Section 684.13

(a) Furrow Design Limitations

Furrow design tables and charts allow a wide selection in length of run, grade, and furrow streams. However, for efficient uniform water application, specific guidelines or limitations should be observed in selecting the design to be recommended. Limitations include permissible deep percolation losses, allowable amount of runoff of irrigation water, and minimum application efficiencies.

(b) Deep Percolation

When water percolates below the root zone of the crop, the water not only is lost for consumptive use of the plants, but frequently contributes to a buildup of the groundwater level and may damage or destroy lower lying land where it returns to the surface and waterlogs the soils. In addition to the loss of water, deep percolation results in the loss of plant food. An acre inch of water that percolates below the root zone frequently carries with it as much as 5 to 12 pounds of nitrogen. It may also unnecessarily leach soluble minerals from the root zone. Normally deep percolation should not be more than approximately 20 to 25 percent of the design application depth.

(c) Runoff

Irrigation runoff water frequently contains colloidal material, minerals, and pesticides which are detrimental to adjoining landowners or to surface water. Runoff water can also be detrimental if ponded on neighboring farms or public or private property. It is extremely difficult to have efficient furrow or corrugation irrigation without tailwater. Provisions should be made for recovery or safe disposal of all the runoff resulting from irrigation regardless of operating procedures used.

(d) Design Efficiency

The design efficiency is defined as the ratio of the designed depth of irrigation to the gross depth of irrigation water applied.

(1) Principles of Control

The depth of irrigation water absorbed at a station along the furrow or corrugation length is in proportion to the opportunity time or time that water is on the station. To obtain uniform intake throughout the length of the furrow, it is necessary to have as nearly uniform opportunity time as is practical for each segment of furrow length. In order to meet this objective, there are three principles of water control that are applicable to one or more of the methods of water application. These are reducing the inflow rate after water has advanced to the end (cut-back method), recirculating or recovery of the irrigation runoff, or impounding the water in the furrow and eliminating irrigation runoff.

<u>Cut-Back Inflow</u>

Reserved. Water applied at a faster rate at the beginning of the irrigation period and then reduced or cutback to a lesser rate, usually one-half the initial rate or that amount to balance with the intake rate.

(e) Continuous Inflow and Recovery

Most irrigators desire a water application procedure by which they can obtain uniform efficient irrigation using a continuous inflow rate stream and avoid the added labor involved in the cut-back procedure. It is common for irrigators to sacrifice both efficiency and uniformity of application merely for operating convenience or to minimize labor requirements. They do this by applying too small a furrow stream for a time longer than needed to obtain the desired application. For the irrigator's convenience, this application time is usually in multiples of 12 hour periods. With the critical need to make the maximum use of available water supplies and the growing energy shortage, this method of operation is becoming unacceptable in shortage areas.

Recovery systems are designed to collect irrigation runoff to be reused in the system. This enables the irrigator to adjust furrow stream sizes and set times for higher irrigation efficiency.

See Section 685.4 for further discussion of reuse systems.