Cooperative Extension
Colorado State University, Fort Collins, Colorado 80523

Colorado State University

AGRON-O-GRAM

July, 1991

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DRY BEAN FIELD DAYS SET FOR EASTERN COLORADO

Colorado State University Cooperative Extension will host two dry bean field programs in eastern Colorado on August 6, 1991. The programs are at the CSU Dry Bean Testing Program field trials near Merino and Ft. Morgan, CO. CSU scientists will speak on topics to include variety test results, bean disease and insect problems/solutions, weed control, soil compaction, soil fertility and new pinto bean varieties. The variety plots contain pinto beans at both sites, small whites at Fort Morgan and kidneys at Merino. Following both programs, a meal will be provided by the local bean dealers and sponsors of the program. Local arrangements will be made by Bruce Bosley, Logan County Extension agent (303-522-3200). The program is sponsored jointly by CSU Cooperative Extension, the Colorado Dry Bean Advisory Board and the Colorado Dry Bean Commission. The time/date, grower/cooperator and directions to the field site follow. (Brick)

TIME	COOPERATOR/ Address	DIRECTIONS TO PLOTS
10:00 AM Tuesday August 6	Roger Miller 22047 Hwy 30, Ft. Morgan, CO	From Ft. Morgan, go 3 mi., east on Hwy 34 to Rd 22, then 1/2 mi. north.
4:00 PM Tuesday August 6	Howard Hettinger Rt 1, Box 117 Merino, CO	From Merino, go S on Rd 25 to Rd 8, then E on Rd 8 to Rd 29.

The Field Day at Burlington has been cancelled because of severe hail.

GROUNDWATER QUALITY

Update on SB 90-126 activities:

Several events related to SB 126 (The Agricultural Chemicals and Groundwater Protection Act) have recently occurred which effect the implementation of this bill. The Colorado Department of Agriculture (CDA) has hired Mitch Yergert to coordinate their water quality program. Mitch is a CSU graduate with a degree in Agronomy, who previously worked as a CDA Plant and Insect Specialist. His immediate task is working on regulations for bulk storage and agricultural chemicals handling. The CDA originally planned to wait on these regulations until the EPA published their standards on storage and handling. However, the EPA decided to delay the development of storage regulations and focus instead on developing regulations for pesticide containers. The CDA chose not to delay the process any longer and will proceed as required by SB 126. They will develop

regulations in three phases, beginning with the large commercial bulk storage facilities. It will probably be several years before any regulations affecting small commercial applicators or large farm operations will be implemented.

The Colorado Department of Health (CDH) has hired Brad Austin to coordinate their groundwater monitoring activities for SB 126. His priority is to establish a groundwater monitoring program in the west slope fruit growing region. The Department of Health is also involved in classifying Colorado aquifers as to use and acceptable contamination standards. This has significant opposition but the CDH is currently working for a suitable compromise. Delineation of contamination standards in Colorado aquifers is one of the first steps toward future regulatory controls.

The SB 126 advisory board has directed that Cooperative Extension assist and cooperate with other agencies within Colorado to develop a coordinated set of Best Management Practices (BMP's). Development of BMP's for Colorado agriculture should be pursued on a localized basis with significant local input. They further suggested that an effort be made to work with other agencies within Colorado to develop a coordinated set of BMP's. Due to the diversity of Colorado agriculture, some priority has to be established for BMP development. The SB 126 advisory board agreed that the lower Platte River basin including the Denver metro area was a logical first priority, given the documented problems with high nitrate levels. Lloyd Walker, myself, CSU specialists and agents will be collaborating to produce educational materials useful for county programs on water quality. Please contact me if you have input on what types of information would be most beneficial.

Site-Specific Best Management Practices:

Colorado farmers and land owners are eventually going to be asked to assess their specific operations to determine impact on groundwater quality. The following questions (excerpted from Acre Fact Sheet #20) are the basis of a such a self-assessment.

Chemicals stored / used on site

- If spilled on the soil, would the products leach?
- If spilled, would the products break down slowly in the soil?

Site characteristics

- Is the water table near the surface?
- Are there abandoned or unsafe wells on the property?
- If spilled, would the chemicals run off toward wells or other water supplies?

Soil Properties

- Is soil texture porous so large quantities of water move through it rapidly?
- Is soil organic matter and clay content insufficient to help bind chemicals and slow movement in the soil?

