

Potential Use of Supplemental Irrigation for Establishment of Vegetation on Surface-Mined Lands

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Irrigation is a potential reclamation tool that may have application in establishing vegetation on surface disturbed lands, especially perennial rangeland vegetation. Research concerning the use of supplemental irrigation has been initiated, and continued study will better define the benefits and techniques of supplemental irrigation for the establishment of plants and plant communities on surface-mined lands in North Dakota.

Expanded strip mining for coal in North Dakota and the obligatory commitment to restore these lands to high levels of productivity have stimulated interest in techniques of establishing and growing vegetation on land disturbed by surface mining. Almost all post-mining land uses—recreation, livestock and wildlife grazing, crop production, and soil protection—depend upon vegetation. Irrigation is a potential reclamation tool that may have application in establishing vegetation, especially perennial rangeland vegetation. Perennial grasses and forbs are important to North Dakota, because about 50 to 60 per cent of the lands being mined are currently used for range or pasture.

The western coal fields of North Dakota receive an average of 16 in. (40 cm) of precipitation annually. June has the highest average amount of precipitation, and this coincides with the period of most rapid plant growth. Vegetation can be established when precipitation is normal or above and proper cultural practices are used. However, in years of limited or irregular precipitation, new seedlings are often subjected to severe water stress which results in failure.

Figure 1 presents the 60-year maximum, minimum and average precipitation by month at the Northern Great Plains Research Center, Mandan, North Dakota. The spread between the maximum and minimum precipitation in any one month gives some idea of the variation that can be expected. Even with favorable average precipitation

amounts and patterns in North Dakota, we can expect occasional failure to establish certain or all plant species due to lack of water.

The extensive body of knowledge concerning irrigated agriculture can, to a large extent, be used to develop irrigation techniques to establish vegetation on disturbed lands. However, certain differences between irrigated agriculture and irrigation for establishment should be recognized. First, the purpose of irrigation in the production of agricultural crops is to provide enough water to stimulate yield and quality of desired crops year after year. On the other hand, the purpose of irrigation for establishment is to supply enough supplemental water along with natural precipitation to insure establishment initially and survival after irrigation is ended.

A second difference is that irrigation for establishment may allow a greater amount of water stress on the plants being established than is tolerable with irrigation for production and quality, which strives to eliminate water stress. As a result, irrigation for establishment requires appreciably less water than irrigation for crop production. Because less water is added, water of lower quality may be used.

Finally, the effect of irrigation on root growth and distribution may be of major concern when irrigating for establishment. These differences in purpose and principle must be considered when modifying existing agricultural irrigation concepts and techniques to better fit supplemental irrigation for the establishment of vegetation on disturbed land.

Important considerations of production irrigation also apply to supplemental irrigation for

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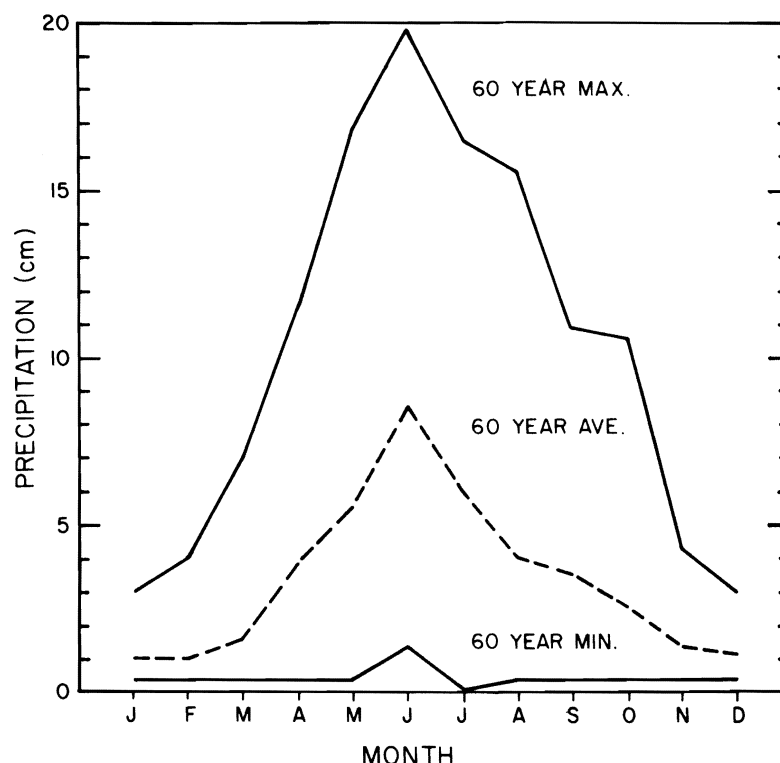


Figure 1. Sixty-year maximum, minimum, and average monthly precipitation at Mandan, North Dakota.

establishment. These factors include application rates, irrigating schedules, nutrient requirements, infiltration, drainage, soil erosion, salt problems, water quality, chemical and physical characteristics of the soil or spoil and economics. Existing literature on irrigated agriculture does not fully cover these points when only irrigation for establishment is considered. Consequently, irrigation research is needed to develop irrigation practices required for the establishment of perennial plant communities.

In the spring of 1975, a study was begun at the Northern Great Plains Research Center entitled "Establishment of range grasses on disturbed land using irrigation". The study objectives are (1) to determine amounts and frequencies of irrigation most beneficial in establishing range species and in turn stable communities on disturbed land, (2) to monitor establishment, successional trends, and stability of these range species and communities after establishment and termination of irrigation, and (3) to determine if seeding date has an effect on specie establishment, successional trend and stability of these range species and communities. Natural precipitation was supplemented with irrigation applied at various times and in various quantities during the 1975 growing season only, with no additional irrigation thereafter.

Results from this study to date show that the application of limited quantities of water at certain critical times during the year of establishment can greatly influence the species composition of the plant community. Successional sequences are also influenced by time of seeding and amount of water received.

The study has not been in progress long enough to evaluate the response of various species to the termination of irrigation. Continued monitoring and analysis of data from this project should give a better understanding of the role of supplemental irrigation in the Northern Great Plains in terms of species survival and successional changes after termination of irrigation, whether irrigation amount or frequency is critical, and the importance of planting dates.

The need for supplemental irrigation to establish vegetation on disturbed land has been realized and accepted as a necessity in areas of minimal precipitation. Needs for supplemental irrigation for the establishment of vegetation in North Dakota are less clear because of the higher amounts and generally better timing of natural precipitation. Continued study will better define the benefits from supplemental irrigation for the establishment of plants and plant communities on surface-mined land in North Dakota.