Planning To Irrigate . . . A Checklist

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When considering an investment in irrigation, one of the first questions to be asked is, "Why do I want to irrigate?" **The primary reason must be to increase net farm income over dryland production.** Irrigating as insurance against insufficient rainfall, just because the water is available, or because you have fields with irrigable soils are poor reasons. The higher yields possible with irrigation require greater management skills and inputs in the form of fertilizer and pest control.

The transition from dryland to irrigated agriculture is not easy. On North Dakota farms, the irrigated acreage is usually small compared to the dryland acreage, so irrigation must be integrated into the total farm enterprise. Irrigation requires better fertility management, improved weed and insect control, timely identification of disease problems and above all record keeping. Management will be the key factor in the success of your irrigated crops. The need for information and assistance from both public and private sources becomes more critical under irrigation.

Advance Planning

To make the transition from dryland to irrigated production a success, the equipment should be installed and operational before the growing season. Take time to decide on the system you want and allow time -- several months -- for delivery and set up. Give serious consideration to fall delivery of equipment so it can be assembled during the slack period and be operational prior to the cropping season. Attempts to rush the process may prove costly in both capital outlay and development that may not fit your needs over the 15- to 20-year life of the system.

There are several publications available from NDSU that provide information relative to irrigation:

- **Irrigation Handbook**, Extension Agricultural Engineering Dept, NDSU ($15.00)
- **Irrigation Power Unit Selection**, NDSU Extension Circular AE-88.
- **Selecting a Sprinkler Irrigation System**, NDSU Extension Circular AE-91.
- **Irrigation Water Pumps**, NDSU Extension Circular AE-1057.
- **Irrigation Pipe Selection**, NDSU Extension Circular AE-95.
- **Regional North Dakota Irrigated Crop Production Budgets**, County Extension Offices and Extension Agricultural Economics
- **Irrigation Scheduling by the Checkbook Method**, NDSU Extension Circular AE-792.

Doing some homework should help you decide if irrigation is for you. When you have decided that irrigation will fit into your farming enterprise, following the step by step procedure outlined below will help avoid serious and costly mistakes.

Steps to Follow:

Irrigation Equipment Costs Example

1. Are Your Soils Irrigable?

You must check the county soil survey to determine the irrigation suitability of the soils in the fields you want to irrigate. If your county soil survey hasn't been printed, the local Soil Conservation Service (SCS) office can obtain the information for you. Not all soils can be irrigated due to various physical problems, such as low infiltration rates and poor internal drainage which may cause salt buildup. Soils are classified as either irrigable, conditional or non-irrigable and are defined in the following way:

> **Irrigable soils** have no restrictions for sustained irrigation using proper application rates, amounts and water quality.
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> **Conditional soils** have restrictions for sustained successful irrigation due to such factors as water table elevation, layers of low permeability, potential for salinization, steep slopes and other problems. Some restrictions can be corrected with drainage. Conditional soils should have a detailed field level soil survey conducted before irrigation is developed.
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> **Non-irrigable soils** have severe restrictions to irrigation and should only be developed where they are minor inclusions into irrigable soils.

Sources of Information:
Extension Service, SCS, County Soil Survey, North Dakota Irrigation Guide, On-Site Investigations.

2. Can You Obtain the Quantity and Quality of Water You Need?

The water supply is the heart of any irrigation development. If you are going to use a surface water source, check with the SCS or State Water Commission to determine if there will be sufficient water available during the summer months. If you are going to use ground water, check the county ground water survey published by the State Water Commission. It will provide approximate information as to location, size and production capacity of the aquifers within your county.

Small aquifers may exist that are not shown in the county ground water survey. Test drilling and pumping is the only sure way to determine if sufficient water is available. The minimum amount needed is 6 gallons per minute per irrigated acre. A state certified irrigation well driller should drill the test holes. If there is sufficient water, one or two of the test holes should be developed as observation wells to monitor the effect of irrigation pumping on the ground water level and assist in diagnosis of well problems should they occur.

Both ground water and surface water should be tested for quality. Water samples sent to the NDSU Soil Testing Laboratory along with the soil survey information will be analyzed for quality and correlated with the soil conditions on your farm. This is very important because the soil type will determine the quality of water which can be used.

A water permit is required for all water appropriations except domestic use and non-commercial lawn and garden irrigation of one acre or less. When a water permit is first issued it is called a conditional permit. When the water source is developed and the irrigation system has been installed and inspected by the State Water Commission, the conditional permit is changed to a perfected permit.

A water permit should be obtained before a production well is drilled and irrigation systems are constructed. A water permit application and instructions can be obtained from the State Water Commission. When submitted to the State Water Commission, the application must be accompanied by the appropriate fee and a map showing the location of the water diversion, acreage to be irrigated and a signed certificate of surveyor. You can fill out the permit application with the help of a local surveyor, the SCS, or a consulting engineer.

Sources of Information:
Extension Service, NDSU Soil Testing Lab, SCS, State Water Commission, County Ground Water Survey, Test Drilling, Licensed Well Drillers.

3. What Kind of Power and Equipment Will You Need?

Power Source

If available, electricity is generally the preferred source of power. However, it may be economically advantageous to use an internal combustion engine if your land is not near an existing power line. Construction costs and repayment for extension of power lines vary with each electrical provider. An estimation of annual power use, costs and construction repayment is necessary to determine the most economical power source.

If electricity will be used, three-phase power is preferred, but phase converters allow single-phase power use. Early contact with the power supplier is necessary to allow time to plan and construct facilities.