Management factors

- Are chemical storage, mixing, and loading areas properly located away from wells and other water sources?
- Are you properly rinsing and disposing of containers and rinse water?
- Have you planned for emergencies and rehearsed your response?
- Do you inspect your wells and test your well water periodically?

Farmers and land owners who have researched these questions for their operation are probably already using best management practices. An accurate assessment of these questions should help minimize contamination of groundwater by selecting the proper inputs and practices for their situation. (Waskom)

THE EFFECT OF PLANT RESIDUES ON RAINFALL RUNOFF

The practice of leaving residue on fields has long been promoted as the single most important and effective way to slow down rainfall runoff allowing it to percolate into the soil.

This fact was demonstrated recently at a field day at the Southwestern Colorado Research Center near Yellow Jacket. The demonstration was conducted by Dr. Steve Hinkle, USDA-ARS Engineer from the Central Great Plains Research Station, Akron, CO and Dr. Gary Peterson, CSU Agronomist.

Soils in southwestern Colorado are inherently low in organic matter, and because of low-residue crop production, soils have reduced water intake rates.

For demonstration purposes, a very intense rainfall of 3.75 inches per hour was applied with a rainfall simulator, and the runoff was measured over a 40 minute time period. The demonstration compared runoff from three different tillage treatments as follows: 1) Disked with little residue, 2) No-tilled wheat stubble, and 3) Disked with straw residue (90-95% cover). Flumes were set up on the downhill side of each tillage treatment to measure rainfall runoff from the various land treatments.

The results of this demonstration are given in Table 1 and Figure 1. The no-till treatment had water start to runoff within 15 minutes, the disked treatment was next at 18 minutes and the disked with straw was last at 25 minutes. After 40 minutes, the disked treatment had almost 3.5 inches per hour running off and the other two treatments had just 2.4 inches per hour running off the fields. Therefore, the no-tilled wheat stubble and the disked with 90-95 percent wheat straw residue reduced the runoff rate by more than an inch per hour over the disked only treatment.

In conclusion, there was a marked increase in water infiltration into the soil because of the plant residues left on or near the surface. (Follett)

(Adapted from an article written by Carrol E. Hamon in the June 1991 issue of *Conserving Colorado*)

Table 1. The rainfall runoff measured over a 40 minute time period from three different tillage treatments.

	Runoff: Inches per hour		
Time (mins)	No-tilled	Disked	Disked with straw
15	0, started		
18		0, started	
20	0.77	1.45	
25	2.12	3.01	0, started
30	2.41	3.47	0.38
40	2.41	3.47	2.41

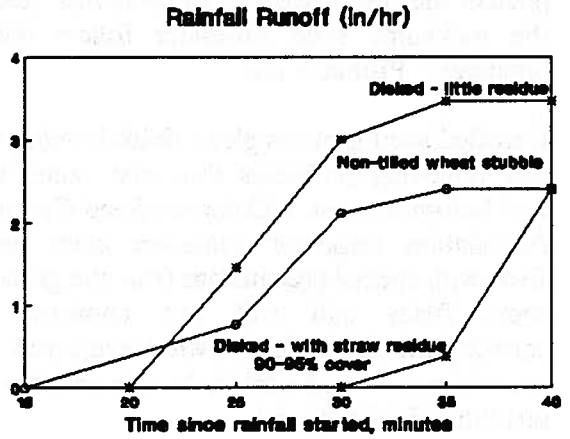

Figure 1. The effect of tillage treatment on the rainfall runoff.

THE NAME GAME

Take a look at the classified section of your local newspaper or regional farm paper in the next few weeks. Under the section listing "seed for sale", pick out ads listing certified seed for sale. This may sound simple until you look at the way some ads are written. Some ads contain phrases such as "certified quality", "grown from registered seed" or "certifiable". The seed represented in these ads may be of inferior quality.

All these terms are just nicknames for grain with which the seller hopes to make a few extra dollars. Comparisons to certified seed are flattering but way off base. It takes more than planting registered seed to end up with certified seed. Certified seed production involves a rigorous management program including seed purity testing by independent seed labs.

Planting registered seed does not insure a pure line seed in the next generation. Certified seed growers use an extensive system to protect against contamination. Rotations to discourage volunteer plants, cleaning tillage equipment between fields, and vacuuming out grain drills between varieties are some methods that certified seed producers use to protect the seed buyers from problems. Does the nickname seed producer follow these practices? Probably not.

