

Water Dynamics in Plant Production, 2nd Edition

Questions and Discussion Points

Chapter 18 – Controlling Water Use by Crop Management

Section 18.1

1. What is a crop rotation? Explain the advantages of including a wide range of plant groups in a crop rotation. Present reasons for simplifying crop rotations in large-field agriculture.
2. Comment on water availability, climate and establishment of a crop rotation.
3. In dry areas, a fallow year is often part of the crop rotation. What is the aim of the fallow?
4. The efficiency of the fallow for collecting precipitation can be poor. How is the fallow efficiency ascertained?
5. Characterize the steppe climate in the Great Plains of the USA (Fig. 15.2) and outline how it differs from a Mediterranean climate. Wheat production is common under both climates. Why is the fallow efficiency so limited under a steppe climate?
6. Describe the difficulties in storing rainwater during fallow as part of the wheat–fallow crop rotation in Montana, Nebraska and Colorado (Fig. 18.1, Table 18.1).
7. Discuss the contribution of zero-tillage with mulching compared with conventional inversion tillage on water storage at Akron, Colorado (Table 18.2).
8. What is the main impetus for varying and extending the simple crop rotation wheat–fallow in the Great Plains of North America by inclusion of several crops?
9. Discuss some of the problems associated with the water available to winter wheat that may be linked with rejecting the simple and short wheat–fallow rotation by the inclusion of other crops.
10. In the Great Plains of North America, the move from a wheat–fallow rotation to a varied crop sequence may be made easier by applying ‘opportunistic cropping’. What are the basic considerations for the introduction of this cropping mode?
11. In contrast to ‘double cropping’, the application of ‘intercropping’ can assist in combating water loss (Eqn 17.5) and erosion during the rainy season of a monsoon climate (Fig. 15.2). Explain the two terms and the application of intercropping by small-scale farmers (for instance in India).
12. What are the climatic preconditions for double cropping? How can farmers adjust to weather variability from year to year?
13. Some crops can be included within a crop rotation because of some specific effects that benefit other crops in the rotation. Please discuss some examples.

Section 18.2

1. Please identify some of the crops in the area where you live and list them according to their decreasing water use. Try to describe the peculiar characteristics of these crops with respect to water requirement.
2. Comment on leaf inclination and water use of crop cultivars.

Section 18.3

1. Comment on the relationship between seeding date and crop water use.
2. What is the optimum plant density in areas where water is limited? Present an overview of water use during the different stages of plant development, focused on cereals and row crops. Also include consideration of unproductive water losses.
3. Can planting geometry (i.e. distribution and arrangement of plants within an area at a given plant density) contribute to efficiency in transpirational water use by reducing unproductive water losses?

Section 18.4

1. What is the effect of addition of fertilizer on the growth of shoots and roots, on water use and water use efficiency?
2. What limits to fertilizer application need to be considered where water supply is limited?
3. Explain the phenomenon of 'haying-off' (Fig. 18.7).