Western PhytoWorks

Western Colorado Research Center

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## Students Tour Grand Valley Agriculture

Six upper classmen and graduate students along with a professor from BYU came from Provo, Utah to Grand Junction in late September 2008 to learn about soil and salinity issues in the Grand Valley. The students spent 2 days touring several locations throughout the Grand Valley. The tour was part of an upper level course designed for students to develop problem-solving skills related to agricultural issues. Upon arrival in the Grand Valley, the group first met with me, Dr. Calvin Pearson, tour host, at the Western Colorado Research Center (WCRC) - Fruita where I presented introduction and background information on local agriculture, soils, and related environmental issues facing the area.

Following my introductory remarks we traveled to Grand Junction where we met with Mike Baker, Planning Team Leader, with the Bureau of Reclamation. Mike gave a very informative Powerpoint presentation on salinity and selenium issues in western Colorado. During his presentation numerous questions were asked and we enjoyed an excellent discussion about salinity and selenium in western Colorado.

At the conclusion of Mike Baker's talk we traveled to the WCRC - Orchard Mesa where Dr. Harold Larsen provided a walking tour at the center and discussed the topic of "Effect of irrigation and irrigation water quality on salinity in fruit trees." The students learned how irrigation practices and irrigation water quality can have a negative impact on fruit trees and the fruit industry in the area.

The following morning we all went to Mack, Colorado where we visited a grower's farm to see a salinity problem that is causing major problems in an alfalfa field. Bob Rayer, soil scientist with USDA-NRCS, and Wayne Guccini, Irrigation Water Management Specialist, Mesa County Conservation District, met us at the farm location. Bob presented background information about the salinity problem facing the farmer. The problem is so severe that part of the field had to be abandoned and is no longer in crop production. As a group, we spent a considerable amount of time discussing the situation and brainstorming economic solutions to the problem.

We traveled from Mack back to WCRC- Fruita where we viewed the Mancos shale in an exposed profile along the Little Salt Wash. The students learned how agriculture and irrigation contributes to salt loading into the Colorado River and how irrigation activities in the Grand Valley can impact water quality on downstream users.

The tour was an excellent opportunity for students from a neighboring state to learn about real world issues and see first-hand some of the environmental problems related to soils, salinity, selenium, and irrigation occurring in western Colorado.

We thank Mike Baker, Bob Rayer, Wayne Guccini, and Harold Larsen who contributed their time and expertise to make the tour a valuable learning opportunity for the students.

For more information about this article contact Dr. Calvin Pearson at calvin.pearson@colostate.edu.

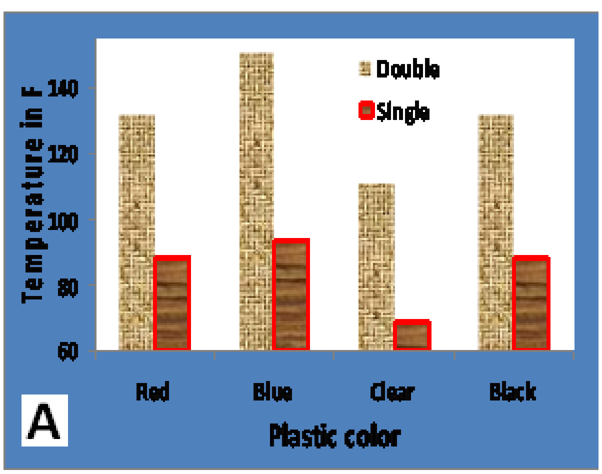
Students and their professor from BYU discuss a soil salinity problem occurring in an alfalfa field at Mack, Colorado with Bob Rayer and Wayne Guccini.

