UPSC CSE Mains Exam 2001-2023:

Previous Year Questions

Model Answer

By: AGRIMLY IAS TEAM

Agriculture Optional (Paper-1)

Physical and Social Environment as Factors of Crop Distribution and Production

Questions:

1. Write the different elements of weather affecting crop production with suitable examples. (10 Marks, IAS 2020)
2. Photoperiodism and Thermoperiodism (10 Marks, IAS 2013)
3. Climatic Parameters in Agro-Ecosystems (10 Marks, IAS 2013)
4. Define the theory of tolerance and relate it to the principles of plant distribution and adaptation. (20 Marks, IAS 2014)

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Candidate must adhere to the word limit specified in the question.
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Write the Different Elements of Weather Affecting Crop Production with Suitable Examples (10 Marks, IAS 2020)

Answer:

Elements of Weather Affecting Crop Production:

1. **Precipitation:**
   Heavy and evenly distributed rainfall supports crops like rice, tea, coffee, and rubber.
   Low and uneven rainfall regions support drought-resistant crops like pearl millet and sorghum.
   Example: In the Western Ghats, tea and coffee thrive due to heavy rainfall.
2. **Temperature:**
   Most plants cannot grow if the temperature falls below 8°C.
   The optimal temperature range for agricultural plants is 15-40°C.
   Example: Rice requires a minimum of 10°C, an optimum of 32°C, and a maximum of 36-38°C.
3. **Atmospheric Humidity:**
   A relative humidity of 40-60% is suitable for most crops.
   High humidity increases pest and disease risks.
   Example: High humidity in tropical regions increases the risk of rice diseases.
4. **Solar Radiation:**
   Essential for biomass production.
   Influences crop growth through Photosynthetically Active Radiation (400-700 nm).
   Example: Short-day plants like rice require less than 10 hours of daylight for flowering.
5. **Wind Velocity:**
   Wind speeds of 10 km/hour are suitable for most crops.
   Higher wind speeds can cause crop lodging.
   Example: Wind is required for pollination in maize.
6. **Atmospheric Gases:**
   CO_2 is crucial for photosynthesis.
   Nitrogen is a major plant nutrient.
   Example: Adequate CO_2 levels enhance crop yields in greenhouses.

Photoperiodism and Thermoperiodism (10 Marks, IAS 2013)

Answer:

Photoperiodism:

1. **Definition:**
   Response of plants to the length of daylight.
2. **Developmental Processes:**
   Initiated by daylight length, like flowering and fruiting.
3. **Light Duration:**
   More influential than intensity for yield.
4. **Classification:**
   Long-day Plants: Require more than 12 hours of daylight (e.g., potato, wheat).
   Short-day Plants: Require less than 12 hours of daylight (e.g., rice, sunflower).
   Day-neutral Plants: Unaffected by photoperiod (e.g., tomato, maize).
5. **Application:**
   Helps optimize crop growth and yield.

Thermoperiodism:

1. **Definition:**
   Response of plants to temperature changes.
2. **Developmental Processes:**
   Initiated by temperature changes, like seed germination.
3. **Classification:**
   Thermo-sensitive Plants: Require specific temperature ranges.
   Thermo-insensitive Plants: Unaffected by temperature changes.
4. **Application:**
   Ensures crops receive necessary temperatures for growth.

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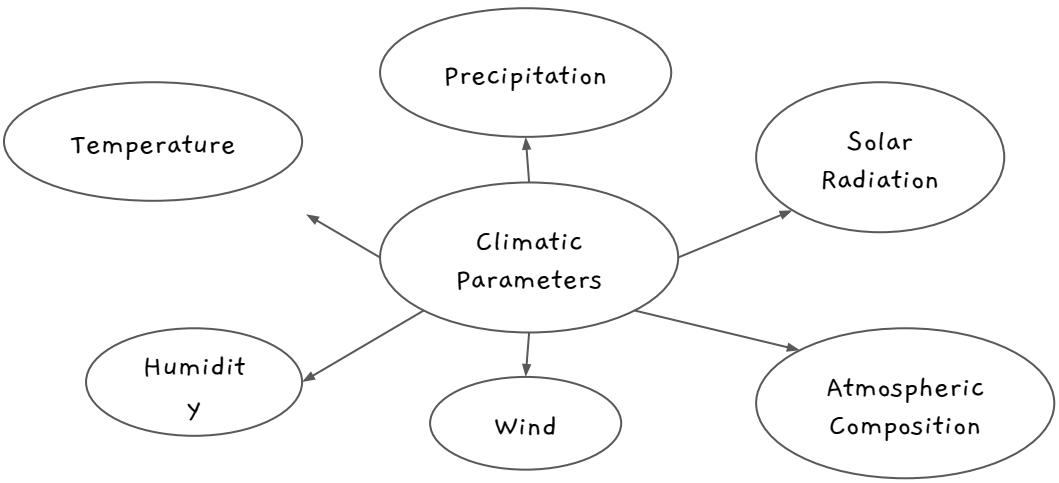
Climatic Parameters in Agro-Ecosystems (10 Marks, IAS 2013)

Answer:

Climatic Parameters:

1. **Temperature:**
   Affects plant growth and development.
   Example: High temperatures accelerate the growth of crops like maize.
2. **Precipitation:**
   Determines water availability for crops.
   Example: Adequate rainfall is necessary for rainfed rice cultivation.
3. **Solar Radiation:**
   Influences photosynthesis and biomass production.
   Example: Sunflower responds to the direction and duration of light.
4. **Humidity:**
   Affects transpiration and disease prevalence.
   Example: High humidity levels increase fungal diseases in wheat.
5. **Wind:**
   Influences pollination and seed dispersal.
   Example: Wind-pollinated crops like wheat rely on wind for pollination.
6. **Atmospheric Composition:**
   CO_2, nitrogen, and other gases affect plant growth.
   Example: Enhanced CO_2 levels can boost crop yields in controlled environments.



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Define the Theory of Tolerance and Relate it to the Principles of Plant Distribution and Adaptation (20 Marks, IAS 2014)

Answer:

Theory of Tolerance:

1. **Definition:**
   Refers to the ability of crops to survive within specific environmental conditions.
2. **Proposed by Shelford in 1913:**
   Organisms thrive only within a specific range of environmental factors.

Principles of Plant Distribution and Adaptation:

1. **Plant Distribution:**
   Geographic distribution of plant species.
   Example: Cacti are distributed in arid regions due to their tolerance to dry conditions.
2. **Adaptation:**
   Traits that allow plants to survive in specific environments.
   Example: Rice adapted to flooded conditions thrives in paddy fields.
3. **Tolerance:**
   High tolerance crops can grow well in varied conditions.
   Example: Wheat is grown in diverse climates due to its broad tolerance range.
4. **Agroecology:**
   Tolerance helps in selecting suitable crops and managing ecosystems sustainably.
   Example: Understanding crop tolerance limits helps farmers optimize growth and productivity.
5. **Environmental Factors:**
   Temperature, moisture, light, and nutrients shape plant distribution.
   Example: Plants tolerant of high temperatures and low moisture thrive in deserts.
6. **Application:**
   Helps farmers choose appropriate crops and manage environments for optimal growth.
   Example: Selecting drought-resistant crops for dry regions.