

APPENDICIES

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Acre-Foot (AF): The volume of water required to cover one acre to a depth of one foot (43,560 cubic feet). An acre-foot equals 325,851 U.S. gallons.

Advance Ratio (AR): For furrow irrigation, the ratio of the total time irrigation water is applied to the furrow (set time) to the time needed for irrigation water to reach the lower end of a sloping furrow (advance time).

$$AR = \frac{\textit{SetTime}}{\textit{AdvanceTime}}$$

Annual Distribution Uniformity (ADU): See "Distribution Uniformity."

Annual Irrigation Efficiency (AIE): [See "Irrigation Efficiencies."](#)

Applied Water (AW): Water applied to a field by irrigation, excluding the tailwater which runs off the field and is collected for reuse in the irrigation of another field on that farm, expressed as a depth of water in inches or feet.

Available Soil Moisture: The difference in soil moisture content between Field Capacity and Permanent Wilting Point. This represents the moisture which can be stored in the root zone for use by crops, expressed as a depth of water in inches or feet (Israelson & Hanson, 1979).

Beneficially Used Water (BU): Irrigation water used to satisfy a portion or all of the following: evapotranspiration, leaching

requirement, special cultural practices, and/or water stored in the soil for use by crops, expressed as a depth of water in inches or feet (ASAE, 1988; Burt, et al., 1988). Conservation: ". . . planned management of a natural resource . . ." (Webster's New World Dictionary, 1989.)

Crop Root Zone: The soil depth from which a mature crop extracts most of the water needed for evapotranspiration. The crop root zone is equal to effective rooting depth and is expressed as a depth in inches or feet. This soil depth may be considered as the rooting depth of a subsequent crop, when accounting for soil moisture storage in efficiency calculations (Burt, et al., 1988).

Crop Water Requirement (CWR): The infiltrated water required to grow a crop, expressed as a depth of water in inches or feet (Burman, et al., 1981).

$$CWR = ET - EP + LRD + CP$$

Cultural Practices (CP): Irrigation water which is used for necessary farming practices such as soil reclamation, climate control, crop quality, and weed germination, expressed as a depth of water in inches or feet (Burt, et al., 1988).

Deep Percolation (DP): The amount of irrigation water that flows below the crop root zone and is unavailable for evapotranspiration, expressed as a depth of water in inches or feet (Merriam & Keller, 1978).

Depth of Water: The depth of a volume of water spread over a given area, expressed as a depth of water in inches or feet.

Distribution Uniformity (DU): The ratio of the average low-quarter depth of irrigation water infiltrated to the average depth of

irrigation water infiltrated, expressed as a percent (ASAE, 1988).

Effective Precipitation (EP): That portion of rainfall that contributes to satisfying the evapotranspiration and/or leaching requirement of a crop, expressed as a depth of water in inches or feet (Burman, et al., 1981).

Electrical Conductivity (EC): The property of a substance to transfer an electrical charge and a measure of the salt content of water. EC_w is the term used as a measure of the salt content of irrigation water, EC_e is the term used as a measure of the salt content of an extract from a soil when saturated with water, expressed as decisiemens per meter (dS/m) (Doorenbos & Pruitt, 1984).

Evapotranspiration (ET): The amount of water loss over a period of time through transpiration from vegetation and evaporation from the soil, expressed as a depth of water in inches or feet (Doorenbos & Pruitt, 1984).

Evapotranspiration of Applied Water (ETA_w): The portion of the total crop evapotranspiration that is satisfied by applied water, expressed as a depth of water in inches or feet (Central Valley Water Use Study Committee, 1987).

Evapotranspiration Potential (ETP): Evapotranspiration potential is a value calculated with a modified Penman equation and is equal to daily alfalfa evapotranspiration when the crop occupies an extensive surface; is actively growing, standing erect, and at least eight inches tall; and is well watered so that soil water availability does not limit evapotranspiration, expressed as a depth of water in inches or feet (Burman, et al., 1980).

Field Capacity: Depth of water retained in the soil after ample irrigation or heavy rain when the rate of downward movement has substantially decreased, usually one to three days after irrigation or rain, expressed as a depth of water in inches or feet (Doorenbos & Pruitt, 1984).

Groundwater Table: The upper boundary of groundwater where water pressure is equal to atmospheric pressure, i.e., water level in a bore hole after equilibrium when groundwater can freely enter the hole from the sides and bottom (Doorenbos & Pruitt, 1984).

Infiltration Rate: The rate of water entry into the soil expressed as a depth of water per unit of time in inches per hour or feet per day. The infiltration rate changes with time during irrigation (Burt, et al., 1988).

