

# UPCATET Agronomy Sample Paper-10

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.** Which of the following is the recommended seed rate (kg/ha) for the timely sown dwarf varieties of wheat in Uttar Pradesh?

- (A) 75–80
- (B) 100–125
- (C) 140–150
- (D) 50–60

**Q2.** Deep black soils found in southern Bundelkhand region of Uttar Pradesh, locally known for high clay content and swelling-shrinking properties, are classified under which local name?

- (A) Rakar
- (B) Parwa
- (C) Mar
- (D) Bhur

**Q3.** The critical growth stage for moisture requirement in Maize crop where water stress can lead to the maximum reduction in grain yield is:

- (A) Knee-high stage



- (B) Silking and tasseling stage
- (C) 4–6 leaf stage
- (D) Dough stage

**Q4.** Which of the following herbicides is most widely recommended for the selective control of *Phalaris minor* in wheat fields where isoproturon resistance has been confirmed?

- (A) 2,4-D Ethyl Ester
- (B) Sulfosulfuron
- (C) Atrazine
- (D) Fluchloralin

**Q5.** The nursery raising method in rice which requires the least amount of water and allows seedlings to become ready for transplanting within 12–15 days is known as:

- (A) Wet bed method
- (B) Dry bed method
- (C) Dapog method

**Q6.** Which type of soil water is held between 0.3 atmospheres and 31 atmospheres of tension and is considered the primary source of water available to agricultural crops?

- (A) Gravitational water
- (B) Capillary water
- (C) Hygroscopic water
- (D) Chemically combined water

**Q7.** Which of the following is a multi-purpose primary tillage implement designed to break deep hardpans, improve sub-surface drainage, and alleviate soil compaction without inverting the soil?



- (A) Disc harrow
- (B) Chisel plow
- (C) Cultivator
- (D) Rotavator

**Q8.** The non-selective, contact, post-emergence herbicide commonly used for absolute vegetation control in zero-tillage or conservation agriculture systems is:

- (A) Pendimethalin
- (B) Paraquat
- (C) Alachlor
- (D) Butachlor

**Q9.** The stripping and retting processes are crucial post-harvest operations associated with the extraction of commercial fiber from which of the following cash crops?

- (A) Cotton
- (B) Jute
- (C) Sugarcane
- (D) Tobacco

**Q10.** For the calculation of water-use efficiency (WUE) of a field crop, which of the following formulas is scientifically accurate?

- (A) Water-use efficiency = Yield / Evapotranspiration
- (B) Water-use efficiency = Evapotranspiration / Yield
- (C) Water-use efficiency = Yield / Total Irrigation Water Applied
- (D) Water-use efficiency = Transpiration / Yield

**Q11.** What is the ideal row-to-row and plant-to-plant spacing (in cm) recommended for the optimum plant population of main-season pigeonpea (Arhar) under uniform flat sowing?

- (A) 30 x 10



- (B) 45 x 15
- (C) 60 x 20
- (D) 90 x 20

**Q12.** The form of soil water erosion that manifests as minute, finger-like micro-channels across a cultivated field and can be easily obliterated by normal tillage operations is called:

- (A) Splash erosion
- (B) Sheet erosion
- (C) Rill erosion
- (D) Gully erosion

**Q13.** An irrigation scheduling method that utilizes a porous ceramic cup filled with water connected to a vacuum gauge to measure the soil moisture tension directly in the root zone is called:

- (A) Piezometer
- (B) Tensiometer
- (C) Lysimeter
- (D) Neutron moisture probe

**Q14.** Which of the following physiological adaptations is most characteristic of drought-resistant crops (CAM plants) to minimize water loss under severe dryland conditions?