Equipment

Select an irrigation system (pump, motor, pipeline, water application equipment) which fits your needs relative to water supply, irrigated acreage, crops to be grown, crop rotations, labor requirements and the power supply. Irrigation system pressure requirements and sprinkler selection should be based on soil and topography. Remember, this equipment will have a useful life of 15 to 20 years or more and selecting the wrong system may limit future cropping patterns.

Visit irrigators with similar systems and listen to their experiences and opinions to determine the advantages and disadvantages of their systems. Select a dealer who is well established, is capable of designing a good system and has a good service record. Buy as much as possible of the entire system from one dealer. This may help eliminate problems of responsibility and installation.

The pump and motor should be adequately sized to fit the system and the well or water supply. The pipe size and wall thickness should be selected to match flow rate and pressure requirements. Pump and motor information should be furnished by the dealer and filed for future reference. Typical equipment costs are shown on the last page.

Sources of Information:
Extension Service, SCS, Electric Power Suppliers, Other Irrigators, Licensed Well Drillers, Irrigation Dealers, Contractors.

4. Does Irrigation Pay in Your Farm Enterprise?

Detailed crop budgets covering economic and cash costs must be prepared for the proposed irrigated cropping system. If the budgets show an adequate return to labor, capital and management, then a total enterprise analysis should be made to determine how irrigation will fit into the farming operation. For example, irrigation of grass or hay may not bring a big return by itself, but coupled with a livestock operation may increase net returns and lend stability to the farm enterprise. Irrigation alone does not assure financial success. It requires planning and good management on the part of the farm operator. Without these two key ingredients, failure is almost assured.

Sources of Information:
Extension Service.

5. Can You Obtain Financing?

The problem of adequate financing can be minimized by proper planning prior to contacting a financial institution. Success in irrigation depends largely on your management ability. An indication of that ability can be expressed to your credit supplier in the form of farm records, profit and loss statements, net worth statements, and cash flow statements. In addition to these records, you should be prepared to supply your credit agency with an estimation of the potential payback capacity of the irrigation investment. This is where the crop budgets and total enterprise analysis in step 4 would be very helpful.

Sources of Information:
Irrigation Equipment Manufacturers and Dealers, Banks, Farm Financial Organizations

6. How Are You Going to Select and Manage Your Irrigated Crops?

Crops selected to be irrigated must exhibit an economic yield increase to irrigation. This means the average yearly yield increase over dryland production must be great enough to pay for the investment in irrigation and increased production costs as well as some additional profit. Historically, irrigating corn (for silage or grain), alfalfa, sugarbeets, potatoes, and dry edible beans has been profitable for good irrigation managers.

Irrigation provides an environment conducive to increased plant production for long season crops. However, it also provides a favorable environment for disease, insects and weeds. The irrigator must know how to manage the irrigation system and crop rotations to minimize potential problems. By scouting the field on a regular basis and using Integrated Pest Management methods and Best Management Practices the irrigator should be able to manage the irrigation system profitably. The irrigator must be aware of agronomic practices that favor irrigation and are crop specific, such as proper row widths, appropriate plant populations, higher fertilizer requirements, split applications of fertilizer to minimize leaching potential and hybrid selection.

Irrigated crop water management is extremely important to prevent yield loss due to moisture stress, minimize pumping costs and prevent leaching of nutrients. A method of irrigation scheduling must be used. Soil moisture monitoring by the feel method is commonly used, but there are more accurate methods such as the checkbook method. Whichever method is used, it will require increased management skills and additional time. Irrigation scheduling is a daily process.

Sources of Information:
Extension Service, SCS, NDSU Experiment Station.

Irrigation Equipment Costs

The following example development costs are for a center pivot irrigation system covering 130 acres. One well is assumed to provide an adequate water supply of 800 gallons per minute for the system.

1. **Irrigation System:** $33,000 to $40,000 for a new, full quarter section, center pivot system. Included is a chemigation check valve, flowmeter, gate valve, pressure gage, air and pressure relief valves and a chemigation pump with a storage tank.
2. **Pipeline:** A pipeline from the well to the pivot should be either 8 or 10 inches in diameter to reduce friction loss and provide sufficient carrying capacity. Air and pressure relief valves as well as a pump out must be part of the piping system. Pipe cost can vary significantly, so check with local supplier.
3. **Power and Control:** An electric safety circuit must be connected between the well and the pivot control panel. This provides protection in case of pivot or pump failure.
   a) Electric drive pivot -- electrical lines must be run from the local electric supplier to the control panel and then to the pivot. Three phase power is preferable if economically available. An engine and generator can also supply power.
   b) Hydraulic drive pivot _ either electric or engine driven hydraulic pump is required.
4. **Well Costs:** $12,000 to $18,000. Includes test holes, production well site selection, drilling, testing and developing, screen and casing. Typical costs range from $125 to $175 per foot completed.
5. **Pump and Motor:** Costs depend on the depth to water, feet of lift, system pressure requirements, length of pipeline, and flow rate. Electric powered pump may be about $14,000, a comparable diesel powered pump may cost about $17,000 which includes the right angle gear head, fuel tank, and other accoutrements.

Total capital costs are calculated using an annual straight line depreciation and a zero salvage. The following example calculates the yearly total capital cost of a typical irrigation system on a per acre basis:

	New Cost	Est. Life	Depreciation (per acre/yr.)
Irrigation System	$35,000	15 yrs	$17.95
Pipeline & Wire	$10,000	20 yrs	$3.85
Deep Well	$16,000	20 yrs	$6.15
Pump and Motor	$14,000	15 yrs	$7.18
TOTAL	$75,000		$35.13

Annual per Acre Interest on Average Investment is 10%.

$75,000
---------- x 0.10 = $28.85
(2) x (130)

TOTAL CAPITAL COST =
Depreciation plus Interest = $35.13 + $28.85 = $63.98/acre/year

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