1. **Title:** Evaluating adaptation and water use of selected dryland overwintering cover crops and subsequent yield effect on dryland cotton & grain sorghum—Texas Southern High Plains

2. **Personnel**: Principle Investigator: Calvin Trostle, Texas A&M AgriLife Extension, Lubbock
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3. **SUMMARY/ABSTRACT:**

Using recent cover crop establishment/adaptation/survival results from the same Lubbock and Lamesa, TX test sites, six cover crop species/mixes have been identified for further testing in a dryland cropping system for cotton and grain sorghum. Cover crops will be established with gravimetric soil moisture readings at seeding and termination as well as data recorded in order to apply the NRCS WEPS model to evaluate the potential benefit of cover crops. The potential effect of cover crop soil moisture use will be evaluated by gauging subsequent summer crop use.

This project complements the current OAP project "Dryland Texas South Plains No-Till/Con-Till Cropping Sequences to Achieve Stable, Long-term Production" and will be conducted at adjacent sites. This project is well-positioned at both sites for use in educational events designed to outline advantages and disadvantages of cover cropping in dryland cropping systems, especially water use. The project will also provide regional information to balance some of the national discussion and recommendations regarding cover crops, which is dominated by regions that are less concerned about cover crop moisture use (high rainfall areas like the Corn Belt, northerly regions where ET is much less).

4. **PROJECT NARRATIVE:**

This project is follows a previously funded OAP project FY14-15 for evaluation of the adaptation of sixteen overwintering cover crops in the Texas South Plains. Only small grains (wheat, especially rye) and to some extent large-seeded cover crops (Austrian winter pea, hairy vetch, tillage radish) demonstrated any consistent ability to establish on minimal moisture or emerge later. All smaller seeded crops like mustards, canolas, and clovers were subject to shallow seeding and established poorly if at all in 2012 and 2013.

Objectives:

1) Establish in early September to early October (the timing in response to germination soil moisture) six selected cover crops species or mixes to create test conditions for dryland cropping.
2) Evaluate soil moisture remaining after cover cropping for subsequent summer cropping as well as gauge standard soil erosion potential after cover cropping.
3) Gauge dryland cotton and grain sorghum response to cover crop treatments.

Rationale/Overview:

As noted in other OAP projects, the Texas South Plains is exceptionally subject to wind erosion but the steady decline in Ogallala irrigation water is gradually pushing tillable acres back to dryland. Due the sandy nature of these soils, bare-soil listing is the only commonly practiced method of controlling wind erosion, but this method relies on physical means to control erosion all the while destroying soil properties that may reduce soil erosion such as soil aggregation, improved water infiltration, and potential increase in soil organic matter.

Cover crops are widely advocated by many parties as a solution to wind erosion and sustainable cropping system, but these assertions are drawn primarily from areas of the U.S. with rainfall totals of well over 20" and/or evaporative demand that are more in line with the north-central U.S. (Trostle, 2013). Furthermore, the potentially detrimental water use of cover crops is not accounted for my many if not most advocates of cover cropping, including the current national NRCS cover cropping campaign.

Initial results with dryland cover crop adaptation in the South Plains was confounded by overall lack of winter moisture, but prior to moisture deficits our experience indicated that earlier planting (before mid-September) may be needed if cover establishment is critical to subsequent protection of a dryland crop. If you wait to seed cover crops later (mid-October, especially if there is a crop that needs to be harvested), a farmer may not have germination moisture. Furthermore, small-seeded species can't be planted deep enough to reach germination moisture, so this presents a potential problem. Yet even the crop insurance industry and FSA recognize the potential role of a dryland cover even in droughty regions some producers in the lower Texas South Plains are permitted to use rye as a cover provided they terminated by a specified date.

