NORTH DAKOTA IRRIGATION GUIDE

Chapter 1

General

This guide has been prepared for use in all of North Dakota. The material and tables assembled in the guide were developed to assist those who are engaged in the planning, design, management and evaluation of sprinkler irrigation systems. This document is available and maintained on the North Dakota Natural Resources Conservation Service (NRCS) web site, under Electronic Field Office Technical Guide (eFOGT)/Section II. http://www.nrcs.usda.gov/technical/efotg/

The guide does not attempt to make recommendations relating to economic evaluations of irrigation as to crops or types of system. Economics of irrigation must be determined on an individual field or farm basis.

Successful irrigation depends upon erosion being adequately treated, soil and water compatibility and monitoring. Scheduled monitoring of irrigation water and soils is an essential part of an irrigation management plan.

Consumptive Use and Crops

In order to account for the diversity in climate, the state was divided into four climatic areas. The areas were determined by taking into account similarities in rainfall amounts, temperate patterns, length of growing season, and potential evapotranspiration. Average data for each climatic area was used in determining the consumptive use values for each crop. The modified Penman equation and general crop growth curves were used in the calculations.

Only the commonly irrigated crops were included in the guide. Recommendations for specialty crops or other crops involving limited acreage will require assistance from the NRCS staff or the Agricultural Extension Service.

Glossary

Consumptive use - Often called evapotranspiration, is the amount of water used by the vegetation in transpiration and building of plant tissue and that evaporated from adjacent soil or intercepted by plant foliage. It is expressed by volume as acre inches per acre or by depth in inches. It can denote the use as daily, peak, design, monthly, or seasonal.

Peak period consumptive use - Peak period consumptive use is the average daily rate of use of a crop occurring during a period between normal irrigations when such rate of use is at a maximum.

Design period consumptive use - Design period consumptive use is the peak period consumptive use with consideration for probable precipitation during the period.

Consumptive water requirement - The amount of water potentially required to meet the evapotranspiration needs of vegetative areas so that plant production is not limited from lack of water.

Effective rainfall - Precipitation falling during the growing period of the crop that is available to meet the consumptive water requirements of crops. It does not include such precipitation as is lost to deep percolation below the root zone nor to surface runoff.

Net irrigation requirement (net water application) - The depth of irrigation water, exclusive of precipitation, stored soil moisture, or ground water, that is required consumptively for crop production and required for other related uses. Such related uses may include water required for leaching, frost protection, etc.

Irrigation efficiency - The percentage of applied irrigation water that is stored in the soil and available for consumptive use by the crop. When the water is measured at the farm headgate, it is called farm-irrigation efficiency; when measured at the field, it is designated as field-irrigation efficiency; and when measured at the point of diversion, it may be called project-efficiency.

Gross irrigation requirement (gross water application) - The net irrigation water requirement divided by the irrigation efficiency.

Field capacity - The moisture percentage, on a dry weight basis, of a soil after rapid drainage has taken place following an application of water, provided there is no water table within capillary reach of the root zone. This moisture percentage usually is reached within 2 to 4 days after an irrigation, the time interval depending on the physical characteristics of the soil and the effect of the growing crop.

Wilting point - The wilting point is the moisture percentage, also on a dry weight basis, at which plants can no longer obtain sufficient moisture to satisfy moisture requirements and will wilt permanently unless moisture is added to the soil profile.

Carryover soil moisture - Moisture stored in soils within root zone depths during the winter, at times when the crop is dormant, or before the crop is planted. This moisture is available to help meet the consumptive water needs of the crop.

Irrigation frequency - Refers to the allowable numbers of days between irrigations. It depends on the consumptive-use rate of a crop and on the amount of available moisture in the root zone (moisture extraction depth) between field capacity and the starting moisture level for irrigation. Irrigation period refers to the number of days a system, of given capacity, takes to irrigate the design area. Irrigation period should always be equal to, or less than, irrigation frequency.

Available water holding capacity (AWC) - Available water holding capacity is the amount of water the soil will hold between field capacity and the permanent wilting point.

Maximum application rate - Is the maximum rate that water, can be applied to a soil during the time required for the soil to absorb the depth of application without runoff for the conditions of soil, slope and cover.

Irrigation depth - Is the soil depth used to determine irrigation water requirements for design of systems. A high moisture level must be maintained in this depth for top production of crops. It is not necessarily the maximum root depth for any given plant.