Cooperative Extension
Colorado State University, Fort Collins, Colorado 80523

Colorado State University

AGRON-  -GRAM

May, 1990

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AVAILABILITY OF SOIL TESTING EQUIPMENT

The Soil Testing Laboratory has had several inquiries concerning the availability of soil sampling equipment. The following companies supply a variety of sampling equipment depending on your needs. The inclusion of a company in this list does not imply endorsement by the Colorado State University Soil Testing Laboratory.

Clements Associates, Inc.
Rural Route No. 1
P.O. Box 186
Phone: 1-800-247-6630

M&M Supply Company
Marketing Div. of Last Perch, Inc.
209 Mill Street, SW
Mitchellville, IA 50169
Phone: 515-967-4377

Sauze Technical Products, Corp.
212 Oak Street Extension
Plattsburg, NY 12901
Phone: 518-561-6440

Giddings Machine Company*
401 Pine
Ft. Collins, CO 80525
303-482-5586

*Giddings also makes hydraulically operated sampling equipment that can be fitted to the back of a pickup truck. (Self)

IRRIGATING DRY BEANS

An irrigation experiment was recently conducted at the Colorado State University Research Center at Fort Collins. Dry beans (variety Olathe) were irrigated when different levels of soil moisture stress occurred during the vegetative and reproductive growth stages. The plots were furrow irrigated and irrigation was applied when the available soil moisture content was allowed to deplete 30% (no stress), 50% (moderate stress), 70% (high stress), and non-irrigated. Bean yield varied from 3156 lbs/A to 1672 lbs/A. The results (Table 1) indicated that soil moisture stress during the vegetative stage did not influence seed yield. However there was a direct relationship between soil moisture stress during the reproductive stage and seed yield. All plots irrigated when 30% of the available soil moisture was depleted during the reproductive stage gave non-significantly higher yield, followed by 50 and 70%. These

results confirm the findings of others that beans tolerate water stress during the vegetative stage but not during the reproductive stage. An experiment conducted by Stoker in New Zealand found that water stress during the early to late vegetative stage caused a 20% yield reduction, whereas the same level of stress during early pod fill caused a 50% reduction in yield, and stress during the late podfill caused no reduction in yield.

This study also determined that soil moisture stress accelerated floral initiation and plant maturity.

Based on published results, dry beans should not be stressed for moisture during the floral and pod filling periods. When irrigation water supplies are limited, water should be managed to avoid stress during the critical flowering and pod filling periods. A recent Service-In-Action (no. 4.707) provides additional information regarding irrigation scheduling by the water-balance approach. There is also a NEB Guide available from the Nebraska Cooperative Extension entitled "Irrigating Dry Beans" (no. G84-686). These publications point out the need to supply the maximum amount of water during flowering and pod fill because that period coincides with the most sensitive stage of growth and peak demand period for water due to evapotranspiration. Weekly water needs of the bean crop change from less than one inch in early June, to approximately 2.5 inches from mid-July to mid-August, then declines rapidly following pod fill. The specific weekly needs of your bean crop will vary depending on the soil depth, occurrence of soil compaction, soil texture and evaporative demand of the environment.

Table 1. Dry bean irrigation experiment at Fort Collins, CO 1989.

%ASMD[1]			
V	R	Yield[2]	Water[3]
70	30	3156 a	19
30	30	2875 ab	16
50	30	2799 ab	16
70	50	2762 ab	11
50	50	2667 ab	13
50	70	2404 b	15
70	70	2329 b	10
Non-Irrig		1672 c	3

[1]Percent available soil moisture depletion (V) Vegetative and (R) Reproductive growth stages.
[2]Yield pounds/acre. Means followed by same letter are not significantly different (05).
[3]Total water (in) supplied per treatment.
(Brick and Bandaranayaka)

NON-CONVENTIONAL SOIL AMENDMENTS

Now is a great time to get soil tests done or review results of the tests that were taken last fall and develop sound fertilization programs. Unfortunately, it's also the time of year that many calls are received asking if any information is available on a certain product sounding "too good to be true." These "too good to be true" products often fall in a category called non-conventional soil amendments. They include products that contain extremely low amounts of nutrients (or none at all) but act on the soil to release "stored" or "fixed" nutrients. These products may contain either bacteria, humates, humic acids, enzymes, plant growth regulators, gypsum, products high in carbon or some combination. They may contain low levels of nutrients or micronutrients. Application rates per acre are generally low, but

per acre costs are high (often $10 per acre or more).

