

# **Fundamentals of Monitoring Soil Moisture with Surface Irrigation in Afghanistan**



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## **Phases of Seedling Development that Require Different Watering Methods**

### **1. Germination Phase (Seedlings begin to develop, moderate water need)**

- If soil is too wet, seed will not germinate and rot
- If soil is too dry, seed will not germinate and dry out
- Check soil moisture depth at 0-3 cm
- Provide enough water to keep “seed zone” moist (soil will form a ball, but no wet outline of ball, and no water dripping)





## **Phases of Seedling Development That Require Different Watering Methods**

### **2. Shoot Growth Phase (Seedlings actively growing, high water need)**

- Too much water will drown seedlings
- Frequent, light irrigation will cause shallow root systems to develop
- Too little water will reduce shoot growth
- Too little water will kill seedlings
- Check soil moisture at depth of 0-30 cm
- Provide enough water to keep “root zone” moist (soil will form a ball, but no wet outline of a ball, and no water dripping)



## **Phases of Seedling Development that Require Different Watering Methods**

### **3. Dormancy Phase (Seedling growth is slowing, moderate water need)**

- Shoot growth is complete; buds are developing
- Roots and stem diameter are growing
- Plants are still using water; need to replace and store water
- Days are cooler and shorter
- Check soil moisture at depth of 0-30 cm
- Provide enough water to keep “root zone” moist (soil will form a ball, but no wet outline of a ball, and no water dripping)



## **Advantages of Surface Irrigation**

- 1. Easy to install**
- 2. Easy to operate**
- 3. Provides uniform application of water**
- 4. Can provide good results**





## **Disadvantages of Surface Irrigation**

- 1. May not be most efficient use of irrigation water for tree seedlings**
- 2. Could increase root and foliar disease in tree seedlings**
- 3. Could increase salt concentrations in the soil**
- 4. Could create water-logged soil that could kill seedlings**
- 5. If have clay soils, could reduce germination and seedling development**
- 6. Field must be level for uniform application of irrigation water**



## **Two common methods of surface irrigation in Afghanistan tree nurseries**

### **1. Flood Irrigation**



#### **Advantages:**

- Easy to install
- Easy to manage

#### **Disadvantages:**

- Uses much water
- Could drown seedlings
- Could drown seed

## **Two common methods of surface irrigation in Afghanistan tree nurseries**

### **2. “Joya and Pushta” (Ditch and Mound)**



#### **Advantages:**

- Uses less water than flood
- Seed is planted on raised beds (better chance to germinate and develop)
- Improved root development

#### **Disadvantages:**

- Requires more labor to prepare
- Requires more labor to maintain



# Five Steps to Monitor Soil Moisture with Surface Irrigation

## 1. Insert Probe 30 cm into soil, and withdraw



## **Five Steps to Monitor Soil Moisture With Surface Irrigation**

- 2. Squeeze the soil sample in your hand to form an irregularly shaped “ball.”**



## **Five Steps to Monitor Soil Moisture with Surface Irrigation**

- 3. Squeeze soil sample out of your hand between thumb forefinger to form a ribbon.**





## **Five Steps to Monitor Soil Moisture with Surface Irrigation**

- 4. Observe:**  
soil texture, ability to ribbon,  
firmness of soil ball, water shine,  
soil/water stain on hand, soil color



## **Five Steps to Monitor Soil Moisture Using Surface Irrigation**

- 5. Compare observations with photographs to estimate percent water available and amount of irrigation needed**



## Feel and Appearance of Clay Soil

<u>Degree of Moisture</u>	<u>Amount of Moisture</u>	<u>Description</u>	<u>Irrigation Needs</u>
Low	0-25%	Crumbly; will not Hold together	3 – 6 cm
Fair	25-50%	Somewhat pliable, balls under pressure	2 – 4.5 cm
Good	50-75%	Forms ball; ribbon between thumb and forefinger	1-3 cm
Excellent	75-100%	Easily ribbons between fingers; has sticky or slick feeling	0-1.5 cm
Wet (Field Capacity)	100%	Wet outline of ball is left on hand when squeezing	0 cm




**No photo**



**No photo**



## Feel and Appearance of Loamy Soil

<u>Degree of Moisture</u>	<u>Amount of Moisture</u>	<u>Description</u>	<u>Irrigation Needs</u>	
Low	0-25%	Crumbly; will not Hold together	2.5 – 5.5 cm	No Photo
Fair	25-50%	Crumbly; hold Together with Pressure	2 – 4 cm	
Good	50-75%	Forms ball; somewhat Plastic; may stick Together with Pressure	1 – 2.5 cm	
Excellent	75-100%	Forms ball, pliable, Sticks if high in clay Content	0 – 1.5 cm	
Wet	100%	Wet outline of ball is Left on hand when squeezing	0 cm	No Photo

## Feel and Appearance of Sandy Soil

<u>Degree of Moisture</u>	<u>Amount of Moisture</u>	<u>Description</u>	<u>Irrigation Needs</u>
Low	0-25%	Crumbly; will not Hold together	1.5 - 3 cm
Fair	25-50%	Appears dry; will Not form ball with pressure.	.5 - 1.5 cm
Good	50-75%	Appears dry; may form ball with pressure but seldom holds together	.75 – 2.5 cm
Excellent	75-100%	Tends to stick together; may form weak ball, breaks easily, will not stick	0 - .75 cm
Wet	100%	Wet outline of ball is left on hand when squeezing	0 cm

No photo



No photo

## **When to Determine Soil Moisture Levels** **Using Feel and Appearance Method**

### **Before Irrigation**

- Take soil probe
- Determine soil moisture level by feel and appearance
- Soil moisture level should be “fair”
- Depth of irrigation water = enough water to reach 100% soil moisture

### **After Irrigation (1 hr > irrigation)**

- Take soil probe
- Determine soil moisture level by feel and appearance
- Soil moisture level should be “excellent”







### **Example 1 (Clay Soil)**



#### **When (Before):**

**Morning soil probe**

#### **Feel/Appearance:**

**Somewhat pliable, balls under pressure**

#### **Moisture Level:**

**25-50%**

#### **Degree of Moisture:**

**Fair**

#### **Action:**

**Irrigate (2 – 4.5 cm depth)**

#### **When (After):**

**One hr > irrigation**

#### **Feel/Appearance:**

**Easily ribbons between fingers;  
Has sticky or slick feeling**

#### **Moisture Level:**

**75-100%**

#### **Degree of Moisture:**

**Excellent**

#### **Action:**

**Irrigation complete**

## **Example 2 (Clay Soil)**

**When:**

**Morning soil probe**

**Feel/Appearance:**

**Easily ribbons between fingers;**

**Has sticky or slick feeling**

**Moisture Level:**

**75-100%**

**Degree of Moisture:**

**Excellent**

**Action:**

**Irrigation not necessary**



## **Regular Cultivation Will Improve Water Use in Nurseries**

- Breaks soil crust for infiltration of water
- Prevents run-off of irrigation water
- Loosens soil for percolation of water
- Removes competing vegetation





**With careful use of water and cultivation,**  
**Afghanistan's Nurseries will make**  
**Afghanistan Green Again**