Certified seed growers glean fields looking for and removing problems that may come up. Just before harvest, a Colorado Seed Growers Association inspector examines each field. Even with special precautions from the grower, some fields still will not conform to certification standards and will be rejected. Is the nickname seed subject to this amount of scrutiny? Probably not.

Harvest and conditioning time brings up new challenges. Combine cleanup for certified seed producers can normally take several people 2 to 4 hours per variety. Seed plant clean out will take a crew about the same time. Certified seed conditioners will normally even take the time to inspect and clean out your truck, often using pocket knives or screwdrivers to clean out any cracks or crevices. Is the equipment used to harvest and condition the nickname seed cleaned this well? Probably not.

Once certified seed is cleaned, it is tested for germination, purity and the presence of noxious weed seed. If problems are found, the seedlot is rejected and final certification is refused. Only seed that has passed all the tests can be called CERTIFIED and be sold with a blue tag or bulk sales certificate. Does the nickname seed that is advertised pass these tests and is it sold with such a tag to assure quality? Definitely not.

So who should the farmer trust when he is looking for his seed? Trusting the certified seed producer who puts extra time and money into producing seed is the smart way to go. Should he trust the fellow who gives the nickname "certifiable quality" to an inferior product? Definitely not. (Stanelle)

UREA IS A VERSATILE FERTILIZER (PART II)

In the past issue of **Agron-O-Gram**, it was mentioned that urea should not be left on the surface of high pH soils for more than a few hours. Otherwise, it will volatilize as ammonia gas resulting in nitrogen loss. Therefore, urea should be incorporated or irrigated into the soil as soon as possible after broadcast application. In this article, I will talk about application of urea through an irrigation system, and foliar feeling.

Fertigation, applying urea through irrigation systems, is an alternative to soil application. Urea is very soluble in water and can be metered into any irrigation system and applied

to the soil. Application of urea or any other nitrogen fertilizer in furrow or flood irrigation systems is discouraged unless system uniformity is high and tailwater is not allowed to enter surface or ground water. A new experimental fertilizer, urea phosphate (17-44-0) is specially made for drip irrigation for calcareous soils. The advantage of 17-44-0 is that both nitrogen and phosphorus can be applied through the irrigation system simultaneously and it is easier to handle than phosphoric acid.

Foliar feeding of urea is an efficient method of applying nitrogen to crops. However, in no case should the urea concentration in water exceed 2.5% or leaf burning will result. Urea sprays should be applied late in the afternoon when air temperatures are not high to cause rapid evaporation of water resulting in leaf burn. Table 2 shows that foliar feeding of urea was superior to soil application of nitrogen fertilizers. Ten pounds of nitrogen (22 pounds of urea) was dissolved in 100 gallons of water and sprayed on potatoes once a week for 10 weeks starting June 30th and ending August 11th. It should be noted that foliar feeding of urea should be combined with disease or insect control sprays if possible to reduce the cost of application, otherwise it may not be economical.

Mixing zinc sulfate or iron sulfate with urea will increase the rate of movement of zinc and iron into the leaves. Therefore, it is recommended that zinc or iron sprays include about 1-2% urea in solution (0.8-1.6 pounds of urea per 10 gallons of solution).

In summary, applying urea through sprinkler and drip irrigation systems will reduce volatilization losses significantly, compared to broadcast application without incorporation. Foliar feeding of urea is more efficient than soil application (whether direct or indirect through irrigation) because it will prevent nitrogen leaching but may not be economical unless combined with other sprays.
(Soltanpour)

Table 2. Effect of different nitrogen treatments on yield of potatoes (P. N. Soltanpour, CSU Experiment Station PR73-29)

Treatment (200 pounds of Nitrogen/ acre)		No 1 potatoes	
Source	Time & method		
		cwt/acre	%
AS	Band at planting	179	62
½ AS + ½ AS	Band at planting & Sideband 47 days after planting	160	61
½ AS + ½ Urea	Band at planting & 10 Sprays	201	75

AS = Ammonium sulfate

ALTERNATE CROP RESEARCH

New or old crops may be tested in the alternate crop program at Colorado State University and eventually provide additional income for the producer. Usually acreage for alternate crops is small but may grow, depending on the success of the crop. Sunflowers, canola, blue corn and dry beans (white, black, kidney) fit into this category. Additional new crops are now being tested. Taro and Chia are new food sources Dr. Duane Johnson and Dr. Joe Maga are looking at.