The number of these products being marketed in Colorado is unknown, but the list is long and growing. It is impossible to evaluate these products in field research trials, but in the past several years, several of these compounds have been tested. This information has been reported in a Compendium of Research Reports on Use of Non-Traditional Materials for Crop Production. This compendium is a large regional publication which is updated every three to four years. To summarize the research in Colorado to date, non-conventional soil amendments or additives tested have not been effective.

To be legally sold, these products must be registered as a soil amendment with the Colorado Department of Agriculture. Registration requires that proof of effectiveness data be submitted with the registration application. Few products are currently registered. To get around registration as a soil amendment, several products claim small amounts of nutrients and are registered as a fertilizer. If producers decide to try these types of products, start small and use test strips. Be sure to have a control strip with the conventional fertilization program for comparison. Don't compare different fields. Remember, it's buyer beware--if it sounds "too good to be true," it probably is.
(Follett)

ORGANIC MATTER - AN IMPORTANT COMPONENT OF SOIL

Soil organic matter consists of plant and animal residues in various stages of decay. The organic matter content of soils varies from about 1 to 3 percent in sandy or light colored, highly weathered soils up to 5 to 8 percent in the surface of dark colored soils or even higher in muck or peat soils. Plants do not require organic matter to grow and reproduce, but they produce more efficiently when it is present.

About 95 percent of the dry weight of all organic matter originates from green plants through photosynthesis. The other 5 percent consists of nutrients from the soil, water, and air. Each year throughout the world an estimated 30 billion tons of organic matter on a dry weight basis are produced by photosynthesis. About one-third of this organic matter eventually comes in contact with the soil with the remainder fixed in perennial vegetation or in the bodies of animals or people. Eventually, nearly all of these residues are returned to the soil.

Why is organic matter important? Adequate levels of organic matter benefit the soil in many ways. Organic matter is a storehouse for several anions including nitrates, phosphates, sulfates, borates, molybdates, and chlorides. Another related function is increasing the cation exchange capacity (CEC) of soils. More available nutrient cations such as ammonium, potassium, calcium, and magnesium are thus adsorbed by soils. In addition, as organic residues decompose, small quantities of essential plant nutrients are supplied to growing plants in time sequence with plant needs. For a specific example, it is estimated that 3.1 million metric tons of nitrogen are mineralized from organic matter in the United States each year. Between 10 and 15 percent of the total annual nitrogen input to soils comes from organic matter mineralization. The importance of organic matter to plant nutrition is obvious.

Another benefit of organic matter is a buffering or protecting the soil against rapid changes due to

acidity, alkalinity, salinity, some pesticides, and toxic heavy metals. This function of organic matter is well illustrated by an example of herbicide adsorption. The use of herbicides such as Bladex, Atrazine or Dual are not recommended on soils that are below 1% organic matter. Carryover could affect some crops. When organic matter levels are sufficient, enough of the herbicide is adsorbed to reduce detrimental effects on the crop, but still allow effective weed control. In addition, the adsorptive powers of organic matter reduces the potential for leaching of some herbicides to groundwater.

Yet another benefit of organic matter is protecting the surface soil against wind and water erosion by reducing raindrop impact on soil particles, increasing infiltration, reducing runoff, and increasing the soil's total and available water-holding capacity. Adequate organic matter levels can decrease surface crust formation by decreasing the soil-dispersing action of intense, short duration rains. Adequate organic matter levels can be helpful in decreasing the extremes of soil surface temperature. Overall, adequate organic matter levels tend to improve soil physical conditions resulting in improved soil tilth and lower soil bulk densities.

