UPCATET Agronomy Sample Paper-8

Duration: 20 Minutes **Maximum Marks: 100**

Instructions

- This paper contains **25** Multiple Choice Questions.
- Each correct answer carries **+4** mark. Incorrect answer: **−1** marks. Only **one** correct option.
- Unattempted questions carry **0** marks.
- Use of mobile phones, smartwatches, or any electronic gadgets is strictly prohibited.

Q1. The optimum seed rate for sowing late-sown wheat under irrigated conditions in Uttar Pradesh is generally recommended to be:

(A) 100 kg/ha

(B) 125 kg/ha

(C) 150 kg/ha

(D) 75 kg/ha

Q2. Which type of soil crusting is most commonly observed in the alluvial soils of the Indo-Gangetic plains of Uttar Pradesh after a light shower followed by a dry spell, hindering seedling emergence?

(A) Structural crust

(B) Depositional crust

(C) Flexural crust

(D) Chemical precipitation crust

Q3. When the available water in the root zone reaches the critical level, scheduling irrigation based on the Climatological Approach uses the ratio of Irrigation Water (IW) to Cumulative Pan Evaporation (CPE). For a wheat crop during its vegetative growth stage, the ideal IW/CPE ratio is:

(A) 0.45

(B) 0.60

(C) 0.75

(D) 0.90

Q4. Which of the following acts as a selective, systemic, post-emergence herbicide commonly utilized to manage both grassy and broad-leaved weeds simultaneously in direct-seeded rice (DSR)?

(A) Pendimethalin

(B) Bispyribac-sodium

(C) Pretilachlor

(D) Atrazine

Q5. The critical stage for irrigation in the mustard crop (Brassica juncea), where water stress causes the most significant reduction in seed yield, is:

(A) Rosette stage

(B) Flowering and siliqua development stages

(C) Early branching stage

(D) Seed hardening stage

Q6. The Bundelkhand region of Uttar Pradesh prominently features "Rakar" and "Mar" soils. Which of the following is a characteristic feature of "Mar" soil?

(A) Light textured reddish sandy loam with poor water holding capacity

(B) Black cotton soil type, rich in clay, showing deep cracking behavior when dry

(C) High gravelly and stones-mixed brown forest soil

(D) Highly saline-alkali soil with calcareous nodules

Q7. For complete reclamation of highly sodic soils (Usar) found in central districts of Uttar Pradesh like Unnao and Hardoi, the quantity of gypsum application is calculated based on the:

(A) Electrical Conductivity (EC) of the saturation extract

(B) Exchangeable Sodium Percentage (ESP) and CEC of the soil

(C) Total soluble salts present in the upper 15 cm soil layer

(D) Active acidity measured by soil pH water suspension

Q8. In dryland agriculture, the use of chemical antitranspirants helps minimize moisture loss. Which of the following is classified as a stomata-closing type antitranspirant?

(A) Kaolin clay

(B) Phenyl mercuric acetate (PMA)

(C) Liquid paraffin

(D) Celite

Q9. An oilseed crop grown widely during Rabi in UP is linseed (Linum usitatissimum). When it is cultivated primarily for both high-quality fiber (flax) and seed purpose, it is taxonomically referred to as a:

(A) Single-purpose crop

(B) Dual-purpose linseed

(C) Catch crop

Q10. The scientific reason behind providing a "blind hoeing" operation in sugarcane crop management is to:

(A) Distribute nitrogenous fertilizer evenly near the root zone after germinating

(B) Break the hard soil crust and eliminate early weeds before the sprouts emerge

(C) Earth up the soil around the rows to prevent lodging during high winds

(D) Support the multi-tier root system of ratoon crops

Q11. In sub-surface drainage systems designed for waterlogged agricultural lands, the vertical distance from the ground surface to the centerline of the tile drain pipe is known as the tile depth. The spacing between two parallel tile drains increases when:

(A) The hydraulic conductivity of the soil profile is low

(B) The hydraulic conductivity of the soil profile is high

(C) The drainage coefficient required is very high

(D) The depth of the impermeable barrier layer is very shallow

Q12. Which of the following absolute root parasitic weeds poses a major threat to the cultivation of mustard and rapeseed crops in the semi-arid tracts of Uttar Pradesh?

(A) Striga asiatica

(B) Cuscuta reflexa

(C) Orobanche aegyptiaca

(D) Loranthus longiflorus

Q13. The recovery percentage of sugar from sugarcane stalks in subtropical regions like Uttar Pradesh generally hovers around which of the following standard ranges?

