The Viability of Dryland Farming on Fields Formerly Irrigated by the Fort Lyon Canal

January 2016

Prepared by: Brad Walker
AgSkill, Inc.
221 Saratoga Dr.
Windsor, CO 80550
(970)324-9756
bradleywalke221@comcast.net

FLCC Bylaw Hearing
Exhibit ARF-6
I. INTRODUCTION

This report reviews the viability of dryland farming on fields formerly irrigated with water from the Fort Lyon Canal. Dryland farming is defined as a system of growing crops in arid or semiarid regions without the aid of irrigation. I will outline several possible Dryland farming management plans in this report. To improve dryland farming success many farmers are using drought-resistant crops and conserving moisture with special methods of tillage or no-till management.

II. Past Experience

From 1985 to 2010 I worked as a crop consultant. I performed weekly field checks and advised producers in the following areas: Irrigation Management, Insect Pest Management, Plant Disease Management, Soil Fertility Management, Sprayer and Planter Calibration, and general farming practices. I have consulted on many of the fields irrigated with water from the Fort Lyon Canal. I have collected many soil samples from fields under the Fort Lyon Canal and a few water samples from the Fort Lyon Canal.

I am also familiar with Dryland farming techniques and have consulted with many Dryland farmers in the state of Colorado. In addition, I have inspected fields for the Colorado Water Courts. In many of these fields farmers have grown, and are trying to grow, crops using Dryland farming techniques on fields formerly irrigated. I have seen both successes and failures in these fields.

III. No-Till Farming Improves Soil Stability

One type of Dryland farming technique is no-till Dryland farming. No-till is defined as a system of planting crops into untilled soil by opening a narrow slot, trench or band, only of sufficient width and depth to obtain proper seed coverage. No other soil tillage is done. Most U.S. farmers prepare their soil for seeding and weed and pest control through tillage or plowing operations that disturb the soil. Tillage practices affect soil carbon, water pollution, and the farmer’s energy and pesticide use, and therefore, data on tillage can be valuable for understanding the farmer’s role in reaching maximum crop yields and other environmental goals. USDA researchers compiled data from the Agricultural Resource Management Survey and the National Resources Inventory-Conservation Effects Assessment Project’s Cropland Survey. The data show that approximately 35.5 percent of U.S. cropland planted to eight major crops, or 88 million acres, had no tillage operations in 2009.

A joint Agricultural Research Service (ARS)-multi-university study across the central Great Plains on the effects of more than 19 years of various tillage practices shows that no-till makes soil much more stable than plowed soil. The study was led by Humberto Blanco-Canqui of Kansas State University at Hays, KS., and Maysoon Mikha at the ARS Central Great Plains Research Station in Akron, CO. ARS researchers Joe Benjamin and Merle Vigil at Akron were part of the research team that studied four sites across the Great Plains: Akron; Hays and Tribune, KS., and the University of Nebraska at Sidney.
In general, the less the soil is disturbed by tillage, the more organic matter it retains. When the soil is tilled, CO₂ is released to the atmosphere which will cause a decrease in soil organic matter. When organic matter increases, soil aggregation, soil structure and soil stability all improve. The improved soil structure allows more water to infiltrate into the soil and less water to runoff the field. The crop residue on the fields reduces wind and water erosion. Residue also keep the soils cooler and reduces evaporation from the soil.

No-till stores more soil carbon, which helps bind or glue soil particles together, making the first inch of topsoil two to seven times less vulnerable than plowed soil to the destructive force of raindrops. Research conducted by Dr. Gary Peterson at CSU, in southeast Colorado has shown the stubble from the previous crop intercepts the impact from the raindrops and preserves soil structure. Tillage damages soil aggregates and makes soil less resistant to being broken apart by raindrops because the clumping is disrupted and soil organic matter is lost through oxidation when soil particles are exposed to air.

The structure of these aggregates in the first inch of topsoil is the first line of defense against soil erosion by water or wind. Understanding the resistance of these aggregates to the erosive forces of wind and rain is critical to evaluating soil erodibility. This is especially important in semiarid regions such as the Great Plains, where low precipitation, high evaporation, and yield variability can interact with intensive tillage to alter aggregate properties and soil organic matter content.

Increased available water for plant growth is also achieved with no-till farming. First, the improved water infiltration allows more water to enter the soil. Second, the soil surface temperature is decreased, so there is less evaporation from the soil. Third, the soil surface in no-till will dry out, creating a zone of dry soil on the surface that prevents the soil below it from drying out. Whenever the soil is tilled, moist soil is brought to the surface and the moisture is then lost to evaporation. In Colorado, it is estimated 0.25 to 0.4 inches of moisture is lost every time the soil is tilled.

In annual cropping systems, much of a field’s organic matter exists in the form of residue from previous crops that is left on the field. The residue and the standing stubble from the previous crop greatly reduce both wind and water erosion.

IV. Farm Management and Types of Dryland Farming Practices

Conventional Dryland farming
This management practice utilizes tillage to control weeds and prepare the seedbed to plant the crop into. Most farmers in the United States, including farmers in southeastern Colorado, prepare their soil for seeding and perform weed- and pest-control through tillage or plowing operations.

