Water Dynamics in Plant Production, 2nd Edition

Multiple Choice Questions

Chapter 17 – Controlling the Soil's Water Balance by Soil Management

1. Water use efficiency (WUE) can be determined from the following equation:

$$\mathrm{WUE} = \frac{\mathrm{TE}}{1 + (\mathrm{E} + \mathrm{R} + \mathrm{D})/\mathrm{T}}$$

where TE is transpiration efficiency, E is soil evaporation, R is runoff and D is deep seepage from the subsoil.

(i) What is the term that best describes the combination of E, R and D?

(a) soil-based losses
(b) surface and seepage losses
(c) unproductive water use
(d) non-plant water use

(ii) At any one location TE is more or less a constant over a growing season. In soils where runoff and deep seepage can be ignored, evapotranspiration efficiency or water use efficiency depends on the value of E/T, an expression of the soil evaporation as a proportion of transpiration. As the season progresses, crops increase their leaf area index and transpiration will increase. Later in the season under such conditions, which of the following statements are true?

(a) Water use efficiency tends to the value of transpiration efficiency (TE).
(b) Water use efficiency tends to transpiration/evaporation (T/E).
(c) Water use efficiency is given by: $\frac{\text{above-ground biomass production}}{\text{transpiration + evaporation}}$
(d) Water use efficiency tends to infinity.

2. From the equation given in Question 1, it appears that to optimize water use efficiency (WUE), reducing surface runoff will be an important factor. Which of the following practices contributes to reducing runoff?

(a) regular and frequent deep tillage
(b) ensuring that compacted traffic lanes do not develop
(c) producing a fine seedbed to ensure rapid germination
(d) protecting the soil surface with biomass residues
(e) all of the above
(f) none of the above

3. Which of the following practices can contribute to reducing soil evaporation? (There may be more than one correct answer.)

(a) creation of a loose surface layer
(b) adding a mulch cover
(c) adopting stubble mulch tillage
(d) regular and frequent deep tillage between crops
(e) all of the above
(f) none of the above

4. Which of the following practices increases the quantity of water extractable by plant roots?
(a) preventing soil compaction by heavy machinery
(b) cultivating under conditions that allow the soil to fragment rather than smear
(c) incorporating organic matter, such as compost
(d) all of the above
(e) none of the above

5. Conservation tillage is considered to meet many of the requirements to optimize soil water availability, prevent soil erosion and reduce unproductive water losses. Which of the following practices are consistent with the principles of conservation tillage? (There may be more than one correct answer.)
(a) ensuring clean tilled surfaces
(b) growing at least some crops that produce extensive root systems
(c) making sure that at least 30% of the soil surface is covered by crop residues
(d) using tine or chisel implements to open the soil
(e) avoiding inversion tillage and running tractor wheels in open furrows