Irrigation Efficiencies: Irrigation efficiencies are used to determine the efficiency of replacing moisture in the soil profile and may be calculated for single or multiple irrigations and is the ratio of the depth of water stored to the depth of applied water. The equations for single and multiple irrigations are as follows:

1. **Preirrigation Efficiency (PIE):** This definition is used to calculate the efficiency of an on-farm preirrigation and is the ratio of the sum of the depth of water used for soil moisture replacement and cultural practices to the depth of applied water, expressed as a percentage (Burt, et al., 1988). No leaching requirement is included.

$$PIE = \frac{SMR_1 + CP_1}{AW_1} \times 100$$

2. **Regular Season Irrigation Efficiency (RIE):** This definition is used to calculate the efficiency of one

or more regular season on-farm irrigations and is the ratio of the sum of the depth of soil moisture replacement water and water used for cultural practices for each irrigation after the preirrigation to the sum of the depths of water applied during these irrigations, expressed as a percentage. No leaching requirement is included (Burt, et al., 1988).

$$R/E = \frac{SMR_1 + CP_1 + SMR_2 + CP_2 + \dots + SMR_n + CP_n}{AW_1 + AW_2 + \dots + AW_n} \times 100$$

3. Annual Irrigation Efficiency (AIE): This definition is used to calculate the efficiency of all on-farm irrigations and is the ratio of the sum of the depth of soil moisture replacement water and water used for cultural practices for all irrigations plus the water to satisfy the seasonal leaching requirement to the sum of the depths of water applied during all irrigations, including the preirrigation, expressed as a percentage (Burt, et al., 1988).

$$AIE = \frac{SMR_1 + CP_1 + SMR_2 + CP_2 + \dots + SMR_n + CP_n}{AW_1 + AW_2 + \dots + AW_n} \times 100$$

Leaching Fraction (LF): The ratio of deep percolation (DP) to infiltrated irrigation water (Viw), V_{dp}/V_{iw} . It is the fraction of water that enters the root zone by irrigation that is not used in ET and which passes below the root zone as deep percolation (Rhoades, 1991).

Leaching Requirement (LR): The theoretical amount of infiltrated irrigation water that must pass (leach) beyond the root zone in order to keep soil salinity within acceptable levels for sustained crop growth. Different models may be used to estimate LR. For uniform and no rainfall conditions, a

simple estimate is: Where EC_w is the electrical conductivity of the infiltrated irrigation water and EC_e is the maximum EC of the saturated extract of the soil tolerable (not causing significant yield loss) by the crop in question. Actual leaching needed for salinity control may be more or less than this estimate dependent upon uniformity of irrigation/infiltration and amount and distribution of rainfall, respectively

$$LR = \frac{EC_w}{5EC_e - EC_w}$$

Leaching Requirement Depth (LRD): The depth of water corresponding to the leaching requirement including extra water for nonuniformity in distribution.

$$LRD = \frac{ETAW}{(DU + 100)} \times \frac{LR}{(1 - LR)}$$

Low Quarter Depth: The average depth of water infiltrated into the quarter of the field infiltrating the least amount, expressed in inches or feet.

Minor Losses (ML): Water losses due to evaporation during irrigation, uncollected surface runoff from the field, and on-farm conveyance and storage systems expressed as a depth of water in inches or feet.

Permanent Wilting Point (PWP): The moisture remaining in a soil at a uniform soil moisture tension of about -15 bars of atmospheric pressure, which is the approximate tension at which plants irreversibly wilt due to moisture stress, expressed as a depth of water in inches or feet.

Preirrigation: An irrigation that occurs prior to the planting of a crop.

Preirrigation Efficiency (PIE): [See "Irrigation Efficiencies."](#)

Regular Season Irrigation Efficiency (RIE): [See "Irrigation Efficiencies."](#)

Salt Balance: The condition when the amount of salts added to a soil profile through irrigation and the amount removed by leaching are equal (i.e., no net gain nor loss of salt in the crop root zone). This balance will be established if adequate leaching occurs each year; the average root zone salinity at equilibrium will depend upon the amount of leaching and the quality of the applied water (Hoffman, et al., 1980).

Seasonal Application Efficiency (SAE): This term measures the efficiency of applied irrigation water based on crop water requirements, where evapotranspiration is estimated using a modified Penman equation and crop coefficients and is expressed as a percentage

$$SAE = \frac{BU}{AW} \times 100 = \frac{CWR}{AW} \times 100$$

Soil Moisture Deficit (SMD): The amount of water needed to refill the crop root zone to field capacity at the time of irrigation, expressed as a depth of water in inches or feet (Westlands Water District, 1985).

Soil Moisture Replacement (SMR): The amount of water that is used to replace a portion or all of the soil moisture deficit, expressed as a depth of water in inches or feet.

Tailwater: Applied irrigation water that runs off the lower end of a field. Tailwater is the average depth of runoff water, expressed in inches or feet.

Underirrigation (UI): The difference between the water actually stored in the crop root zone during an irrigation (soil moisture replacement) and the water needed to refill the root zone to field capacity (soil moisture deficit) in all or part of the field, expressed as a depth of water in inches or feet.

An additional source for this type of information is the NRCS National Engineering Handbook, part 652, [Glossary and References](#), PDF format.

GRAPHIC SCHEDULING SHEETS

[Coarse Soils](#)
[Medium Soils](#)
[Fine Soils](#)
[Very Fine Soils](#)
[Pocket Size Sheets](#)