Organic matter also serves as a good source for many beneficial soil organisms and microorganisms, from earthworms to symbiotic nitrogen-fixing bacteria to mycorrihizae. These organisms carry on a multitude of important functions in the soil.

With adequate fertilization and good crop production management practices, more crop residues are produced which help maintain organic matter levels in the soil thus benefiting physical, chemical, and microbial soil properties. (Follett)

HIGH LEVELS OF SELENIUM ARE NOT A PROBLEM IN MOST AREAS OF COLORADO

Vegetables, forages and grains from the Western Slope do not contain harmful levels of selenium. Results of an extensive survey of selenium contamination in Mesa, Montrose and Delta Counties show that selenium levels in plant tissue, soil and water are well within the safe levels established by the National Academy of Sciences and the U.S. Environmental Protection Agency.

Interest in selenium began when the Sacramento Bee published a series of articles last year that alleged millions of Americans were at risk because of excessive levels of selenium in food. Colorado was one of the states implicated in the Sacramento Bee's story.

Consumers as well as vegetable growers in Montrose, Delta and Mesa Counties, were concerned about the effect this publicity could have on the area. Unfortunately, the actual status of selenium in the area was not known. Members of the sweet corn and broccoli marketing-order committees in the area contacted Colorado State Cooperative Extension and asked for help in evaluating area selenium levels.

Selenium, which has Jekyll and Hyde characteristics, is a naturally occurring element in soils, plants and water. It is essential for life; however, in excessive amounts, it can cause such problems as garlicky breath, loss of hair and fingernails, blistering, swollen skin and nausea.

The EPA recommends 0.01 ppm as the upper limit in drinking water for humans, 0.05 ppm in drinking water for livestock and 0.02 ppm in irrigation water.

A sampling program was conducted in the summer of 1989. The program was supported by sweet corn and broccoli marketing-order commit-

tees in Mesa, Montrose and Delta Counties, Colorado State Cooperative Extension and the Agricultural Experiment Station. Soil samples from the vegetable-test sites ranged from less than 0.01 ppm to 0.03 ppm of selenium, well within safe limits. Soil samples from field-crop test sites ranged from 0.01 ppm to 0.26 ppm selenium. Only two field-crop sites tested above the critical limit of 0.1 ppm selenium: an alfalfa field and a durum-wheat field.

On a fresh-weight basis, the sweet corn samples contained less than 0.1 ppm selenium or less than 10 micrograms selenium per 100 grams of sweet corn.

Four of the five broccoli samples tested contained less than 0.1 ppm selenium on a fresh-weight basis and the fifth sample tested at 0.1 ppm. This equates to less than 10 micrograms of selenium per 100 grams of chopped broccoli.

The water samples were all below the upper limits for irrigation water and all but one of the samples were below the upper limit for human drinking water. All of the water samples were below the upper limit for livestock drinking water.

The selenium values found in field crops were far below the suggested upper limits.

Excessive selenium in plants, water and soil in the area surveyed is not a problem. However, this is not to say a selenium problem does not exist anywhere in Colorado. High selenium levels can be found in isolated areas of the state.

Anyone who suspects a selenium problem in soil, water or plants--either an excess or a deficiency--can have a sample checked by the Colorado State Soil Testing Laboratory. Routine soil, plant tissue and water tests are $15, $20 and $25 respectively. A selenium evaluation is an additional $10 per sample.

For more information refer to Technical Bulletin, LTB 90-2, "Selenium Levels Found in Soil, Water, Vegetable and Field Crop Samples in Western Colorado." A copy of this Bulletin is being sent to each County Office. (Follett)

COLORADO STATE UNIVERSITY WILL SHOW APHID TOLERANT WHEAT AT WHEAT FIELD DAYS

Field days will be conducted from June 11-26 at 24 locations throughout eastern Colorado according to the following schedule. Extension agents and Colorado Wheat Administrative Committee members will serve as hosts and local coordinators.