Taro, Xanthosoma caracu Koch. & Bouche, a new alternate crop is now being tested and may show promise in the future. Taro is a tropical plant that grows to 4 feet and produces corms much like an Iris. From this structure, starch is extracted to make "taro" or "poi" eaten by Hawaiians. The taro corm is cooked, ground-mashed and kneaded is

somewhat like a paste that can be made into various products. Dr. Joe Maga says that it makes a tasty chip. It is possible that through selection and breeding, taro may be adapted to southern Colorado. It is now found throughout the tropics and India.

Chia, Salvia hispanica L., an oilseed crop growing about 4 feet tall, is extremely high in mono and poly-unsaturated fats. Chia seeds contain a natural anti-oxidant which keeps the oil from becoming rancid. They are looking at this one for possible production in the San Luis Valley, the Arkansas Valley and northeastern Colorado. Chia originally comes from Mexico. We have seen chia seeds before in pet pottery. Pet pottery planted with chia seeds will grow, for example, making a little pottery dog turn into a growing mass when wetted with water. Chia has a high concentration of soluble fiber in the husk, allowing it to stick to the pottery. This soluble fiber is similar to that of beans, psyllium, and oats. (Croissant)

RAINFALL TREND ANALYSIS

If we look at annual precipitation data, Figure 2 (page 8), we see many lines creating confusion. How do I know if it is getting wetter or drier? Tom McKee, State Climatologist, CSU Atmospheric Science Department recently showed me a method for analyzing trends in long-term rainfall data. The results are shown in Figure 3 (page 8).

The method is to calculate the difference between the actual monthly total rainfall and the long-term monthly average total (MD = MONTHLY DEPARTURE = Monthly total - Monthly average), divide this MD by the long-term average annual total rainfall (AN), and then calculate a summation of this "fractional departure" (FD = MD/AN).

The statistic that is summed is the summation of the monthly FD's from the beginning of the period to the present. The following Table 3 shows a sample calculation beginning with the Akron Research Station data of January, 1908 . . .

Table 3. Rainfall Trend Analysis for Akron, CO 1908-1991.

YEAR	ACTUAL MONTHLY TOTAL	83-YEAR AVERAGE MONTHLY TOTAL	FD	SUM OF FD'S
1908 JAN	0.00	0.33	-0.02	-0.02
FEB	0.34	0.34	-0.00	-0.02
MAR	0.00	0.83	-0.05	-0.07
APR	1.70	1.69	+0.00	-0.07
MAY	3.30	3.05	+0.02	-0.05
JUN	2.37	2.49	-0.01	-0.06
JUL	2.42	2.69	-0.02	-0.08
AUG	1.47	2.05	-0.04	-0.12

YEAR	ACTUAL MONTHLY TOTAL	83-YEAR AVERAGE MONTHLY TOTAL	FD	SUM OF FD'S
SEP	0.05	1.24	-0.07	-0.19
OCT	3.20	0.85	+0.14	-0.05
NOV	2.00	0.54	+0.09	+0.04
DEC	0.00	0.42	-0.03	+0.01
	.	.	.	.
	.	.	.	.
1991 MAY	4.10	3.05	+0.06	+0.00

Table 3 (continued)

From the calculation, you can see that an above average rainfall gives a positive FD, and a below average month gives a negative FD. As the summation increases with a larger positive value, this shows a trend to wetter conditions. A decline in the summation indicates drier conditions.

A graph of the SUMMATION OF FD's is shown (Figure 3). An upslope line shows wetter conditions and a downslope line shows drier or more drought conditions.

The graph (Figure 3) of the Akron Research Station Data shows that from 1908 until the early 20's, we were in a "wetter" trend. Declines occurred in the late '20's and, of course the mid to late 30's, bottoming out about 1941. A significantly wetter trend occurred through the 40's reaching a peak just before 1950.

Note the steady drop or continual drying trend from 1950 until 1979, with only a blip or two around 1957, 1965, and 1973. This was a general, 30 year, trend toward lower rainfall conditions. Since 1979, it appears we are in a general upward trend, with about the same slope as the early 1908 to 1923 period (about 16 years).