(A) 6.5% to 8.0%

(B) 9.5% to 11.5%

(C) 14.0% to 16.0%

(D) 17.5% to 19.0%

Q14. Under the universally accepted Universal Soil Loss Equation (USLE), $A = R \times K \times L \times S \times C \times P$, the factor 'K' specifically denotes the:

(A) Rainfall erosivity index calculated from kinetic energy

(B) Soil erodibility factor based on inherent soil properties

(C) Topographic slope length and steepness ratio

(D) Cropping management and conservation practice system

Q15. For achieving maximum water use efficiency (WUE) in a widely spaced high-value commercial crop like Bt Cotton or Sugarcane, which method of pressurized irrigation is technically superior?

(A) Surge irrigation

(B) Check basin irrigation

(C) Drip/Trickle irrigation

(D) Perforated pipe sprinkler irrigation

Q16. The physiological phenomenon of "Flushing" or "Nipping" in chickpea (Cicer arietinum) management implies the removal of apical buds to:

(A) Prevent early flowering and extend the vegetative framework

(B) Induce lateral branching, which increases the total number of pod-bearing sites

(C) Check the infestation of gram pod borer at an early vegetative stage

(D) Maximize sunlight penetration to lower branches to avoid fungal rotting

Q17. The dominant weed species found competing intensely within wheat crops across western Uttar Pradesh that has developed widespread resistance against the herbicide isoproturon is:

(A) Phalaris minor

(B) Chenopodium album

(C) Avena fatua

(D) Convolvulus arvensis

Q18. Which index is calculated to evaluate the efficiency of a field drainage system by assessing how rapidly the water table falls within a given period after heavy precipitation?

(A) Drainage Coefficient

(B) Drawdown rate

(C) Leaching requirement index

(D) Hydraulic gradient ratio

Q19. The process of "Retting" in jute or sunnhemp cultivation is essentially a bio-chemical process governed by microorganisms to loosen the phloem fibers from the woody core. The optimum water temperature range for efficient retting is:

(A) 18°C to 22°C

(B) 25°C to 28°C

(C) 34°C to 38°C

(D) 42°C to 46°C

Q20. What type of tillage is defined as a system that minimizes soil disturbance, leaves at least 30% of crop residue cover on the soil surface to mitigate water erosion, and optimizes energy inputs?

(A) Clean intensive tillage

(B) Conservation tillage

(C) Deep structural plowing

(D) Year-round rotary tillage

Q21. The specific symptom of "Khaira disease" in rice fields, prevalent in the Tarai region of Uttar Pradesh, can be rectified by the foliar application or basal dressing of:

(A) Ferrous sulfate

(B) Manganese sulfate

(C) Zinc sulfate

Q22. The moisture content at which plants can no longer extract water from the soil because the suction pressure of the soil particles exceeds the osmotic extraction capabilities of the roots is known as the:

(A) Permanent Wilting Point (PWP) at 15 bars tension

(B) Field Capacity at 0.33 bar tension

(C) Hygroscopic coefficient at 31 bars tension

(D) Maximum water holding capacity at zero tension

Q23. Which pulse crop is highly sensitive to waterlogging conditions during its early growth phases but exhibits excellent drought resistance during later stages, making it highly suitable for rainfed tracts of UP?

(A) Field Pea (Pisum sativum)

(B) Lentil (Lens culinaris)

(C) Pigeonpea / Arhar (Cajanus cajan)

(D) Mungbean (Vigna radiata)

Q24. The concept of "Critical Period of Weed Competition" implies the specific time span during the crop growth cycle when:

(A) Weeds grow faster than the crop and produce seeds for the next cycle

(B) Weed management practices yield the highest economic returns and prevent maximum yield loss

(C) Herbicides display their highest physiological selectivity inside the weed system

(D) Weed roots completely exhaust the soil moisture profile

Q25. In zero-tillage systems for establishing wheat after rice harvesting, the physical property of soil that is expected to show an increase in the top 0–5 cm layer over long-term continuous practice is:

(A) Bulk density

(B) Total macroporosity

(C) Soil organic carbon content and aggregate stability

(D) Saturated hydraulic conductivity

Detailed Solutions

Q1.

Solution

Concept:

Agronomic management of wheat (Triticum aestivum) in Uttar Pradesh requires adjusting the seed rate depending on the sowing window. When wheat sowing is delayed into late December or early January, typically following late-harvested rice or sugarcane, the crop encounters lower temperatures during early growth phases and a shortened vegetative period, which severely restricts its natural tillering capacity.

Solution:

(a) Under normal, timely-sown irrigated conditions in the state, a seed rate of 100 kg/ha is sufficient because the individual plants have ample time to develop primary and secondary tillers.