- (A) Broad leaf blade orientation
- (B) High stomatal density on upper leaf surface
- (C) Stomata opening exclusively during the night
- (D) Shallow adventitious root systems

**Q15.** The process of removal of lower unproductive leaves from the sugarcane stalk around 150–180 days after planting to improve aeration and minimize pest infestation is known as:



- (A) Propping
- (B) Detrashing
- (C) Earthing up
- (D) Topping

**Q16.** Which index is calculated by dividing the economically valuable yield by the total biological yield of a crop, expressing the efficiency of dry matter partitioning?

- (A) Crop Index
- (B) Land Equivalent Ratio
- (C) Harvest Index
- (D) Consumptive Use Efficiency

**Q17.** The specific form of soil acidity dominant in heavy-rainfall regions, causing toxicity of which twin elements to the root systems of sensitive pulse crops?

- (A) Calcium and Magnesium
- (B) Sodium and Potassium
- (C) Aluminum and Manganese
- (D) Zinc and Iron

**Q18.** An artificial sub-surface drainage system designed to lower a high water table by laying perforated corrugated PVC pipes at a calculated depth and spacing is called:

- (A) Tile drainage
- (B) Open ditch drainage
- (C) Surge drainage
- (D) Border strip drainage

**Q19.** Which of the following oilseed crops contains erucic acid in its oil and glucosinolates in its cake, requiring strict breeding standards for quality improvement?



- (A) Groundnut
- (B) Rapeseed and Mustard
- (C) Sunflower
- (D) Sesame

**Q20.** When tillage operations are performed across the slope of a hill or undulating field rather than up and down the slope, the main objective is to reduce:

- (A) Wind velocity
- (B) Water runoff and soil erosion
- (C) Evaporation loss
- (D) Weed seed germination

**Q21.** The botanical name of the 'Miracle Tree' or 'Wonder Plant' frequently integrated into dryland agroforestry systems across semi-arid zones for fodder, fuel, and soil nitrogen fixation is:

- (A) *Azadirachta indica*
- (B) *Leucaena leucocephala*
- (C) *Eucalyptus tereticornis*
- (D) *Dalbergia sissoo*

**Q22.** Which critical nutrient deficiency causes the specific physiological disorder known as 'Khaira' in rice fields, highly prevalent in calcareous soils of Uttar Pradesh?

- (A) Nitrogen
- (B) Iron
- (C) Zinc
- (D) Boron

**Q23.** The absolute percentage of total geographical area under a particular soil group that makes Alluvial soils the most dominant and agriculturally vital soil order in Uttar Pradesh is approximately:



- (A) 25
- (B) 40
- (C) 65
- (D) 80

**Q24.** What is the optimum critical stage of irrigation for the Chickpea (Gram) crop where field flooding must be strictly avoided to prevent excessive vegetative growth and flower drop?

- (A) Flowering stage
- (B) Pre-flowering and pod development stages
- (C) Germination stage
- (D) Active tillering stage

**Q25.** The specific companion cropping system where two crops with different growth habits and growth durations are grown together to eliminate inter-crop competition for resources is termed as:

- (A) Parallel cropping
- (B) Synergistic cropping
- (C) Relay cropping
- (D) Multi-tier cropping



**Detailed Solutions****Q1.****Solution****Concept:**

Agronomic management of cereal crops involves identifying optimal seed rates to ensure adequate plant population, which directly impacts grain yield. For dwarf wheat varieties in the plains of Uttar Pradesh, seed rate varies depending on the time of sowing and soil moisture conditions.

**Solution:**

- (a) For timely sown conditions (first fortnight of November) using a seed drill or line sowing method, a seed rate of 100 kg/ha is globally recommended for standard dwarf wheat varieties like HD 2967 or PBW 343.
- (b) When using the broadcasting method or when sowing under late conditions (December), the seed rate is increased by 25 percent to reach approximately 125 kg/ha to compensate for lower tillering capacity.
- (c) Thus, the recommended range covering standard recommended practices for dwarf wheat varieties in Uttar Pradesh is 100–125 kg/ha.
- (d) Lower seed rates like 75–80 kg/ha lead to suboptimal plant density, while higher rates like 140–150 kg/ha induce high inter-plant competition and lodging.