## Plastic Color and Layer Number can Influence Soil Temperatures Needed for Effective Soil Solarization.

Soilborne problems are serious constraint for crop production. Potential causes include soilborne pathogens (fungai, bacteria, plant parasitic nematodes), root feeding arthropods, nutritional imbalances (deficiencies, excesses or unavailability), soil conditions (compacted, poorly aerated soils, salinity, moisture stress, poor drainage, water logging) and pesticide damage to plants. Soilborne problems often are aggravated by coinciding of multiple causes. Biotic agents such as nematodes and root feeding arthropods predispose plants to soilborne plant pathogens by creating disease entry points and vectoring viruses. Management decisions are difficult to make, often compounded by lack of a comprehensive, simple approach where multiple causes are involved. Management difficulties for soilborne problems also can be complicated by lack of conspicuous symptoms on crop plants, e. g. “Replant disease” in stone fruits. This type of disease reduces crop vigor and productivity when planted in the infected soils, year after year. In the past chemicals such as methyl bromide proved to be very effective to manage soilborne pathogens irrespective of cause. However, few options remain to overcome this problem following the loss of this chemical

One answer for soilborne problems could be soil solarization, especially when combined with other techniques. This is a very simple process of heating soil by solar heat to a sub-lethal level for a period of time to inactivate/kill soilborne pathogens; it has been shown to be effective in managing soilborne problems. Moist, loose soil is covered with plastic mulch and the edges of the mulch sealed to provide an airtight environment. Adequate moisture is critical to the process because it absorbs and holds the solar heat, allowing soil temperature to reach and maintain the necessary levels to be effective. The time required depends on the temperature attained; the higher the temperature, the shorter the time needed. At 95° F, it would require 48 days. However, increasing soil temperature beneath the plastic could further decrease the time required and increase the efficacy of the soil solarization.

Similarly, green manuring with mustard and/or use of *Brasssica* seed meal cake containing isothiocyanate effectively reduces soilborne problems while also increasing plant nutrient availability. Research has demonstrated that incorporation of such Brassiceous plants followed by soil solarization can increase the efficacy of the treatment. We have obtained accessions of *Brassica* species (*B. juncea, B. carinata, B. napa*) known to have higher concentrations of isothiocyanates. We have successfully grown mustard in the field and obtained seed in western Colorado. The isothiocyanate content in *Brassica* spp. is highly volatile and escapes into the environment once released from decomposing plant materials that are incorporated in the soil. We have been looking at ways to minimize isothiocyanate losses and increase the soil temperatures beneath plastic to enhance the efficacy of soil solarization and mustard application. Our studies have demonstrated that soil temperatures are raised most effectively in western Colorado by soil solarization beneath the plastic in July-



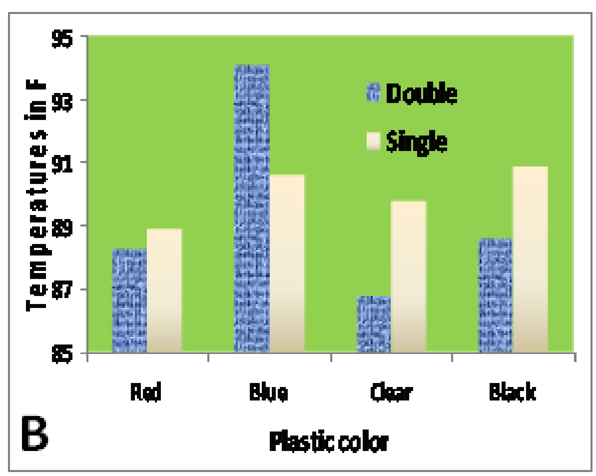




Table 1: Soil temperatures, average of 60 days (A) and maximum during that period (B) beneath different colored plastic mulches at Western Colorado Research Center, Orchard Mesa site,, summer of 2008.

August. We also have observed that mustard can be grown successfully and attain an effective growth by July. Thus, it may be possible to combine the use of mustard and soil solarization to enhance treatment efficacy. Studies to combine such practices are underway; one of the projects (funded by the EPA) looks to manage soilborne problems in onion in a western Colorado grower's field. Moreover, the oil from *Brassicas* spp. can be extracted and used as biofuel. The remaining meal cake has the isothiocyanates and nutrients to support plant growth when applied in soil. This cake will also help to reduce the soil pH. Studies are ongoing to understand the beneficial uses of these *Brassica's* spp.