Field Day speakers will include Jim Echols, Extension Agronomist, Thia Walker, Scott Armstrong, Stan Pilcher or Frank Peairs, Entomologists, Dr. Jim Quick, Wheat Breeder and Dr. Hunter Follett, Wheat Fertility Specialist. However, all speakers will not be at all locations.

Russian wheat aphid management will be the primary topic for discussion. A Russian Selection, T-57, is located at each site and having good aphid tolerance, the use of plant breeding, insecticides, predators and cultural management will be discussed.

Many new varieties, experimental lines, and dryland fertility plots are at each location.

A discussion on long-term financing for research and extension programs will be presented at each location.

At Stratton on June 13 and at Sterling on June 20, Dr. Gary Peterson will be present to explain long-term rotation and management studies. On June 20, personnel at the Akron Research Center will provide information about their research programs. (Echols)

WHEAT FIELD DAYS SCHEDULE

JUNE 11
1:00 p.m., Bill Stone, Punkin Center, 4 E on 94 and 7/8 S.

JUNE 11
6:00 p.m., Jacobs & Hoffman, Eads, 13 W to Rd. 27, 7-1/2 N.

JUNE 12
8:00 a.m., Eugene Splitter, Sheridan Lake, 3/4 W, 3-1/2 S on 385.

JUNE 12
1:00 p.m., John Stulp, Lamar, 6 S on 287.

JUNE 12
5:00 p.m., Research Center, Walsh, 1/8 W, 4 N, 1 W.

JUNE 13
1:00 p.m., Gary Mulch, Peconic, 7-1/2 S on Rd. 55 (1/4 S of Rd. R).

JUNE 13
5:00 p.m., Miltenberg Bros, Stratton, 4 E on Hwy 24.

JUNE 14
8:00 a.m., Barry Hinkhouse, Burlington, 1-1/2 S on 385.

JUNE 14
1:00 p.m., Roy Andersen, Genoa, 9 N.

JUNE 14
6:00 p.m., Jack Maranville, Matheson, 8-1/2 S.

JUNE 15
9:00 a.m., Cliff Travis, Anton, 5 N to Rd. 17, 2-1/2 W.

JUNE 18
1:00 p.m., Bill Hanson, Clarkville, 2-1/2 W, 1/4 S on Hwy 59.

JUNE 18
6:00 p.m., Greg Stults, Vernon, 1-1/2 W, 1/8 S.

JUNE 19
8:00 a.m., Daryl Hiatt, Sedgwick, 4 W and 1/8 N of Venango, NE.

JUNE 19
4:30 p.m., Jim Carlson, Ovid, 6-1/2 S of I-76.

JUNE 20
8:30 a.m., Research Center, Akron, 4 E, 1/8 S, 1/4 W.

JUNE 20
5:00 p.m., Gilbert Lindstrom, Sterling, 1/4 S of Intersection of Co. Rd. 6 & 59

JUNE 21
8:00 a.m., Wilfred Mertens, Willard, 3 E on Rd. 18.

JUNE 21
12:30 p.m., Dean Gillham, Peetz, 1-3/4 S on 113, 1/8 E.

JUNE 21
6:00 p.m., Bud Peterson, Chapel, NE, 10 N on Hwy 27.

JUNE 22
9:00 a.m., Univ. of Nebraska, Sidney, NE, 5 N on Hwy 385, 3 W, 1 N.

JUNE 25
5:00 p.m., Marvin Helzer, Bennett, N on 79 to Rd. 144, 1/4 E.

JUNE 26
1:00 p.m., R.M. Hough, Fort Morgan, 17 S on Co. Rd. 19.

JUNE 26
5:00 p.m., Gary Castor, New Raymer, W to Buckingham, 1/8 N.