(b) When the crop is sown late, the individual plant growth period is shrunk, leading to significantly fewer tillers per unit area.

(c) To compensate for this biological limitation and ensure an optimum spike-bearing population per square meter, the seed rate must be increased by 25

(d) This elevates the standard recommendation from 100 kg/ha up to 125 kg/ha for late-sown conditions.

(e) Raising the rate further to 150 kg/ha creates excessive intra-crop competition for light and nutrients, which degrades grain quality, whereas 75 kg/ha results in a sparse plant population and low yields.

Final Answer: The optimum seed rate for late-sown wheat under irrigated conditions is 125 kg/ha.

Answer: (B)

Go Back to Question 1

Q2.

Solution

Concept:

Soil crusting is a critical physical phenomenon occurring at the soil-atmosphere interface. In the Indo-Gangetic alluvial plains of Uttar Pradesh, light rainfall breaks down surface soil aggregates. Subsequent rapid solar drying forms a hard, consolidated layer that acts as a strong mechanical barrier against emerging plumules.

Solution:

(a) Structural crusts develop in situ through the direct kinetic energy of raindrops breaking down vulnerable soil aggregates, combined with the chemical dispersion of clay particles at the surface.

(b) Depositional crusts form when soil particles are detached from higher spots, transported by running water, and deposited in low-lying micro-depressions, creating a layered, muddy seal.

(c) Alluvial soils with high fine sand and silt fractions but low organic matter are highly susceptible to structural crusting when dry spells follow light rain.

(d) The resulting high tensile strength of this crust severely obstructs tender seedlings from emerging smoothly, causing poor field emergence.

(e) Flexural and chemical crusts are not the primary physical drivers of seedling emergence issues in these non-saline alluvial environments.

Final Answer: The type of soil crusting commonly observed is Structural crust.

Answer: (A)

Go Back to Question 2

Q3.

Solution

Concept:

The climatological approach for scheduling irrigation relies on the scientific relationship between Irrigation Water (IW) and Cumulative Pan Evaporation (CPE). This ratio serves as an index of the crop's atmospheric water demand and evapotranspirational needs across different growth stages, ensuring highly efficient water use.

Solution:

(a) The IW/CPE ratio represents the depth of irrigation water applied divided by the total evaporation loss recorded from an open pan evaporimeter since the last irrigation cycle.

(b) Wheat requires precise water application during its vegetative phase, especially at the critical crown root initiation (CRI) and late jointing stages, to sustain proper tillering and biomass production.

(c) Comprehensive field trials across Uttar Pradesh indicate that maintaining an IW/CPE ratio of 0.75 ensures optimal soil moisture availability without causing water stress or deep percolation loss.

(d) Lower ratios like 0.45 or 0.60 cause water stress, which limits growth, while a ratio of 0.90 is overly excessive and reduces overall water use efficiency.

(e) Adhering to the 0.75 ratio helps maintain a healthy balance between vegetative growth and soil moisture storage.

Final Answer: The ideal IW/CPE ratio for a wheat crop during its vegetative growth stage is 0.75.

Answer: (C)

Go Back to Question 3

Q4.

Solution

Concept:

Direct-seeded rice (DSR) eliminates puddling and transplanting operations, making the crop highly susceptible to severe weed competition. Effective chemical management requires a post-emergence herbicide with a broad spectrum of activity that can safely eliminate weeds without harming the young rice plants.

Solution:

(a) Bispyribac-sodium is a selective, systemic, post-emergence herbicide belonging to the pyrimidinyl carboxy group, which functions by inhibiting the acetolactate synthase (ALS) enzyme in susceptible weeds.

(b) It is applied 15 to 25 days after sowing and is absorbed by weed foliage and roots, efficiently controlling major grasses like Echinochloa spp. and various broad-leaved weeds.

(c) Pendimethalin is a pre-emergence herbicide that is ineffective when applied after weeds have fully emerged.

(d) Pretilachlor is also a pre-emergence herbicide used primarily in transplanted or early wet-seeded systems, requiring a safener for direct-seeded setups.

(e) Atrazine is a selective herbicide restricted to maize and sugarcane crops; applying it to rice causes severe phytotoxicity and crop loss.

Final Answer: The selective, systemic, post-emergence herbicide commonly utilized is Bispyribac-sodium.

Answer: (B)

Go Back to Question 4

Q5.

Solution

Concept:

Identifying critical crop growth stages for irrigation is essential to protect yield potential and save water. For Indian mustard (Brassica juncea), specific phases are highly sensitive to moisture stress because any deficit disrupts pollination, reproductive development, and overall grain filling.