Does this mean that the wetter trend beginning about 1979 will be similar in length to a previous wet trend? If so, we should be in a wetter trend until about 1995. Will we ever reach the peak that occurred in the 40's, or will we see another 30 year decline as happened from 1950 to 1980?

I thought this might be interesting to you as you develop your CROPPING SYSTEMS RESEARCH PROGRAMS.

The data in Figure 2 are the actual annual rainfall totals from 1908 through 1990, with a trend line calculated by David Nielsen. The two calculated rainfall trends are somewhat similar. (Shawcroft)

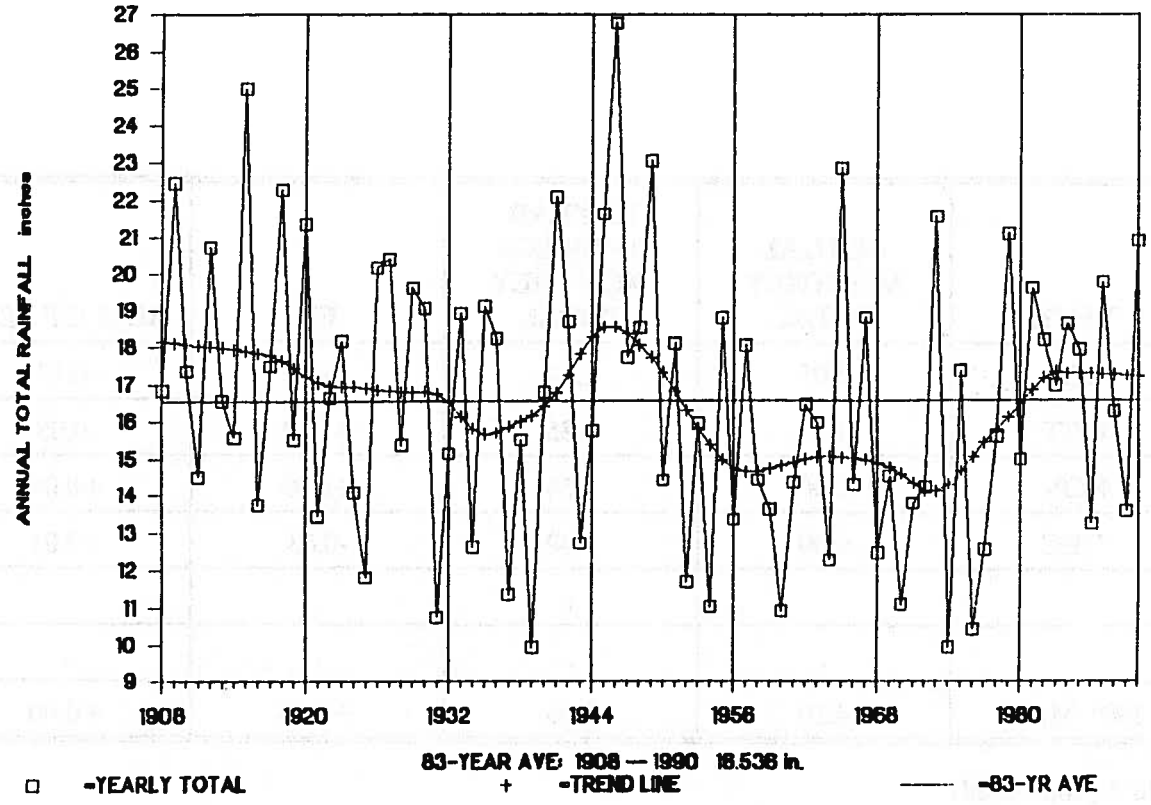

Figure 2. Annual total rainfall, USDA Research Station, Akron, CO

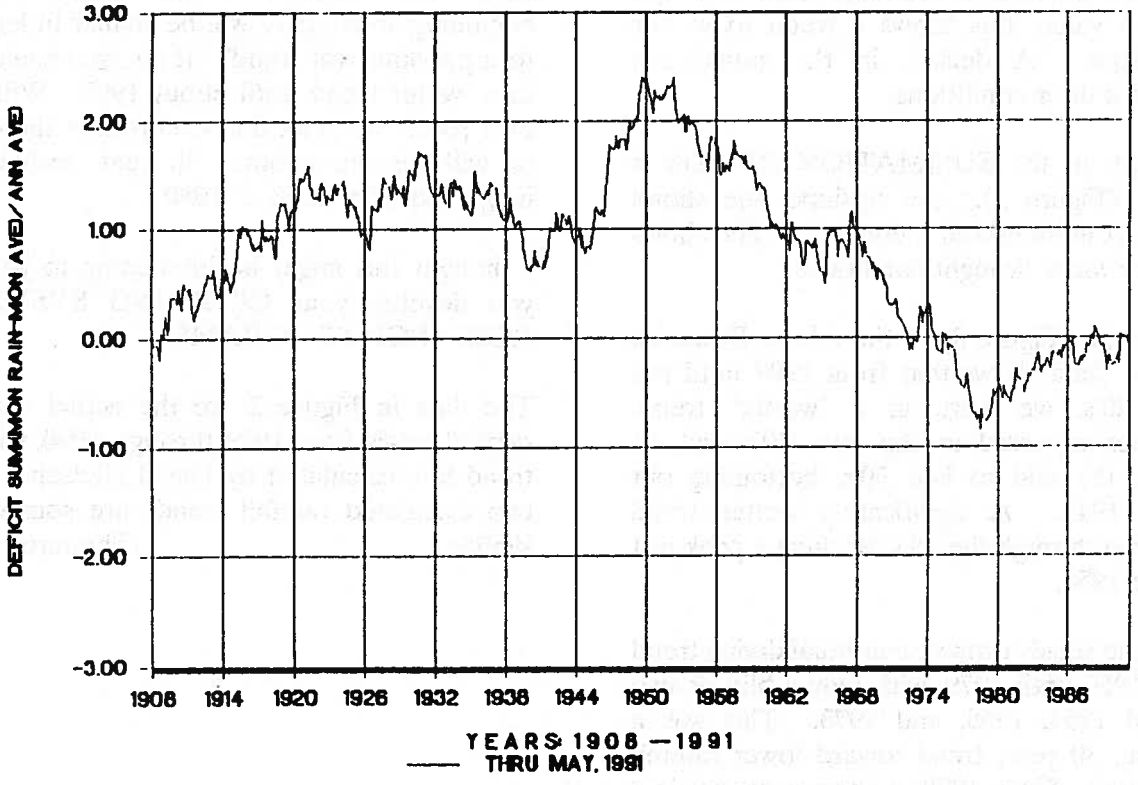

Figure 3. Rainfall trend analysis (ave def/ave), USDA-ARS Research Station, Akron CO

ERRATA

Agron-O-Gram, June, 1991

The first sentence in the third paragraph of the first column on page 6 should read:

The CEC can be estimated by the sum of the exchangeable bases (Ca, Mg, Na, K) in soils with a pH below 7.0 but should be measured by an alternative method in high pH soils (pH > 7.0).