This proposed project compiles initial two-year results from the OAP winter cover crop study (establishment, adaptation, winter survival, biomass produced) to narrow potential choices for cover crop species, which will be followed by dryland cotton and grain sorghum. Soil moisture use and residual soil moisture will be evaluated after each cover crop prior to planting summer crops. The WEPS model (Wind Erosion Prediction System, NRCS, 2012) will be applied to gauge soil erosivity following each cover treatment.

How the Objectives will be met:

Dryland test sites will be at the Texas A&M AgriLife Research Center at Lubbock as well as the Lamesa Cotton Grower's AGCARES research farm in Dawson Co. Based on previous OAP work the following dryland cover crop treatments will be initiated as soon as possible in cotton ground (8 rows X 50' minimum, four replications):

- Rye
- Wheat
- Austrian winter pea/hairy vetch
- Tillage Radish/mustard
- An NRCS-recommended multi-species blend including rye, AWP/HV, mustards, and clovers
- Control (no cover)

Legume cover crops will be treated with crop-specific *Rhizobium* inoculants and a record of nodulation recorded. Stand establishment, growth and development, and field biomass of each cover crop species will be recorded. Percent species distribution will be recorded for each multi-species cover. A photographic record on a monthly basis will be recorded for use in educational programs. The test area will be surrounded with late summer sorghum/sudan

and fall rye (if needed) to protect the test area from soil blowing from other areas.

Gravimetric soil moisture will be recorded in each plot upon cover crop seeding as well as establishment of subsequent cotton and grain sorghum. Cover crops will be terminated in accord with local FSA/NRCS requirements, usually at least 30 days before planting the next crop. Subsequent yield of cotton and grain sorghum will be evaluated after each cover.

Measurements for the NRCS WEPS model will be recorded at the time of cover crop termination as well as at planting (potentially up to two months later) to gauge cover crop protection potential to both the soil and the subsequent crop.

Expected Outcomes:

The information will be shared with producers in the Texas South Plains, including the dryland no-till working group which has been established in the lower Texas South Plains. A similar site funded by OAP at Lamesa has already been a part of three farm tours or turn-row meetings. We will now back the observational OAP results with data and our goal is to lead the way in helping producers consider viable, sustainable cover crop possibilities. This project will also serve as means to help FSA and NRCS evaluate crop programs (approval from FSA for a cover crop is required with a set termination date) and cropping systems, and the sites will serve as a training focus for both NRCS and AgriLife Extension staff. This project and similar work are at the heart of Calvin Trostle's current Extension agronomy programs in the South Plains.

We will be able to track the costs of the individual covers crops and the subsequent crop yields in economic assessment analysis that should not require an economist.

5. Relevant Publications

This is a new area of work for three of the four investigators. Dr. Stewart has published extensively in his role on dryland cropping systems in his role at the WTAMU Institute for Dryland Agriculture, but has not published on cover crops. The previous cover cropping was reported to the OAP in the March 2014 Lubbock conference:

Trostle, C.L.. 2014. Evaluating adaptation and survival of potential dryland overwintering cover crops for the Texas Southern High Plains. Ogallala Aquifer Project annual meeting, Lubbock, TX.

Trostle, C.L., R. Aiken, J. Idowu, D. Lyon. 2013 Semi-arid dryland cover cropping: Panacea or fallacy? Amer. Soc. Agronomy international meeting. Tampa, FL.

6. Literature Cited/References:

Keeling, W., and Abernathy, J.R. (1993) Evaluation of conservation-tillage cotton systems on the Texas Southern High Plains. In: McClelland, M.R., *Conservation-tillage systems for cotton.* Ark. Agric. Expt. Stn. Special Report 160, p. 115-116.

NRCS. 2012. Wind Erosion Prediction System. USDA-NRCS, Ft. Worth, TX (online at http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_019748.pdf)

Trostle, C.L., R. Aiken, J. Idowu, D. Lyon. 2013 Semi-arid dryland cover cropping: Panacea or fallacy? Amer. Soc. Agronomy international meeting. Tampa, FL.