Solution:

(a) Mustard is moderately drought-tolerant during early growth, but its moisture demand peaks sharply when shifting from vegetative growth to reproductive phases.

(b) The combined flowering and siliqua development stages represent the most critical window; moisture stress now triggers flower drop, poor pod setting, and lower oil content.

(c) Individual stages like the early rosette phase or branching require minor moisture, and a shortage there does not lower final yield as drastically.

(d) The seed hardening stage marks the end of physiological maturity, meaning late water applications provide no economic yield benefit.

(e) Providing adequate irrigation during flowering and siliqua development ensures optimal seed size, high pod numbers, and maximum oil production per hectare.

Final Answer: The critical stage for irrigation in the mustard crop is Flowering and siliqua development stages.

Answer: (B)

Go Back to Question 5

Q6.

Solution

Concept:

The Bundelkhand region of southwestern Uttar Pradesh has unique physiographic formations resulting in two broad soil groups: red soils (Parwa and Rakar) and black soils (Kabur and Mar). Understanding their physical behavior is crucial for selecting appropriate tillage and cropping systems.

Solution:

(a) Mar soil is a deep, dark-colored black clay soil rich in montmorillonite clay minerals, making it highly cohesive and sticky when wet.

(b) Because of its high clay content, Mar soil expands when wet and shrinks dramatically upon drying, forming wide, deep cracks across the field surface.

(c) Rakar soil is a degraded, light-textured, reddish sandy loam found on higher slopes with poor water retention.

(d) Mar soils have an exceptional water-holding capacity, but their high stickiness creates a narrow moisture window for effective tillage and seedbed preparation.

(e) These soils are highly fertile but require precise management to avoid compaction when wet and hard clods when dry.

Final Answer: The characteristic feature of Mar soil is that it is a black cotton soil type, rich in clay, showing deep cracking behavior when dry.

Answer: (B)

Go Back to Question 6

Q7.

Solution

Concept:

Reclaiming highly sodic soils (Usar), common in central Uttar Pradesh, requires replacing toxic exchangeable sodium ions on the soil clay complex with calcium ions. Calculating the chemical amendment dose requires assessing the total exchange capacity alongside the relative proportion of adsorbed sodium.

Solution:

(a) Sodic soils are characterized by an Exchangeable Sodium Percentage (ESP) greater than 15, a high pH above 8.5, and low soluble salt levels.

(b) Gypsum requirements cannot be determined by Electrical Conductivity (EC), which measures soluble salts, nor by simple water pH, which only reflects active alkalinity.

(c) The precise gypsum dose depends directly on the initial ESP and the soil's Cation Exchange Capacity (CEC), calculating the total calcium needed to lower the ESP to a safe level.

(d) Applying gypsum supplies calcium ions (Ca^{2+}), which displace exchangeable sodium (Na^{+}) into the soil solution, allowing it to be leached out as sodium sulfate (Na_2SO_4).

(e) This process improves soil structure, root zone aeration, and overall crop productivity.

Final Answer: The quantity of gypsum application is calculated based on the Exchangeable Sodium Percentage (ESP) and CEC of the soil.

Answer: (B)

Go Back to Question 7

Q8.

Solution

Concept:

Antitranspirants are chemical compounds applied to crop foliage to reduce water loss through transpiration. They are vital in dryland and rainfed agriculture to preserve internal plant moisture during prolonged droughts. They are classified into stomata-closing, film-forming, reflecting, and growth-retarding types.

Solution:

(a) Stomata-closing antitranspirants induce partial or complete closure of the guard cells, reducing water vapor loss while minimizing impacts on carbon dioxide fixation.

(b) Phenyl mercuric acetate (PMA) is a classic stomata-closing agent that alters guard cell turgor pressure at very low concentrations.

(c) Kaolin and celite are reflecting antitranspirants; they coat leaves with a white film that increases albedo, lowers leaf temperature, and reduces transpiration.

(d) Liquid paraffin is a film-forming antitranspirant that creates a physical barrier over the leaf surface to block escaping moisture.

(e) Using PMA helps crops survive dry spells by conserving critical moisture reserves within the root zone.

Final Answer: The chemical classified as a stomata-closing type antitranspirant is Phenyl mercuric acetate (PMA).

Answer: (B)

Go Back to Question 8

Q9.

Solution

Concept:

Linseed (Linum usitatissimum) is a multipurpose Rabi crop grown across Uttar Pradesh. Depending on the target economic product, cultivars are selected for oil extraction from seeds, high-strength bast fiber (flax) from stems, or both simultaneously.

