A- **Permanent wilting point**

It is the lower end of the available moisture range. Or the soil – moisture content when plants permanent wilt.

Or an approximation, the permanent wilting percentage can be estimated by dividing (F. C) by factor (2 – 2.4) depending upon the amount of silt in the soil.

For soils of high silt content 2.4 should be used.

B- **Temporary wilting point:**

It is the wilting which occur in many crops on a hot windy day, but the plants recover in the cooler portion of the day.

Permanent wilting, as well as temporary wilting, depends upon:

1) The rate of water used by the plant.

2) The depth of the root zone.

3) W.H.C.

Available Moisture (Available Water) (Aw)

The difference in moisture content of the soil between field capacity (F.C) and permanent wilting is termed the available moisture. Available moisture can be expressed as percentage moisture P_W, as percentage P_V or as depth d.

Readily Available Moisture (RAW)

Soil moisture content near the wilting point is not readily available to the plant. Hence, the term readily available moisture has been used to refer to that portion of the available moisture that is most easily extracted by plants, approximately 75% of the available moisture.

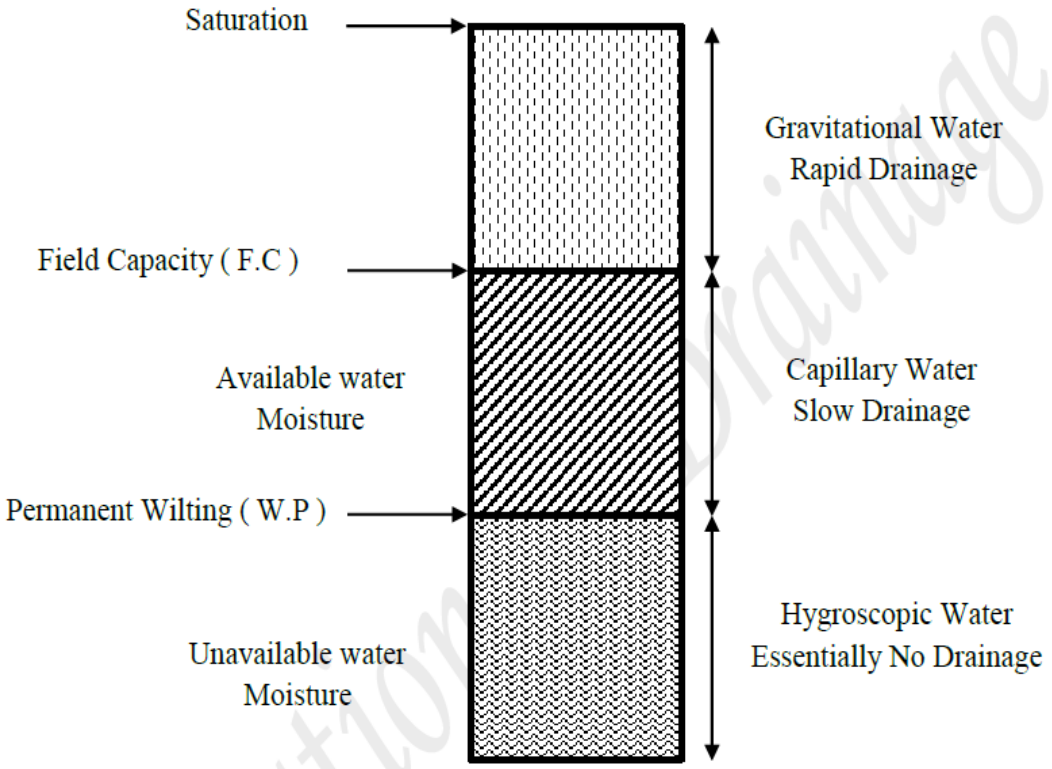
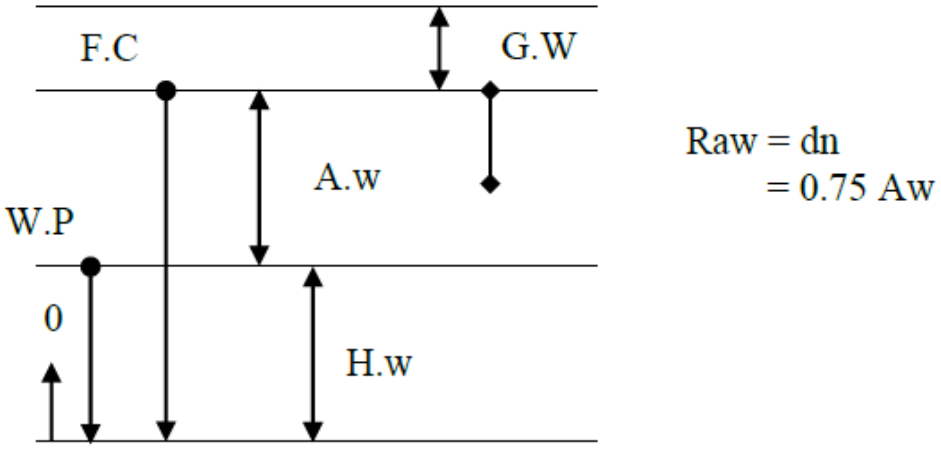