Table 3, Column 3 (Inside Tap with Water Softener (mg/l)), Row 15 (Hardness) should read < 1 instead of 36. The entire table is reprinted on page 10 of this publication.

Where trade names are used, no discrimination is intended, and no endorsement by the Cooperative Extension Service is implied.

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Sincerely,

Robert L. Croissant
Editor
Extension Agronomist

Table 3. The effect of a water softener on the chemical analysis of water from the same house in Ft. Collins, 1991.

Parameter	Outside Tap w/o Water Softener (mg/l)	Inside Tap with Water Softener (mg/l)	Recommended* Limits (mg/l)
Calcium	10.2	0.1	-
Magnesium	1.8	<0.1	-
Sodium	19.4	47.5	20
Potassium	2.0	<0.5	-
Carbonate	<0.1	<0.1	-
Bicarbonate	43.0	44.2	-
Chloride	5.8	6.1	250
Sulfate	22.1	20.3	250
Nitrate as Nitrogen	0.2	0.8	10
Conductivity	109	109	-
Total Dissolved Solids	105	119	500
Total Alkalinity	35	36	400
pH	6.5	6.3	-
Hardness	33	< 1	300
SAR**	7.9	212	10

* Limits suggested by the U.S. Environmental Protection Agency.

**Refer to Follett, R.H. and P.N. Soltanpour. 1985. Irrigation water quality, Colorado State Univ. Service in Action No..506.