Solution:

(a) Purely oilseed varieties are short, highly branched, and produce abundant seeds, while specialized flax varieties are tall with minimal branching to maximize fiber length.

(b) Varieties bred to produce acceptable yields of both high-quality industrial fiber and oil-rich seeds are designated as dual-purpose linseed.

(c) Cultivating dual-purpose types maximizes economic returns per unit area for farmers in rainfed regions.

(d) The term catch crop refers to a quick-maturing crop planted to utilize a short window between two main seasons, which does not apply to full-season linseed.

(e) Selecting a dual-purpose cultivar requires adjusting crop geometry and nitrogen applications to support both stem elongation and seed head development.

Final Answer: The crop is taxonomically referred to as a Dual-purpose linseed.

Answer: (B)

Go Back to Question 9

Q10.

Solution

Concept:

Blind hoeing is a specialized shallow tillage operation performed in sugarcane cultivation after planting but before the crop shoots emerge from the soil. This practice is tailored to the long germination period of sugarcane, which often takes three to four weeks.

Solution:

(a) Frequent pre-emergence irrigations or early spring rains can form a dense surface crust that restricts oxygen availability and blocks emerging sugarcane sprouts.

(b) Blind hoeing breaks this surface crust using a light harrow or cultivator without disturbing the buried setts, improving soil aeration.

(c) It also uproots and destroys fast-growing weed seedlings that emerged before the sugarcane, reducing early weed competition.

(d) It does not involve applying nitrogenous fertilizer to the root zone, as the roots are not yet functional.

(e) Earthing up is done much later in the crop cycle, during the peak tillering and grand growth phases, to prevent lodging.

Final Answer: The scientific reason is to break the hard soil crust and eliminate early weeds before the sprouts emerge.

Answer: (B)

Go Back to Question 10

Q11.

Solution

Concept:

Sub-surface agricultural drainage relies heavily on the physical laws of water movement through porous media. The design parameters, primarily tile drain spacing and installation depth, are calculated mathematically using drainage equations like Hooghoudt's equation. This equation describes steady-state groundwater flow to parallel tile lines based on soil hydraulic properties.

Solution:

(a) According to drainage equations, the spacing between parallel sub-surface tile drains is directly proportional to the square root of the hydraulic conductivity of the soil profile.

(b) When sub-surface soils possess high hydraulic conductivity, lateral water movement toward the drains happens rapidly because the soil particles offer less resistance.

(c) This high permeability enables a single drain line to draw down the water table from a much greater lateral distance on either side.

(d) Consequently, agricultural engineers can place parallel tile drains further apart from each other while still achieving the desired lowering of the water table.

(e) If soil hydraulic conductivity is low, as seen in heavy clay soils, lateral movement is sluggish, which requires tighter, narrow drain spacing to prevent prolonged root zone waterlogging.

Final Answer: The spacing between two parallel tile drains increases when the hydraulic conductivity of the soil profile is high.

Answer: (B)

Go Back to Question 11

Q12.

Solution

Concept:

Parasitic weeds cause massive economic losses by siphoning nutrients, water, and photosynthates directly from host crops. In rapeseed and mustard farming, root-attached holoparasites lack chlorophyll and depend entirely on chemical signals from host roots to trigger seed germination and establish a vascular connection.

Solution:

(a) Orobanche aegyptiaca, commonly known as broomrape, is an absolute, non-chlorophyllous root parasite that attaches itself via haustoria to the root system of cruciferous crops.

(b) The parasite seeds remain dormant in alluvial or light soils for years until stimulated by strigolactones exuded by growing mustard roots.

(c) Striga species are semi-parasitic weeds that primarily target cereal crops and millets like sorghum or pearl millet, rather than oilseeds.

(d) Cuscuta reflexa is a total stem parasite with yellowish leafless vines that wrap around the shoots of trees or dense hedges.

(e) Loranthus is a partial stem parasite commonly found on perennial horticultural plantation trees like mango or citrus, rather than annual field crops.

Final Answer: The absolute root parasitic weed that poses a major threat is Orobanche aegyptiaca.

Answer: (C)

Go Back to Question 12

Q13.

Solution

Concept:

Sugar recovery is an essential economic metric representing the commercial yield of crystallized sugar expressed as a percentage of the total weight of sugarcane stalks crushed. This recovery index varies based on agro-climatic conditions, crop maturity, milling efficiency, and regional temperature variations.

Solution:

(a) In subtropical regions like Uttar Pradesh, climatic conditions alternate between hot summers and distinct cold winters, which regulates sugar synthesis and accumulation in sugarcane internodes.