HAY DRYING AGENTS

Recently, the use of chemical hay drying or conditioning agents has been advocated as a means of reducing field curing time and dry matter losses during harvest of alfalfa, resulting in improved quality. These products generally contain potassium carbonate as the active ingredient, and are applied in a solution through a boom mounted on the front of the windrower at mowing time. They function by modifying the waxy cutin layer of leaf and stem surfaces so it is more permeable to water; thereby, reducing drying time.

The results of a study conducted near Greeley, Colorado on four cuts of alfalfa investigating the effect of the product Conservit (Fenn Products) on forage drying time (Fig. 1) illustrates the potential benefit of these types of products. This figure shows that the treated hay required 1 to 2 fewer days to reach safe baling moisture than the untreated hay, with the greatest differences between treatments occurring when drying conditions were optimal (cuttings 2 and 3). Rainfall on the cut forage occurred only for the 1st cutting.

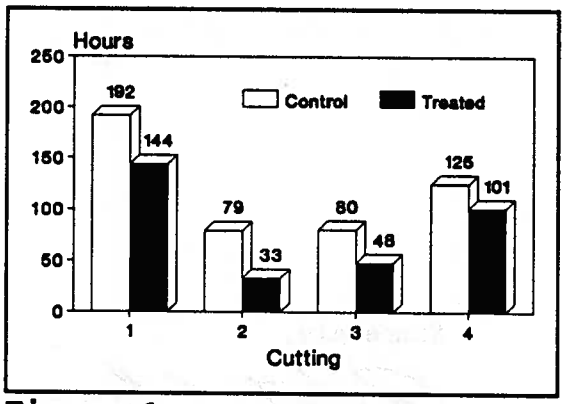

Figure 1. Hours required for hay to reach 18% moisture for control and chemical treatments across four cuts of alfalfa in 1989.

The conditioning agent increased crude protein content (Fig. 2) and reduced fiber content (data not shown) on all but the 4th cutting, indicating that forage quality was improved by the product. These results likely occurred because conditioning agents typically allow stems to dry faster, such that leaves don't become overly dry during the curing process. This allows more leaves to be retained during baling, thereby, improving the quality of agent treated hay.

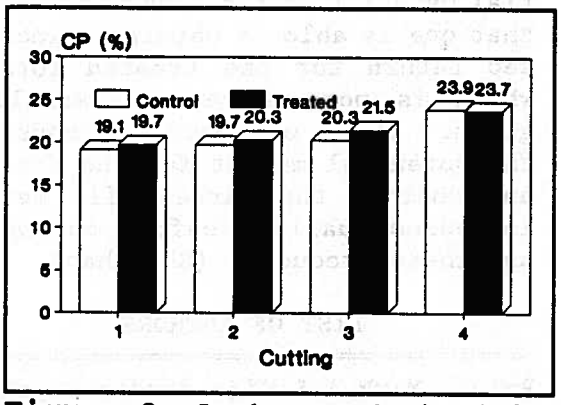

Figure 2. Crude protein (%CP) for control and chemical treatments across four cuttings of alfalfa in 1989.

These results indicate that the product reduced field curing time under both dry and wet conditions as well as improved quality. Is this a profitable input? This question is difficult to answer with absolute certainty. Under some conditions it may save an entire crop, obviously making it a worthwhile investment. However, it would appear that the treatment may be warranted also under optimal drying conditions. For example, treated hay possessing an advantage of 1% point in protein over untreated hay, would be worth an additional $5/ton, assuming that protein from soybean meal costs $0.24/lb of protein. With the cost of the treatment ranging from $4 to $10/ton of

hay produced, the input cost would be nearly offset by the increase in worth of the product. Additionally, some insurance value would be assigned to the treatment because of its effect on minimizing exposure of the forage to rain. However, the potential benefits of the treatment assume that one is able to obtain an increased return for the treated forage, which is not always necessarily a given. Thus, one needs to consider the potential market for the forage, and whether the market will reward increased quality, before opting to use these products. (Shanahan)

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Sincerely,

Robert L Croissant

Robert L. Croissant
Extension Specialist
and Assoc. Prof.