Efficacy of soil solarization increases with increase in soil temperature beneath the plastic. Studies are in progress on ways to increase soil temperatures. According to one of the studies conducted, colors and layers of plastic seem to influence the temperature beneath the plastic (Figure 1 A and B). This study will be repeated in summer of 2009 to prove this hypothesis. A double layer of blue colored plastic was the most effective in raising the soil temperatures at 6" depth.

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## Alfalfa Production and Quality Evaluation on Three Different Irrigation Systems

Water use for alfalfa production using furrow irrigation on the Western Slope of Colorado typically exceeds alfalfa's water requirements due to the inefficiency of furrow irrigation. A three-year research and demonstration project was carried out at WCRC – Rogers Mesa to determine if sprinkler and drip irrigation methods could produce equal or better alfalfa yields with similar quality to furrow irrigation. Three one-acre stands of Pioneer 53V08 alfalfa were planted in 2006 with an oat nurse crop. Once the crop was established data was taken for the 2007 and 2008 growing seasons. Furrow, sprinkler, and drip irrigation systems were compared for water use efficiency, yield, and hay quality. Although soil moisture sensors were used, irrigations were applied every 10 to 14 days for the furrow system to mimic local grower practices and every 7 to 10 days for the sprinkler and drip applications due to smaller application amounts at each irrigation.

Although furrow irrigation is the most commonly used irrigation method for hay production in Western Colorado, sprinkler systems such as center pivot and linear move systems are becoming more widespread due to ease of use and reduced labor inputs. Drip irrigation for alfalfa production has not been previously evaluated in the area. Drip irrigated alfalfa is successful in areas with costly or limited irrigation water because of its higher water use efficiency. Drip irrigation technology has been successfully applied to horticultural crops in the area, but establishing alfalfa on a drip system requires the drip tape to be buried and a pressurized irrigation system is needed to irrigate with drip systems. The goal of using drip in alfalfa fields is to reduce plant stress while using less water. By adding less water more frequently throughout the growing season the alfalfa exhibits more even growth with sprinkler and drip systems due to less plant stress. Furrow irrigation systems stress plants following irrigations due saturated soil conditions in the root zone. Following saturated soil water drainage, furrow irrigated crops typically exhibit more even growth.

Our findings show that both the sprinkler and drip irrigated fields used much less water than the furrow irrigated field. The data shows that the furrow system operated at approximately 48% efficiency, meaning that 48% of the water applied was used by the crop, the remainder was runoff and deep percolation. The sprinkler system operated at approximately 75% efficiency and the drip system at approximately 85% efficiency. These efficiency levels are within typical application efficiency ranges for these systems. On average the furrow irrigation used 36 ac-in of water per year, sprinklers used 20 ac-in, and drip used 16 ac-in to produce similar tonnage and quality of alfalfa.

Sprinkler and drip irrigated plots produced equal or better quality alfalfa utilizing less water with tonnage approximately equal to the furrow irrigation system. Yields for all three systems in 2007 were slightly greater than 4 tons per acre and approximately 6 tons per acre in 2008. The across the board increase in tonnage is probably due to the increased maturity of the crop. All of the feed quality parameters tested remained high and constant through both years of the project and showed that high quality feed can be attained from all three irrigation systems.

Special thanks to Debra Lester, Randy Cramer, and Colorado State University for their expertise and assistance with this project. Special thanks to the Delta Conservation District, the U.S. Bureau of Reclamation and Rocket Compost for funding this project.

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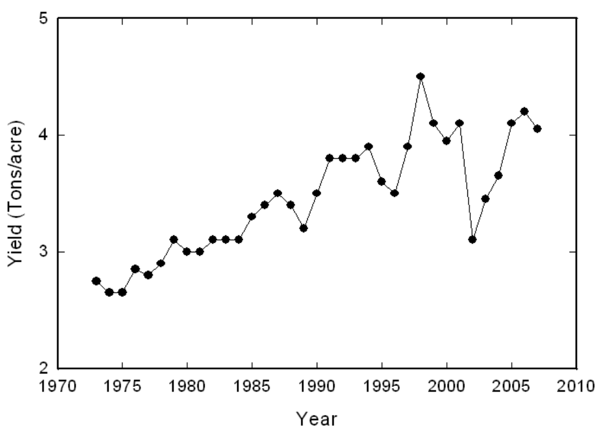
## Alfalfa Continues to be a Valuable Crop for Western Colorado

Alfalfa is a valuable crop in Colorado. According to the Colorado Ag Statistics, in 2007, 2.96 million tons of alfalfa hay were produced in Colorado on 800,000 acres with an estimated value of $408 million. In some years, the value of all hay (alfalfa and other hay) in Colorado exceeds that of wheat and corn.

