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http://www.ext.nodak.edu/extnews/snouts

Irrigation Resource Web site

The Web is a wonderful resource if you are looking for information on irrigation. For information on almost any topic dealing with irrigation, one of the first Web sites to visit is the irrigation resource page maintained by North Dakota State University (NDSU) Extension Agricultural Engineering at:

www.ag.ndsu.nodak.edu/abeng/irrigation.htm .

It provides access to *Water Spouts* issues back to April 1996, chemigation equipment and management page, irrigation research reports and projects, crop water use tables and maps, electronic copies of NDSU irrigation publications and links to irrigation information from other states.

Tom Scherer (701) 231-7239
NDSU Extension Agricultural Engineer
tscherer@ndsuext.nodak.edu

Specialty Crops Update

The potential for specialty crops is growing in North Dakota. During the last month, we have toured a vineyard, pumpkin field, carrot production, onion production, mint processing, jalapeno pepper plots and horticultural production for landscapers. All of these crops are being commercially grown in North Dakota. Every specialty crop has a story behind it and no two are alike in production or marketing. More producers continue to look for ways to add more dollars per acre on their production farms.

The interest in wineries has grown rapidly in North Dakota. Smaller growers and even people who are able to pick North Dakota fruit in the wild are excited about the potential to help build the wine industry. One winery owner has taken in more than 9,000 pounds of chokecherries this fall and 15,000 pounds of apples so far. Growers are looking to produce more grapes in the state and serve the new wine industry. North Dakota State University (NDSU) research will be working with grapes and more new specialties this next season. With these potential markets, it is important to talk to your market before jumping into large acreages, but the potential is there.

With small national acreages of crops like mint, you can overproduce quickly and ruin the marketplace. Many vegetable crops require special handling and storage, much like sugarbeets and potatoes currently growing in the state. Processing facilities are important in addition to storage so markets can be for fresh, processed and frozen or dehydrated. This gives the state the ability to produce and sell to many market segments. All of these precautions must be followed but there are opportunities for specialty crops, just like we talked about added-value processing in the last issue of Water Spouts.

The two newest processors in North Dakota are going to be working closely together on markets and processing. The Dakota Fresh vegetable salad fresh cut processor is continuing production but has found that mixes of products are very important in the marketplace. The whole peel onion operation in central North Dakota is growing and processing onions from other states but will start processing onions grown in North Dakota this fall after harvest. Management personnel will cover both plants. Studies are being considered for more small processing plants in the state.

The North Dakota Agriculture Department this summer worked to build more farmer's markets in North Dakota communities. Farmer's markets are a way to build new crop production from a small to commercial acreage as we learn marketing and production together.

If you have any questions on specialty crops for the 2004 season, please feel free to give me a call or send an e-mail.

Rudy Radke (701) 356-0222
NDSU Extension Ag. Diversification Specialist
rradke@ndsuext.nodak.edu

Fall Irrigation – Is it Worthwhile?

Note from the editor: The hot, dry weather we have experienced the past two months has brought on drought conditions in many parts of North Dakota. Even under irrigation, many crops use more water per day than can be replaced with the irrigation system. This is especially true for center pivots. Consequently, the crops "mine" water from lower in the root profile. It is important to replace this deep soil water prior to the next growing season. Usually, we can rely on fall and spring rains along with some snowmelt to do this, but it doesn't always happen. This brings on discussions of using the irrigation system in the fall to "store" water in the soil prior to freezing.

The following is an article about fall irrigation written by Dr. Jim Bauder, Extension Soil and Water Quality Specialist in the Department of Land Resources and Environmental Sciences at Montana State University.

You know it's a hot topic and one not many people know a lot about when I get six phone calls and three e-mails in one week about fall irrigating. I really wasn't planning to write an article on this topic, but it seems necessary to answer all the questions.

Let's say the questions are: "Should irrigators be fall irrigating?" and "Are there any documented benefits to fall irrigating?" Let me answer the second question first. There are many good reasons for irrigating in the fall after the heat of the summer season is over. However, irrigators need to make sure they know why they are fall irrigating, the consequences and what they hope to accomplish. This leads us to the first question. Whether or not to fall irrigate depends on the purpose.

