6. Estimation of Consumptive Use of Water.

Although various methods have been developed in order to evapotranspiration (consumptive use) values of different crop in an area, or for areas vegetated with the same cropping patteren, but the most simple and commonly used methods are:

1. **Blaney – Criddle Equation, and**
2. **Hargreaves class A pan evaporation method.**
3. **Penman's Equation.**

They are described below:

Blaney – Criddle Equation:

It states that the monthly consumptive use is given by

$$C_u = \frac{k.p}{40}[1.8t + 32]$$

Where,

C_u = monthly consumptive use in cm.

K = Crop factor, determined by experiments for eaSch crop, under the environmental conditions of the particular area.

t = Mean monthly temperature in °C

P = Monthly per cent of annual day light hours that occur during the period.

If $\frac{p}{40}[1.8t + 32]$ is represented by f, we get

$$C_u = k.f$$

However, it is found that the values of k based on seasonal determinations were too low for the short periods between irrigations. This led to furtherdevelopments and finally the formula was expressed as

$$C_u = k \sum f$$

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Where C_u = seasonal consumptive use, (i.e)consumptive use during te period of growth for a given crop in a given area.

The above formula involves the use of crop factor, the value of which is to be determined for each crop and for different places.

At present, this information is not available in india. Moreover, this formula does not take into consideration the factor s such as humidity, wind velocity, elevation,etc. on which consumptive use depends. Hargreaves class A Pan evaporation method is, therefore, generally used in india.

Hargreaves class A pan evaporation method:

In this method, evaporation is related to pan evaporation by a constant K, called consumptive use coefficient. The formula can be written as

$$\frac{Evapotranspiration(Et\ or\ Cu)}{Pan\ evaporation(Ep)} = K$$

Or

$$Et\ or\ Cu = K.\ Ep$$

Consumptive use coefficient (k) is different for different crops and is different for the same crop at different crop at different places.

It also varies with the crop growth, and is different at different crop stages for the same crop.

The above relationship is now available for various crops from many countries such as Isral, philippines, U.S.A. and India.

Penmam's Equation:

While the Blaney ccriddle equation and the Hargreaves class A pan equation using Christiansen formula had been in use for the last many years for computing the consumptive use, Cu values, and net irrigation requirements for different crops;

The Penman equation has, however, more recentlybeen introduced for determining the consumptive use of different segments of a basin, depending upon the type of vegetation covering each sub – basin.

The advantage with this equation lies in the fact that the different specified values of coefficient of reflection, a factor used in this equation, are avaible for different types of areas,

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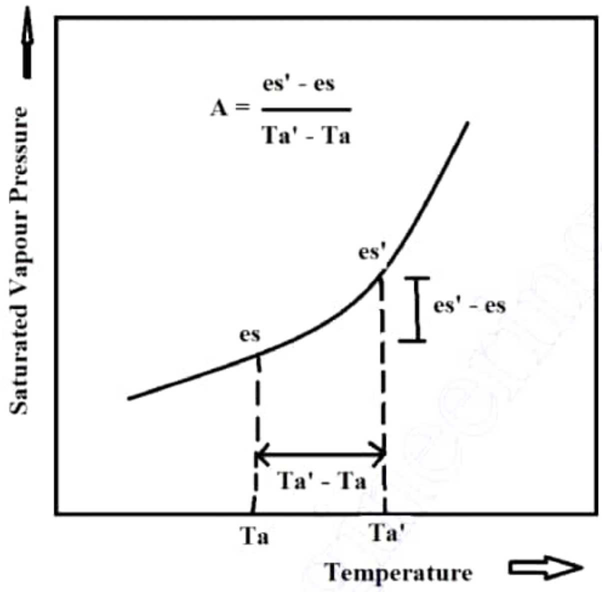
which can be used in Penman's equation tocompute consumptive use values for different segments of command area.

Saturation VApour Pressure vs Temperature curve



Penman's Equation, incorporating some of the modifications suggested by other investigations, is given as:

$$Et = \frac{A.Hn + EA.\gamma}{A + \gamma}$$

Where Et = Daily potential evapo- transpiration

A = Slope of the saturation vapour pressure Vs Temp. curve at the mean air temperature.

Hn = Net incoming solar radiation or energy, expressed in mm of evaporable water per day

Ea = A parameter including wind velocity and saturation deficit(mm/day)

γ = psychromatic constant = 0.49 mm of Hg/°C

$$Hn = Hc\ (1\text{-}r)\left(a + b.\frac{n}{N}\right) - \sigma.T_a^4(0.56 - 0.092\sqrt{ea})\ x\ \left(0.10 + 0.90.\frac{n}{N}\right)$$

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