

April 28, 2009

Notes from meeting with Beneterra, Marathon, Bernadette Barlow and Powder River Basin Resource Council at the Barlow Ranch

Present:

John Beardslee, Marathon

Keith Wiles, Marathon

John Zupancic, Beneterra

James (forgot to write last name), Beneterra

Bernadette Barlow, Landowner

Ashley Roberts, Powder River Basin Resource Council

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Jim Ruby, Executive Secretary
Environmental Quality Council

Subsurface drip irrigation (SDI) with CBM water process overview

SDI

SDI involves growing a crop with irrigation water delivered from below the surface of the ground via drip irrigation. In the instance of Beneterra, CBM discharge water is employed with amendments to grow crops and beneficially use produced water.

Beneterra uses 7/8 inch polyethylene tubing/tape which releases amended water from specialized emitter valves along the length of the tube below the soil surface.

Water is released year round. In summer it is utilized to grow crops.

Beneterra has found that salts move down in the winter as the frost cap minimizes capillary rise (which can bring salts upward) which is enhanced by warmer weather.

How it works

CBM water is sodic, by definition having an SAR (sodium adsorption ratio) of greater than 13 and an EC (electrical conductivity) of less than 4.

CBM water in the area can have SAR of over 60 as well as high EC values

Sulfuric acid is added to the water to reduced the impacts of bicarbonate
 $H_2SO_4 (l) + HCO_3^- \rightarrow ppt + CO_2 (g)$ and some Carbonic acid (l)

This lends gaseous carbon dioxide and lesser amounts of carbonic acid, which beneficially dissolves calcium (Ca^{2+}) ions present in the soil which are then freed to outcompete sodium (Na^+) ions that are present, making the environment for plant growth more hospitable/possible.

This process can lower the SAR, sometimes by a magnitude of 10 (e.g. from 60 down to 6)

Site considerations

10-15 acres is best, minimum of around 5 acres.

A reservoir is typically needed

Haying or rotational grazing are productive, keep utilization of water high

Water assessment

The CBNG water is assessed for the predominant anion and cations, SAR, EC and pH.

Soil Preferences for SDI

High soil calcium and magnesium and or gypsum (calcium sulfate) or lime (calcium carbonate) is preferable so there that the water amendments can free soil ions for plant use

Good soil structure including macropores and fissures to enhance drainage are beneficial to help move salts downward through the soil profile.

Soil sampling procedure to initially assess soil conditions

1. Initial background information is collected for the proposed site
NRCS (Natural Resource Conservation Service) soil maps as well as areal imagery are used to preassess the site.

2.

These are used with onsite GPS groundtruthing to look at:

- Vegetation
- Soil
- Exposed profiles
- Historic or current uses

3.

The survey crew returns and takes soil samples, typically 2 in diameter cores, 10 feet deep. It is analyzed for:

- Texture by feel
- The horizons are described
- Soil chemistry is assessed

In general, they are noticing a consistent profile pattern of low salinity in the upper 18 inches as salts have been pushed down, lime deposition between 2-3 feet down and gypsum below that.

Iron deposition in the soil, either reduced or oxidized, indicates high periods of historic water table.

- Rooting is assessed

Deeper, more extensive rooting indicates a healthier soil and helps with moving salts downward. Roots and crop selection have a more profound effect than any amendment. (See Ilyas 1993). Alfalfa has been very successful for SDI as have legume-trefoil mixtures or other grass mixes with nitrogen fixers.

4.

Water amendments and crop are selected based on soil and water analysis and the needs and wants of the companies and landowners. The system is installed and Beneterra monitors and makes adjustments as needed. A UIC (underground injection control) permit must be obtained for these systems.

Monitoring and management

Soil samples are taken to around 30 inches annually to bi-annually or more depending on the situation to monitor how the crop, soils and salts are interacting. As well as monitoring wells to assess impacts to ground water. Crop production is monitored and quantified.

Around 1 person for every 500 acres is needed to monitor/maintain the system.

Around 1800 acres of land are being irrigated by Beneterra in this manner currently

It is rather expensive.

Challenges

Include the need for rodent control to prevent them from eating the tubing/tape.

Clogging of emitters or leaks which can be easily fixed and determined by changes in flow rates.