Reasons for fall irrigating

1. **Encourage germination of volunteer grain**. By fall irrigating, a crop producer can establish a relatively uniform flush of weeds and volunteer grain while at the same time promoting vigorous, stress-free weed growth. This improves the efficacy of weed control by herbicides. If the objective of tillage is to control fall weeds and volunteer grain, then fall irrigation will enhance that operation.
2. **Facilitate fall tillage**, whether for overwinter soil conditioning or for organic matter decomposition. Tillage in the fall is performed for a variety of reasons that include workload distribution, to facilitate spring planting operations and for residue management — either to remove the residue or facilitate its decomposition. Regardless of the reason, added water to raise the soil moisture level prior to tillage improves the tillage operation while reducing the power requirements. Soil strength is inversely proportional to the soil water content. What that means is the drier the soil, the stronger the soil and vice versa — the wetter the soil, the weaker the soil. By irrigating just to the point of wetting the upper soil depth to field capacity, a producer can facilitate the tillage operation and reduce the time and energy required to complete the operation. Another important aspect is the decomposition of organic matter. Typically at the end of the cropping season the soil is very dry at the surface — possibly even approaching the wilting point. At this soil water content, organic matter decomposition is slow. Microbes need moisture, and added moisture — up to a point — facilitates the organic matter composition.
3. **Water for fall plant growth**. This applies primarily to pasture, grasses and alfalfa. A lot of pasture and hay ground is dominated by cool season grasses — plants which put on most of their growth during the cool months of spring and fall. This is when they store sugars and carbohydrates in the root system. Most folks can quickly recognize the change of seasons by the way the grass in their lawn grows. This also holds true for hay and pasture crops. Begin irrigating in September when the days are getting shorter and the nights cooler and you'll see good grass growth. This growth is a potential valuable source of winter feed after a good hard frost and a good shot for spring growth. Irrigators need to be aware that alfalfa — as tough a crop as it is — is pretty fragile when it comes to fall water. Generally, a vigorously growing alfalfa crop needs about six weeks of "conditioning," which is when growth is slowing, water use is dropping off and before the soil begins to freeze. Top growth might be killed by frost several times, but root growth continues into October and even November. This added moisture from fall irrigating facilitates root growth and repeated top growth. Nevertheless, irrigators should not fall irrigate alfalfa beyond late September. This will allow that six-week conditioning or hardening period.

   This doesn't apply to grasses. The grasses are much hardier and are able to continue growing right up to freezing. Moreover, because the grasses are predominantly supported by a broad diffuse root system, they are not subject to damage from frost heave like alfalfa.
4. **Leaching of salts is a reason not many irrigators think about.** Under a lot of irrigation conditions, the net movement of water during the irrigation season is upward, meaning soluble salts from the irrigation water and soil are drawn upward toward the soil surface. Off-season irrigation can be valuable at moving those salts down in the soil and below the root zone. Off-season irrigation water can also fill the soil pores, enhancing the dissolving and diffusion of those salts from the fine pores, so that when moisture comes from rainfall or snowmelt, the salts are leached further down into the soil — below the root zone. (In fact, in most cases in Montana, irrigators unknowingly rely on this over-winter leaching of salts to satisfy the necessary leaching requirement.)
5. **Soil moisture storage**. Clearly this seems to be one that is being argued a great deal these days. Some folks say it doesn't do any good — it all evaporates before spring. Well, that's not true! Some studies have shown (on a very limited, random sampling) that soil moisture in the fall is evaporated from the soil by the time planting season rolls around. The logical argument then poses the questions: Why fallow? An extensive amount of research by scientists in both North Dakota and Montana has shown that essentially all the moisture stored in the soil, excluding that from irrigation, comes in the months of September to December and March to June, with about 40 percent of the recharge moisture coming in the four fall months.

So, now the question becomes, can you outguess nature? If you fall irrigate, what are the chances of getting more moisture during the months of September-December and March-June than you can hold in the soil? In other words, are you wasting water by fall irrigating? Your guess is as good as mine, but you can play the odds. On a sandy soil, the available water storage capacity is about 1.5 inches per foot. Therefore, if you have four feet of dry soil, let's say at wilting point, about six inches of water can be stored. Anything greater will be lost from the root zone but will contribute to ground water and stream base flow during the dry months. In this scenario, if you fall irrigated and add three inches of water to a sandy soil, you'd still be able to store another three inches of rainfall and snowmelt.

Compare that to a silt loam soil where you can store 2.2 inches of available water per foot of soil. That means you can store between 8 and 10 inches of water in the soil, if it's at wilting point. What's the likelihood of getting eight inches of effective rainfall in September-December? Effective rainfall is any event that results in greater than 1/10th inch of moisture infiltrating into the soil. We don't count the fact that 50 percent or more of our snow cover sublimates (goes directly from snow on the surface to a vapor, without infiltrating into the soil). That's a good argument for adding some of that moisture in the fall.

6. **Effects of additional rain**. The amount of research that has been conducted on the benefits of "added rainfall effects" is mind-boggling. Back in the days when we were seriously looking at making it rain, and more recently as we have looked at the effects of global warming on climatic patterns, one issue that has been exhaustively studied is that of added rainfall. Does it really make a difference if we get one additional inch of moisture during the non-growing season whether from rainfall or irrigation? You bet it does. Researchers in Montana have shown that a single inch of additional moisture can have a significant effect on grass and forage production. Researchers from Montana State University have shown that an additional inch of moisture is worth anywhere from four to eight bushels of wheat per acre, from 400 to 500 pounds of alfalfa per acre and significantly more than four to eight bushels of oats per acre.