(b) The commercial sugar recovery from sugarcane crops across the central and western crushing zones of Uttar Pradesh typically varies within the range of 9.5

(c) High recovery values near 11.5

(d) Tropical regions like Maharashtra or southern India can achieve higher recovery averages due to extended, moderate crushing windows and uniform temperatures.

(e) Very low ranges like 6.5

Final Answer: The recovery percentage of sugar from sugarcane stalks generally hovers around 9.5

Answer: (B)

Go Back to Question 13

Q14.

Solution

Concept:

The Universal Soil Loss Equation (USLE) is a widely used empirical model designed to predict the long-term average annual rate of soil erosion caused by water. The equation integrates distinct environmental, physical, and management parameters to guide regional soil conservation planning.

Solution:

(a) In the mathematical formula, the parameter A denotes the computed spatial soil loss per unit area, which depends on individual interacting factors.

(b) The variable R signifies the rainfall and runoff erosivity index, which evaluates the kinetic energy and maximum intensity of storm events.

(c) The factor K specifically represents the soil erodibility factor, which measures the inherent susceptibility of soil particles to detachment and transport by water.

(d) This K factor is calculated based on intrinsic soil parameters, including structural stability, organic matter content, soil texture, and profile permeability.

(e) The remaining parameters L, S, C, and P account for slope length, slope steepness, cover management, and supporting conservation structures, respectively.

Final Answer: The factor 'K' specifically denotes the soil erodibility factor based on inherent soil properties.

Answer: (B)

Go Back to Question 14

Q15.

Solution

Concept:

Water use efficiency (WUE) relates the economic yield of a crop to the total volume of irrigation water consumed. Maximizing this efficiency requires advanced irrigation methods that minimize conveyance losses, surface evaporation, and deep percolation below the root zone.

Solution:

(a) Drip irrigation delivers water directly to the immediate root zone of individual plants through a network of plastic pipes and emitters operating under low pressure.

(b) This direct application eliminates wide wetting patterns, which minimizes surface evaporation and prevents water from accumulating in non-cropped inter-row spaces.

(c) Check basin and surge irrigation are surface flooding methods that suffer from high evaporation and deep percolation losses.

(d) Sprinkler irrigation distributes water over the entire canopy, leading to high wind drift and evaporation losses in wide-spaced row crops.

(e) For wide-row commercial crops like sugarcane or cotton, drip irrigation maximizes water savings and achieves the highest water use efficiency.

Final Answer: The method of pressurized irrigation that is technically superior is Drip/Trickle irrigation.

Answer: (C)

Go Back to Question 15

Q16.

Solution

Concept:

Nipping or flushing is a vital agronomic modification practiced in chickpea (gram) cultivation. The physiology of the chickpea plant is regulated by apical dominance, where hormones produced in the topmost growing tip suppress the development of lower lateral branches.

Solution:

(a) Removing the dominant apical bud between 30 to 45 days after sowing disrupts the downward flow of auxin within the plant stem.

(b) This hormonal change releases lateral buds from dormancy, stimulating branching and producing a more compact, bushy plant canopy.

(c) Because chickpea flowers and pods develop on lateral branches, increasing the branch count directly boosts the number of pod-bearing sites.

(d) This cultural practice prevents the plant from expending energy on excessive vertical growth, redirecting resources to maximize grain yield.

(e) While nipping can be done chemically or mechanically by grazing sheep, its main objective is structural optimization rather than direct pest control.

Final Answer: The physiological phenomenon of nipping implies the removal of apical buds to induce lateral branching, which increases the total number of pod-bearing sites.

Answer: (B)

Go Back to Question 16

Q17.

Solution

Concept:

Continuous, single-herbicide weed management creates high selection pressure, accelerating the evolution of biotypes with target-site or non-target-site herbicide resistance. This issue is prominent in intensive rice-wheat cropping systems across the Indo-Gangetic plains.

Solution:

(a) Phalaris minor, commonly known as canary grass, is a major mimic weed that infests wheat fields and competes fiercely for nitrogen, light, and space.

(b) For decades, farmers in western Uttar Pradesh relied heavily on the substituted urea herbicide isoproturon to manage this weed species.

(c) Continuous exposure led Phalaris minor to develop widespread resistance to isoproturon, rendering recommended field doses ineffective.

(d) Broad-leaved weeds like Chenopodium album or Convolvulus arvensis have different physiological vulnerabilities and were not the primary drivers of this specific resistance crisis.