**Final Answer:** The recommended seed rate is 100–125 kg/ha.

**Answer: (B)**

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Q2.

**Solution****Concept:**

Soil classification in Uttar Pradesh involves both scientific soil taxonomy and traditional localized nomenclatures based on physiographic zones. The Bundelkhand region exhibits unique soil types owing to its parent rock topography.

**Solution:**

- (a) The soils of Bundelkhand are broadly categorized into two major groups: Black soils and Red soils.
- (b) The deep black soils found in low-lying plains or valleys of this region are locally designated as Mar or Mota. They contain a high percentage of silicate clay minerals, particularly montmorillonite.
- (c) This high clay content imparts characteristic swelling and shrinking properties, leading to deep cracking during dry summer months and high stickiness during the rainy season, similar to typical Vertisols.
- (d) Conversely, Kabar is a shallow black soil, whereas Rakar and Parwa represent the red soil groups of the undulating uplands characterized by coarser textures and lower moisture retention capacity.

**Final Answer:** The local name for deep black soil is Mar.

**Answer:** (C)

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**Q3.****Solution****Concept:**

Every field crop has specific growth phases during which it is highly sensitive to moisture stress. These are termed critical growth stages, where water deficit disrupts physiological processes and results in severe yield decline.

**Solution:**

- (a) In maize (*Zea mays*), the transition from vegetative to reproductive phase marks the period of highest vulnerability to moisture stress.
- (b) This period includes the silking stage (emergence of female flowers/styles) and the tasseling stage (emergence of male inflorescence), occurring roughly between 45 to 60 days after sowing.
- (c) Water stress at this phase inhibits proper pollen germination, delays silking relative to tasseling (increasing the anthesis-silking interval), and leads to poor fertilization, resulting in barren ears or poorly filled cobs.
- (d) While the knee-high stage and dough stage also require moisture, statistical grain yield reduction is highest during the silking and tasseling window.

**Final Answer:** The critical growth stage is the silking and tasseling stage.

**Answer: (B)**

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Q4.

**Solution****Concept:**

Herbicide resistance management is essential in intensive cropping systems. The continuous use of a single chemical class can lead to the evolution of resistant biotypes in problematic weed species, necessitating a shift to alternative modes of action.

**Solution:**

- (a) *Phalaris minor* (Gullidanda) is a major mimicry weed in wheat fields across the Indo-Gangetic plains, including Western and Central Uttar Pradesh.
- (b) During the 1990s, widespread resistance in *Phalaris minor* was recorded against Isoproturon, a substituted urea herbicide that acts as a photosystem II inhibitor.
- (c) To control these resistant populations, alternative herbicides with different mechanisms were introduced. Sulfosulfuron, a sulfonylurea herbicide that inhibits the acetolactate synthase (ALS) enzyme, became highly effective for selective post-emergence control.
- (d) Other options like Clodinafop-propargyl and Fenoxaprop-p-ethyl are also utilized, while Atrazine is used primarily in maize, and 2,4-D targets broadleaf weeds rather than grassy weeds.

**Final Answer:** The recommended herbicide is Sulfosulfuron.

**Answer: (B)**

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Q5.

**Solution****Concept:**

Rice nursery raising techniques vary based on water availability, labor constraints, and the desired turnaround time for transplanting seedlings into the main puddled field.

**Solution:**

- (a) The Dapog method, originally developed in the Philippines, is a mat-nursery technique where seedlings are raised on an impermeable surface such as concrete, plastic sheets, or compacted soil covered with banana leaves.
- (b) Because the roots do not penetrate into the underlying soil, the seedlings derive nutrition purely from the seed reserves and minimal watering, consuming over 70 percent less water than conventional wet nurseries.
- (c) Seedlings grow rapidly and are ready for transplanting within 12 to 15 days of sowing, which is significantly quicker than the 25 to 30 days required in wet or dry bed systems.
- (d) This method facilitates mechanical transplanting and saves considerable time and field preparation costs.