Alfalfa is also one of the major crops grown in western




Colorado. Alfalfa hay produced in western Colorado is marketed to a large cross section of local and out-of-state buyers and end users. These buyers and end users range from local people with one animal to large feeders with thousands of cattle. Over the years, yields of alfalfa hay in Colorado have continued to increase across the state up until the drought years that occurred just before and during 2002 (Fig.1). Recently, hay yields have been increasing again but have not reached the state high that occurred in 1998.

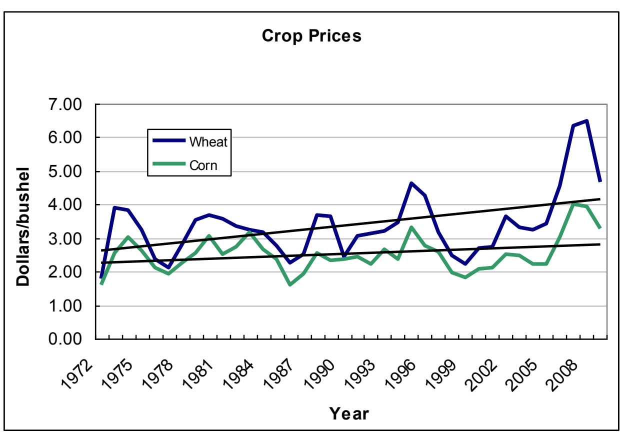



Fig. 2. Farm gate price for wheat and corn in Colorado from 1972 through 2008.

Crop prices for wheat and corn from 1972 through 2008 are shown in Fig. 2. Note the flatter trend line for corn compared to the trend line for wheat. A flatter trend line indicates less of an increase in

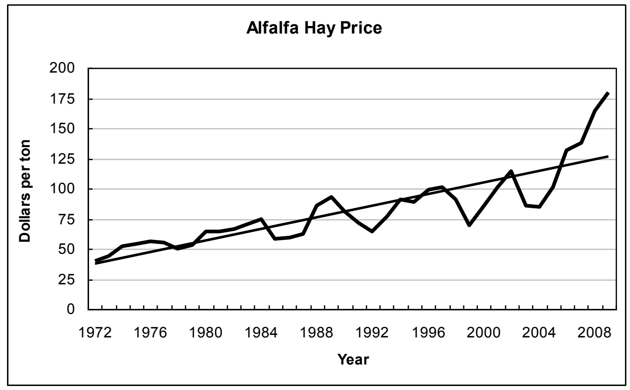



Fig. 3. Farm gate price of alfalfa hay in Colorado from 1972 through 2008.

crop prices during the period. Alfalfa hay prices from 1972 through 2008 are shown in Fig. 3. When the trend lines for Figs. 2 and 3 are compared, one can readily see the price of alfalfa hay has increased more over the years than those for corn and wheat. Certainly, we are currently experiencing economic upheavals not seen for a very long time and it is difficult to predict future prices of any crop, but over the past several decades, alfalfa hay has been a crop for which prices have been on the increase more than some other major crops.

At the Western Colorado Research Center at Fruita we routinely conduct variety performance trials for alfalfa. Yield data are summarized annually and made available to the public. Results of these trials are posted on the Internet after each cutting. This information is available at www.csucrops.com. There are several other locations in Colorado where alfalfa variety performance tests, similar to the one at Fruita, are conducted.

Alfalfa is likely to continue to be a valuable and important crop in western Colorado to meet the needs of local and out-of-state buyers and end users.

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