(e) Managing this resistant biotype now requires rotating herbicides with alternative modes of action, such as sulfosulfuron, clodinafop-propargyl, or pinoxaden.

Final Answer: The dominant weed species that has developed widespread resistance against isoproturon is Phalaris minor.

Answer: (A)

Go Back to Question 17

Q18.

Solution

Concept:

Evaluating the operational performance of sub-surface drainage systems requires monitoring changes in water table depth over time. A functional drainage system must lower waterlogging quickly enough to prevent root asphyxiation and maintain an aerated root zone.

Solution:

(a) The drawdown rate is the measurable speed or vertical distance that the water table drops within a specific timeframe after rainfall or irrigation stops.

(b) This rate directly reflects how efficiently tile drains or open ditches remove excess gravity water from the soil profile.

(c) The drainage coefficient indicates the total depth of water removed from an area in 24 hours, serving as a capacity design value rather than a response rate.

(d) Leaching requirement measures the excess irrigation water needed to flush accumulated salts down past the root zone.

(e) Tracking the drawdown rate helps engineers confirm whether the drainage layout provides adequate aeration to support crop root respiration.

Final Answer: The index calculated to evaluate this performance is Drawdown rate.

Answer: (B)

Go Back to Question 18

Q19.

Solution

Concept:

Retting is a controlled biochemical process used to extract commercial bast fibers from fiber crops like jute and sunnhemp. Submerging harvested stems in water activates aquatic microorganisms that consume pectin, hemi-cellulose, and sticky gums, freeing the fibers from the woody inner core.

Solution:

(a) The rate and efficiency of retting depend on the metabolic activity of anaerobic, spore-forming bacteria like Clostridium butyricum found in the water.

(b) These specialized saprophytic bacteria require warm water to maximize enzyme secretion and speed up the breakdown of plant tissues.

(c) Field research indicates that a water temperature range between 34°C and 38°C provides the ideal environment for these microbes.

(d) Temperatures below 28°C slow bacterial multiplication, prolonging the retting process and lowering fiber quality.

(e) Temperatures above 42°C can kill beneficial microflora or over-rett the stalks, which weakens and damages the fiber strands.

Final Answer: The optimum water temperature range for efficient retting is 34°C to 38°C.

Answer: (C)

Go Back to Question 19

Q20.

Solution

Concept:

Modern resource-conserving technologies focus on reducing intensive tillage to protect soil structure and save fuel. Conservation tillage programs maintain a protective layer of organic residues on the soil surface to buffer the soil against environmental degradation.

Solution:

(a) Conservation tillage is an umbrella term for tillage methods that leave at least 30

(b) This residue barrier intercepts raindrops, reducing soil detachment and limiting water and wind erosion.

(c) Clean intensive tillage removes all surface residues, leaving the bare soil vulnerable to crusting, sealing, and accelerated erosion.

(d) Conservation tillage includes specific variants like zero-tillage, strip-tillage, and ridge-tillage, all of which reduce mechanical soil disruption.

(e) Adopting this tillage management strategy improves long-term soil organic carbon storage, enhances water infiltration, and lowers overall production costs.

Final Answer: The type of tillage defined by these parameters is Conservation tillage.

Answer: (B)

Go Back to Question 20

Q21.

Solution

Concept:

Nutritional deficiencies significantly impair the physiological development of major cereals. Khaira disease in rice is a well-documented nutritional disorder prevalent in the calcareous, high-pH, or poorly drained alluvial soils of the Tarai belt in Uttar Pradesh. This disorder is caused by the unavailability or absolute deficiency of an essential micronutrient needed for chlorophyll synthesis and enzyme activation.

Solution:

(a) Khaira disease is caused by a deficiency of plant-available zinc (Zn^{2+}) in the soil, which often occurs due to high soil pH or excessive phosphatic fertilization that precipitates zinc.

(b) The classic symptoms appear in the nursery or early vegetative phase as a characteristic rust-colored or brownish discoloration on the older leaves.

(c) This discoloration reduces photosynthetic efficiency, leading to stunted plant growth, restricted tillering, and uneven patchiness across the field profile.

(d) Ferrous sulfate addresses iron chlorosis, which causes interveinal yellowing of young leaves rather than rust-colored patches.

(e) Basal application of zinc sulfate at 25 kg/ha or foliar sprays mixed with lime neutralizes the deficiency, restores enzyme functions, and allows the crop to recover its normal yield potential.

Final Answer: The symptom of Khaira disease can be rectified by the application of Zinc sulfate.

Answer: (C)

Go Back to Question 21

Q22.