Fig.2 Classes of soil-water availability to plants and draining characteristics



Percentage of allowable depletion (P.AD)

It’s the percentage of available moisture which can be used by plant

$$P.A.D = \frac{RAw}{Aw} * 100$$

$$P.A.D = \frac{dn}{(Aw)_{by\ depth}}$$

كما في تعريفه لكن تعتبر ٥٠% لأغراض التصميم او للأمان حتى النبات لا يصل الى الذبول

Use PAD = 50% when no information

Ex : Given a loam soil of (1.3 m) deep , it's weight (2.9 N) and it's dry weight (2.5 N) . If it's (F.C = 35 %) by volume and wilting point = 10 % by volume , As = 1.4 Find :

1 - Available water (in mm)

2 - The actual depth of water needed of water irrigation (dn) .

Ans :

1 - Pw= Ww/Ws ×100

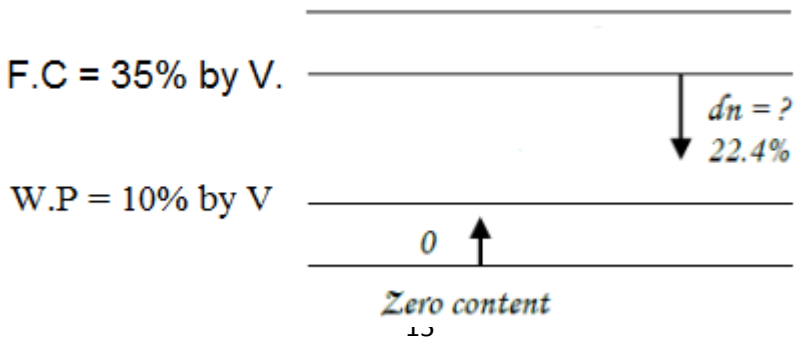
Pw= 2.9−2.5/2.5 ×100 = 16 % by weight

To convert by volume

Pv = Pw × As = 16 % × 1.4 = 22.4 % by vol. Aw$by\ vol. = F.C - W.P$ = (35 − 10) % = 25 % $by\ vol.$

Aw$by\ depth$ *= 25 % × 1300 = 325 mm*

2 - ∴dn = (F.C - IAw)% × D = (35 - 22.4) % × 1300 = 164 mm



EX: Given a root zone of 1.2m depth, the soil is sandy clay; the initial moisture content is 7% by weight. Find the required irrigation depth (dn) if As= 1.4, F.C =22% by weight:

Ans:

Moisture content by weight:

Pw=Fc -initial moisture content (IAW)

Pw= (22-7) %=15% by wt.

Moisture content by vol. (pv) =15 %(pw) ∗1.4(AS)=21%

Moisture content by depth (dn)=21%(pv) ∗ 1200=252mm

Ex: Ws = 0.98 N, V = 70 cm^3, W = 1.22 N

Rs = 2.65, Vw=? , n =?

Ans : As = $\frac{Ws}{\gamma w.V} = \frac{0.98*10^6}{70*9800} = 1.43$

n = $(1 - \frac{As}{Rs}) * 100$

= $(1 - \frac{1.43}{2.65}) = 47\%$

$\gamma w = \frac{W_W}{V_w}$, $W_W = W - W_s = 1.22 - 0.98 = 0.24$ N

$9800 = \frac{0.24}{V_w}$, $V_w = \frac{0.24*10^6}{9800} = 24.5\ cm^3$

Ex As = 1.3, t =? , F.c = 27.2% by wt, w.p = 19% by wt , discharge of pump to irrigated soil with this Aw is ($Q = 75 * 10^{-3}$ m^3/s) , Area = 12 Mishara. , D = 92 cm

Ans F.c = 27.2 * 1.3 = 35.36% by vol.

Aw = F.c – Wp = 27.2 – 19 = 8.2% by weight

Aw by depth = $\frac{8.2}{100} * 1.3 * 92 = 9.8\ cm$

Q = $\frac{V}{t}$, V = 12 * 2500 * $\frac{9.8}{100}$ = 2940 m^3

∴ t = $\frac{2940}{75* 10^{-3}}$ = 39200 sec = 10.89 hr

Ex: Given a certain soil with As = 1.3, w.p = 19% by wt. Area = 12 Mish, and D =92 cm, find the time required to irrigate this water to reach F.c = 27.2% by wt if the discharge of pump is $75 * 10^{-3}$ m^3/sec.

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