**Final Answer:** The nursery raising method is the Dapog method.

**Answer: (C)**

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Q6.

**Solution****Concept:**

Soil moisture is categorized based on physical forces and the energy tension with which water molecules are bound to soil particles. Understanding these ranges helps determine the water fraction actually accessible to plant root networks.

**Solution:**

- (a) Soil water tension ranges from 0 atmospheres at saturation up to thousands of atmospheres when completely oven-dry.
- (b) Capillary water is the moisture held within the micro-pores of the soil against the force of gravity, operating within a tension range of 0.3 atmospheres (field capacity) to 31 atmospheres (hygroscopic coefficient).
- (c) The fraction of capillary water held between field capacity (0.3 atm) and the permanent wilting point (15 atm) represents the available water capacity for agricultural crops.
- (d) Gravitational water drains away freely below 0.3 atmospheres, while hygroscopic water is bound too tightly (above 31 atmospheres) for plant roots to extract.

**Final Answer:** The type of soil water is capillary water.

**Answer: (B)**

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Q7.

**Solution****Concept:**

Primary tillage implements are designed to open up compacted soil profiles, cut residues, and alter physical structure deeply. Selecting the correct implement depends on whether soil inversion or deep fracturing is desired.

**Solution:**

- (a) Heavy tractor traffic and repetitive shallow tillage can create a dense, impermeable layer below the plow depth, known as a hardpan.
- (b) A chisel plow is a specialized primary tillage tool equipped with rigid, narrow shanks that penetrate deep into the subsoil profile (typically 20 to 30 cm) to shatter hardpans and alleviate soil compaction.
- (c) Crucially, it fractures and loosens the soil without turning it over or inverting the profile, which helps preserve crop residues on the surface for moisture conservation and erosion control.
- (d) Disc harrows and rotavators operate primarily in shallow zones, while moldboard plows are designed explicitly for complete soil inversion.

**Final Answer:** The primary tillage implement is the chisel plow.

**Answer: (B)**

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Q8.

**Solution****Concept:**

Conservation agriculture practices, such as zero-tillage, rely heavily on chemical weed management prior to crop establishment. This avoids mechanical field preparation and minimizes soil disturbance.

**Solution:**

- (a) In zero-tillage configurations, the existing weed flora and stubble must be entirely eliminated before or immediately after drilling the seeds, but prior to crop emergence.
- (b) Paraquat (dimethyl-dipyridilium) is a highly reliable non-selective, contact, post-emergence herbicide that rapidly destroys all green plant tissues upon contact by disrupting cell membranes during photosynthesis.
- (c) Because it is immediately inactivated upon contact with clay particles in the soil due to strong adsorption forces, it leaves no residual toxicity for the emerging crop seeds.
- (d) Glyphosate is also non-selective but acts systemically, whereas herbicides like Butachlor, Alachlor, and Pendimethalin are selective pre-emergence formulations.

**Final Answer:** The non-selective contact herbicide is Paraquat.

**Answer: (B)**

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Q9.

**Solution****Concept:**

Post-harvest processing of fiber crops involves specific microbiological and mechanical steps to detach the usable phloem fibers from the woody inner core of the plant stems.

**Solution:**

- (a) Jute (*Corchorus capsularis* and *Corchorus olitorius*) is a major bast fiber crop where commercial fiber is embedded in the bark of the stem.
- (b) Retting is a biological process where harvested jute bundles are submerged in slow-flowing water for 15 to 20 days, allowing aquatic microbes to decompose the pectins and gums binding the fibers.
- (c) Following retting, stripping is performed manually to separate the loosened fiber strands away from the central woody stick (jute reed).
- (d) Cotton utilizes ginning to separate lint from seed, sugarcane undergoes crushing for juice extraction, and tobacco leaves undergo curing to develop flavor and color.