Solution

Concept:

Soil-water energy concepts explain how water is held within the soil matrix by matric and osmotic suction forces. Plants can only extract water if their root suction pressure exceeds the water-retention forces of the soil particles. The point where the soil holds water so tightly that roots cannot absorb it marks a critical physiological limit.

Solution:

(a) The Permanent Wilting Point (PWP) represents the lower boundary of plant-available water storage within the root zone matrix.

(b) At this stage, the soil moisture film is held at a high matric suction pressure of approximately 15 bars (or 1.5 MPa).

(c) Because the soil's retention forces match or exceed the maximum osmotic suction of the root cells, water movement into the plant ceases.

(d) As a result, the plant loses turgor pressure and wilts permanently, failing to recover even if placed in a humid environment without water additions.

(e) Field Capacity occurs at a lower tension of 0.33 bar, representing the upper limit of available water, while the hygroscopic coefficient at 31 bars refers to non-liquid water vapor.

Final Answer: The moisture content at which plants can no longer extract water is known as the Permanent Wilting Point (PWP) at 15 bars tension.

Answer: (A)

Go Back to Question 22

Q23.

Solution

Concept:

Pulse crops exhibit distinct morphological and root structural adaptations that determine their tolerance to moisture extremes. Selecting appropriate pulse varieties for rainfed regions in Uttar Pradesh requires evaluating how crops respond to early excess moisture versus late seasonal droughts.

Solution:

(a) Pigeonpea (Arhar) develops a deep, robust taproot system that allows it to extract water from lower soil profiles during late-season terminal droughts.

(b) However, during its initial vegetative and seedling stages, the crop lacks a well-developed internal aerenchyma tissue system, making it highly vulnerable to root zone waterlogging.

(c) Prolonged stagnant water during early growth causes root asphyxiation, nutrient deficiencies, and high mortality from fungal root rot diseases.

(d) Field peas and lentils prefer cool, well-drained conditions and lack the extensive root depth needed to withstand severe terminal droughts.

(e) Mungbean is a short-duration crop that avoids long-term weather fluctuations rather than enduring them through structural modifications.

Final Answer: The pulse crop highly sensitive to early waterlogging but drought-resistant later is Pigeonpea / Arhar (Cajanus cajan).

Answer: (C)

Go Back to Question 23

Q24.

Solution

Concept:

Weed-crop competition is a dynamic process influenced by crop growth stage, weed density, and environmental factors. The critical period of weed competition is a key component of integrated weed management, defining the specific growth window when weed interference causes permanent yield losses.

Solution:

(a) This critical period represents the specific phase of the crop cycle during which weed growth must be controlled to prevent economic yield decline.

(b) Weeds emerging before or after this window do not compete intensely enough with the main crop canopy to cause severe financial losses.

(c) Managing weeds during this timeframe ensures high resource use efficiency, as inputs are directed toward protecting the crop during its most vulnerable stage.

(d) It does not refer to the period of maximum weed seed production or the time of highest physiological selectivity for chemical herbicides.

(e) Identifying this window helps farmers optimize the timing of manual hoeing or post-emergence herbicide applications, reducing overall management costs.

Final Answer: The concept implies the specific time span during the crop growth cycle when weed management practices yield the highest economic returns and prevent maximum yield loss.

Answer: (B)

Go Back to Question 24

Q25.

Solution

Concept:

Long-term zero-tillage management alters the physical, chemical, and biological properties of the upper soil profile by eliminating mechanical inversion. Retaining crop residues on the soil surface changes how organic matter accumulates and alters structural aggregate stability.

Solution:

(a) Continuous zero-tillage allows roots and left-over crop stubble to decompose gradually in place, concentrating organic carbon within the top 0–5 cm soil layer.

(b) This accumulation of humified organic molecules binds individual soil particles together, improving macro-aggregate stability and surface structural integrity.

(c) Intensive conventional tillage mechanically breaks down these organic bonds, accelerating the oxidation and loss of organic carbon from the soil profile.

(d) While zero-tillage can slightly increase bulk density in the short term due to natural settling, the long-term buildup of organic matter helps mitigate this compaction.

(e) This enhanced structural stability protects the soil surface against rainfall impact, helping to prevent structural crusting and reduce erosion losses.

Final Answer: The physical property of soil expected to show an increase is Soil organic carbon content and aggregate stability.

Answer: (C)

Go Back to Question 25

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	A	3	C	4	B	5	B
6	B	7	B	8	B	9	B	10	B
11	B	12	C	13	B	14	B	15	C
16	B	17	A	18	B	19	C	20	B
21	C	22	A	23	C	24	B	25	C