There are some legitimate reasons for taking a serious look at fall irrigation. The more important question is, "Why?" What do you hope to accomplish by fall irrigating? Clearly, we are not saving moisture, since eventually it all falls into the hydrologic cycle and cycles through the oceans and back to the atmosphere. But, by fall irrigating, we might be able to create a little "added value" to a resource that most of us take for granted, which tourists pay good money to get in a bottle but pay better money to fish in, which often begins its journey from the atmosphere in the hydrologic cycle someplace here in Montana, and which always seems to be in short supply here at the top of the watershed.

Dr. James W. Bauder (406) 994-5685
Soil and Water Quality Specialist,
Montana State University
jbauder@montana.edu

Irrigation Projects – Boon or Boondoggle?

Man has used irrigation for at least 4,000 years as a way to enhance agricultural productivity. Areas in Egypt and China have been irrigated for thousands of years and continue to be highly productive. However, there are vast areas in parts of the world, such as Mesopotamia and North Africa, that are no longer productive due to the negative effects of irrigation on the soils. Irrigation can cause water logging, salinization, crusting, reduced permeability and severe erosion.

When John Wesley Powell made his famous foray into the West in the late 1800s to investigate the potential of the geologic resources, he concluded that much of the land had enormous potential for development. The key factor in meeting that potential was water. We now know that his solution to tapping that potential, by way of irrigation, is not that simple. Finding, developing and allocating irrigation water is a challenge in itself. However, the quality of the water must also be compatible with the soils to be irrigated.

Engineers and geologists often overestimate the potential for irrigation projects, because they lack the professional training and expertise to estimate soil and water compatibility. The original estimates of millions of acres of irrigable land in North Dakota have been reduced to a more realistic number of a few hundred thousand acres as soil scientists surveyed the state. Soil scientists, particularly soil classifiers, are trained to determine the extent of important soil properties and the soil reaction to various types of management, such as irrigation. Soil scientists have shown that when soils are not compatible with irrigation water, inefficient utilization of the water, salinization and sodification are the result.

The first soil survey in North Dakota was conducted in Grand Forks County in 1902. At the same time, Congress passed the "Act for the Reclamation of Arid Lands" which provided for irrigation development in 17 western states. The timing between these two events is not coincidental. Soils information was needed to help determine where irrigation development could occur, so the soil survey and irrigation have been bound together in North Dakota from their respective beginnings.

Irrigation development in North Dakota was slow until the Missouri River diversion plan was funded in 1944. At that time, the Crosby-Mohall area in northwestern North Dakota was tentatively selected for development. However, soil surveys begun in 1947 showed the glacial till soils in the area to be unsuitable for sustained irrigation and the area was dropped from further consideration. In 1967, the Garrison Diversion Irrigation Council was formed to provide technical assistance to the farmers in the irrigation district. An irrigation handbook was developed that provided information on soil and water compatibility. This handbook has been updated through the years and was published in 1979.

Soil scientists recognize that successful irrigation projects begin with knowledge of local soils and their reaction to the application of irrigation water. Soil scientists in North Dakota have rated all soil series for their irrigation potential. Each soil series is placed in one of 25 irrigation subgroups according to

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Extension Service
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their water intake capacity and other factors such as slope, wetness, salinity, sodicity and erosion hazard. These groups are organized into three irrigation classes as irrigable, conditional or non-irrigable. The potential for irrigation in a given area may be determined initially by calculating the acreage of soils within the three irrigation classes. However, the design of management strategies to best protect and maintain soil quality will depend on the extent of soils within each irrigation subgroup.

Interpretation of the potential for irrigation of soils that fall in the conditional irrigation class is particularly challenging, because these soils fall between irrigable and non-irrigable soils. These are soils that have a number of restrictions to irrigation that can result in very serious salinization and sodification problems. Irrigation is possible on conditional soils, but the restrictions must be overcome (for example, a subsurface drainage system may be needed) and careful management is required. Conditional soils under irrigation should be regularly monitored for salt, sodium and pH.

When pursuing the feasibility of irrigation in a given area, determination of soil extent and variability is critical. Establishing the extent of soil properties is often a combination of referring to published soil surveys and actual field investigations. Whether utilizing existing information or site-specific soil samples, data interpretation by a professional that can recognize soil variability on the landscape is essential. That professional must have working knowledge of the intricate hydrologic connection between different soils in the field setting. Soil surveys have their limitations with respect to purity of soil mapping units. A soil professional understands these limitations and how natural soil variability influences interpretations for soil management.

Exact characterization of soils in any area is impossible; however, professional judgment can minimize the error to acceptable levels. North Dakota has been at the forefront of utilizing soils professionals to ensure that irrigation-soil compatibility estimates are accurate. We were the first state to require licensing of soil classifiers to ensure that land management decisions are based on quality soils information. Use of soil professionals will ensure that irrigation projects are an economic boon to North Dakota rather than a boondoggle.

Dr. Bruce Seelig (701) 231-8690
NDSU Extension Water Quality Specialist
and Professional Soil Classifier
bseelig@ndsuext.nodak.edu