

Water Dynamics in Plant Production, 2nd Edition

Questions and Discussion Points

Chapter 19 – Irrigation

Section 19.1

1. Explain the importance of present-day irrigation (land area, crop production) and specify some environmental problems linked with modern irrigation methods.
2. State some reasons why there can be inadequate water use efficiency in irrigated agriculture compared with rain-fed agriculture.

Section 19.2

1. Collection of water is a prerequisite for irrigation in dry areas, when the water supply from lakes and rivers falls short. In addition to water harvesting (Box 17.1) another system of collection supported the development of early civilizations. Outline how this qanāt system works.

Section 19.3

1. Define the term 'water requirement'.
2. List some features that determine the magnitude of potential evapotranspiration (ET_p) and contrast the information with that for reference crop evapotranspiration (ET_o).
3. During the growth of an actual crop, its water requirement will change and will differ from ET_p and ET_o . Describe the various relationships.
4. Please explain, based on Section 19.3, why the cumulative water requirement over the season is often smaller than the cumulative seasonal ET_p or ET_o .
5. Please distinguish between ET_p , ET_o and ET_c , the crop evapotranspiration.
6. What purpose does the empirical 'crop specific coefficient' (K_c) serve?
7. Can the crop water requirement or ET_c be used directly for irrigation control? Or does it serve another purpose?

Section 19.4

1. Please explain how the delivery of irrigation water can be based on soil moisture, specifically as a function of extractable water in the rooting zone.
2. Explain the essential features of the 'climatic water balance'.
3. For irrigation control nowadays, 'climatic water deficit' (CWD) is used. Please explain this principle, employing Eqn 19.5.
4. Do we need to measure soil moisture when using CWD? Which quantities have to be recorded?
5. Mention some methods for the direct determination of when to start irrigation in the case where the CWD method is not applicable.
6. In some instances coarse-textured soils prove to be more rewarding for irrigation water than finer-textured soils in terms of crop yields. Outline the reason for this result.

Section 19.5

1. Explain the meaning of 'supplemental irrigation'.
2. Irrigation can improve crop performance, yield and water use efficiency (WUE). Identify the preconditions for arriving at that goal.
3. Why does WUE increase with the yield level attained but then may level off and even decrease (Fig. 19.5)?

4. Where water is scarce and therefore costly, it is most important to limit the rate at which water is applied. This approach will assure a high WUE of the irrigation water. Please explain these relations by use of Table 19.2.
5. Contrast the terms 'deficit irrigation' and 'supplemental irrigation'.

Section 19.6

1. Give an overview on the most important methods of irrigation. Describe the individual advantages and disadvantages of each method.
2. Characterize the goal of modern micro-irrigation systems.