No-till Dryland farming
Without tillage, a farmer must rely on herbicides to control the weeds. Both contact and residual herbicides should be used. Some herbicide options are, but are not limited to, the following:

- 2,4-D
- Dicamba (Banvel)
- Glyphosate (Roundup)
- Atrazine
- Metsulfuron (Ally)
- Isoxaelutole (Scoparia)
- Sulfentrazone + Metribuzin (Authority MTZ)
- Carfentrazone-etil (Aim)
- Flufopxpyr (Starane)

A no-till drill or planter should be used to plant the crops in the undisturbed soil residue. These drills and planters are specifically designed to cut through the crop residue and opening a narrow slot in which the seed are planted, creating good seed to soil contact.

**Minimum-till Dryland farming**
Some farmers employ some type of minimum tillage in the management of their Dryland farming operation. Using a sweep plow or stripe-till are two examples.

**Periodic falling and crop rotation**
Dryland farmers often use a fallow period in which a crop is not planted or grown. In southeastern Colorado, the fallow period of a crop rotation is very important, and is a definite improvement over continuous cropping. The fallow period stabilizes yields and increases the chances of success in growing a crop. Different crop rotations can be used to maximize the crop production. The Wheat-Fallow rotation is a system where wheat is planted every other year. During the fallow year weeds are controlled and the moisture is stored in the soil for the next year's crop. Another rotation is Wheat-Sorghum-Fallow where winter wheat is planted in the early fall and harvested in the summer. Sorghum is planted next spring and harvested in late fall. Next wheat is planted in the early fall and harvested in the summer. With this “WSF” rotation a farmer can grow 2 crops in 3 years. Another rotation many farmers in Colorado have adopted is a flexible rotation that allows them to plant a crop to take advantage of recent rains, which Dr. Gary Peterson calls “opportunity planting.” For example, when heavy spring rains occur and fill the soil profile, the farmer can take advantage of the moisture and plant a summer crop like, corn, millet or sorghum.

**No Guarantee**
It should be noted that a crop could fail to produce any yield, even with the best Dryland farming management practices. Rain or snowfall is needed to grow crops in southeast Colorado and there are times when we do not receive enough precipitation to grow crops. Like farmers who raise irrigated crops, Dryland farms cannot guarantee a definite yield each year, or any year, from the crops they plant. However, it is well documented that Dryland crops can be grown after irrigation water has been removed from a parcel.
V. Soil Salinity

In most of the previously irrigated and currently irrigated fields in the Arkansas Valley, the soil salts have increased. This is the result of irrigating with water that contains high levels of soluble salts. The increased soil salinity has a negative effect on crop growth. Most of the fields under the Fort Lyon Canal are low in soil salts. This is because, most of the time, the water quality in the Fort Lyon Canal is good and the soils are well drained. However, there are some fields under the Fort Lyon Canal that are very high in soluble salts. In these fields, the yields are very low, due to the high soil salts. Most of these fields have poor internal drainage. This has allowed the salts to accumulate in the soil. Some of these soils are classified as saline soils. By definition, a saline soil is a nonsodic soil containing sufficient soluble salt to adversely affect the growth of most crop plants with a lower limit of electrical conductivity of the saturated extract (EC) being 4 decisiemens / meter (dS/m), which is equivalent to a value of 4 mmhos/cm.

Dryland farming in saline soils will probably not be successful.

Using no-till farming may improve water infiltration and the soil salts will decrease. Rain and snow do not contain salts, so the soil salts will eventually be leached through the soil profile and out of the root zone.

VI. Examples of Dryland Farming on Land Previously Irrigated in the Arkansas Valley

In the course of inspecting dry-up fields for the Colorado Water Courts, I have encountered both successful and unsuccessful attempts of Dryland farming. An area in Bent County that has been dried-up and was formerly irrigated by the Highland Canal has had poor success rates. Several management practices have contributed to the low success rates. These include use of tillage equipment that has destroyed soil structure and reduced soil moisture. Many of the Dryland farmers on the land formerly irrigated by the Highland Canal cannot afford no-till drills and other equipment needed for Dryland farming. While the lack of a no-till drill does not make it impossible to plant into crop residue, it does make it difficult to get the seed in the soil where it belongs. Seeds must be planted at the correct soil depth for good seed-soil contact. This may be impossible to achieve without the proper equipment such as a no-till drill. Also poor weed control has allowed weeds to consume soil moisture, resulting in crop failure.

An area in Prowers County that has been dried-up and was formerly irrigated by the Lamar Canal has had very good success. Several management practices have contributed to the success. These include use of no-till equipment that has improved soil structure and increased soil moisture. Good weed control has prevented weeds from consuming soil moisture resulting in the success of the crop. In most cases, the weed control was obtained by the use of herbicides. It should be noted the soil salts in these fields that have been successfully Dryland Farmed are higher than the soil salts in most fields under the Fort Lyon Canal.
VII. Summary

In summary, no-till farming on most of the dry-up acres under the Fort Lyon Canal is a viable option.
IX. References

Comis, Don. 2010. No-Till Farming Improves Soil Stability. USDA-ARS

Horowitz, Howard. 2010 No-Till Farming Is a Growing Practice. USDA Economic
Information Bulletin Number 70

Meeting. Denver, CO