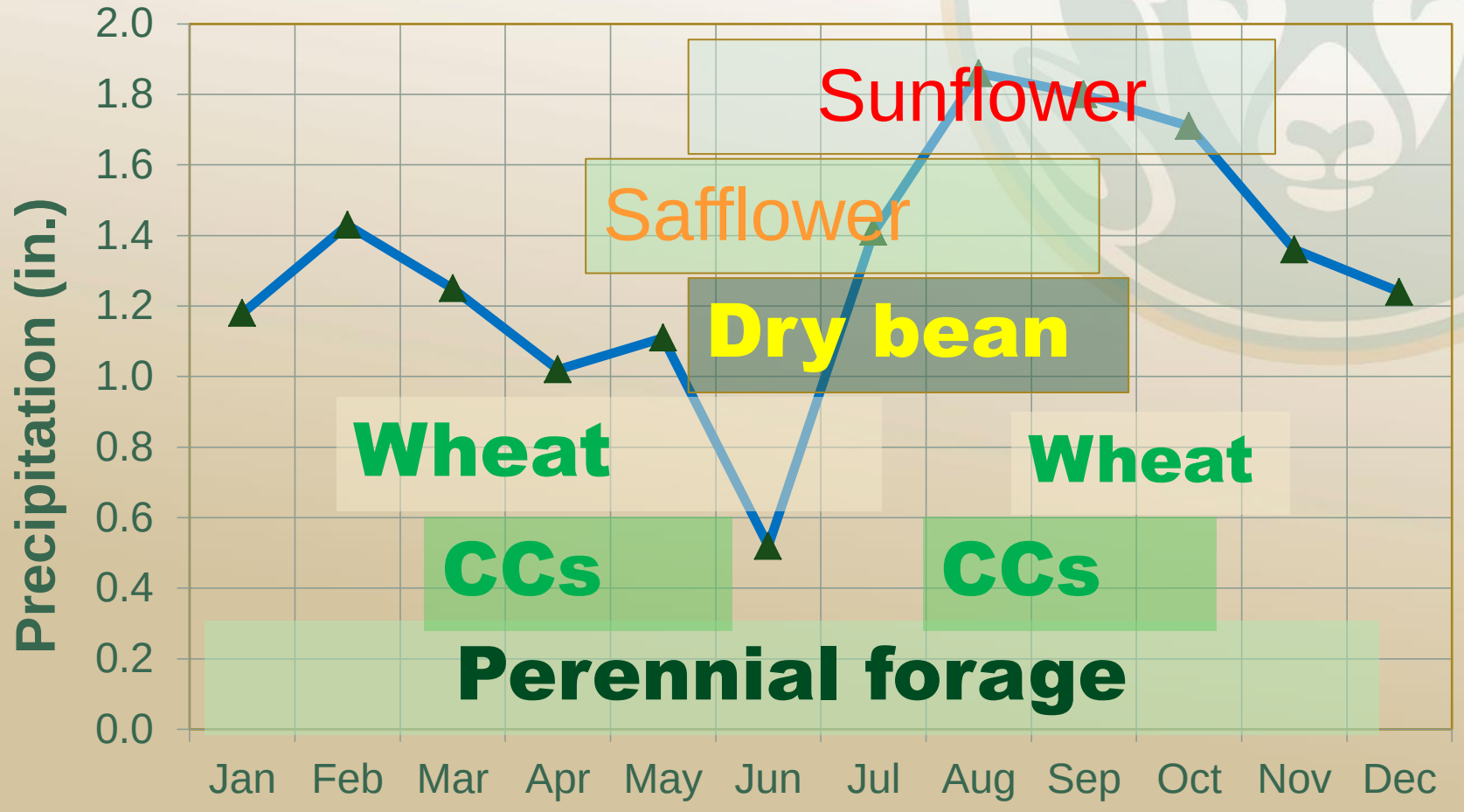
Test	Infiltration rate (in/hr)	Date measured	Notes
OFT 1N	1.8	17-Sep	
OFT 1SW	2.1	30-Sep	
OFT 1F	2.5	22-Sep	
OFT #2	0.9*	17-Sep	Partial
OFT #3	1.2	17-Sep	
OFT #4	5.4	16-Sep	
OFT #5	4.4	16-Sep	
RC #1	1.7	15-Oct	


Precipitation (in.)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Sunflower
Safflower
Dry bean
Wheat
Wheat
CCs
CCs
Perennial forage

http://drylandcovercrops.agsci.colostate.edu/

DRYLAND COVER CROPS

News & Announcements

Colorado State University

Four States Ag Expo

Enhancing the Sustainability of Dryland Farming in the Four Corners Region

November 18, 2016

Final Thoughts

- Strong team & excellent collaboration
- 6 out of 8 field tests started
- Baseline data collected
- Fine-tuning of methodology on-going
- Stay tuned for more updates & results!