**Final Answer:** The commercial fiber crop is Jute.

**Answer: (B)**

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Q10.

**Solution****Concept:**

Water-use efficiency (WUE) is an index that quantifies a crop's capability to transform available water into harvested economic produce. It can be assessed at either the individual plant level or the field scale.

**Solution:**

- (a) At the field scale, water-use efficiency is defined as the ratio of the economic crop yield to the total quantity of water lost via evapotranspiration (ET) over the growing season.
- (b) The mathematical expression is:  $WUE = \frac{Y}{ET}$ , where  $Y$  represents economic yield per unit area and ET is the consumptive use of water through evaporation from the soil and transpiration from the crop.
- (c) This ratio helps agronomists evaluate how effectively a crop converts water into economic biomass under specific climatic and irrigation regimes.
- (d) Dividing yield by total irrigation water applied measures irrigation water-use efficiency (IWUE), which excludes effective rainfall and stored soil moisture contributions.

**Final Answer:** The formula is Water-use efficiency = Yield / Evapotranspiration.

**Answer: (A)**

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Q11.

**Solution****Concept:**

Agronomic spacing practices are optimized to balance resource availability per plant with maximum land use efficiency. For long-duration pulse crops like pigeonpea (*Cajanus cajan*) during the main kharif season, optimal vegetative growth requires wider spatial geometry to yield properly.

**Solution:**

- (a) Main-season pigeonpea varieties possess an indeterminate branching habit, requiring substantial horizontal space to spread their canopy without overlapping excessively, which could restrict light interception.
- (b) Standard scientific recommendations for uniform flat sowing of kharif pigeonpea in Northern plains mandate a row-to-row spacing of 90 cm and a plant-to-plant spacing of 20 cm.
- (c) This geometry sets an optimal plant population density of approximately 55,555 plants per hectare, mitigating high canopy humidity and limiting structural lodging or excessive early vegetative elongation.
- (d) Narrow configurations like 30 x 10 cm or 45 x 15 cm are primarily restricted to short-duration, compact spring or summer varieties, or intercropping arrangements.

**Final Answer:** The ideal spacing is 90 x 20 cm.

**Answer: (D)**

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Q12.

**Solution****Concept:**

Water-induced soil erosion progresses sequentially through distinct visual stages depending on kinetic energy, surface runoff volume, and topsoil binding properties across a topography.

**Solution:**

- (a) The initial impact of raindrops detaches particles during splash erosion, leading to uniform topsoil removal known as sheet erosion, which often remains unnoticed by farmers.
- (b) As surface runoff increases down a slope, it concentrates into defined micro-channels, sculpting minute, finger-like incisions across the soil surface known as rill erosion.
- (c) These rills represent an advanced stage of erosion but remain small enough to be easily smoothed over, broken up, and erased using ordinary cross-tillage or harrowing implements.
- (d) If unmanaged, rills widen and deepen into gullies that create permanent chasms, making normal tillage operations completely impossible without heavy mechanical reclamation.

**Final Answer:** The form of erosion is rill erosion.

**Answer: (C)**

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Q13.

**Solution****Concept:**

Irrigation scheduling relies on measuring soil matric potential to gauge water availability. Instruments that measure this value directly help optimize irrigation intervals and prevent plant water stress.

**Solution:**

- (a) A tensiometer consists of a sealed, water-filled tube tipped with a porous ceramic cup, which is inserted into the crop root zone to establish hydraulic equilibrium.
- (b) As the surrounding soil dries out, water is drawn out from the porous cup into the soil, creating a partial vacuum inside the tube that registers on an attached vacuum gauge.
- (c) This gauge directly measures soil moisture tension or negative matric potential, typically operating effectively between 0 and 0.85 bars of suction.
- (d) Piezometers measure hydrostatic pressure or water table depth, lysimeters measure total evapotranspiration losses directly, and neutron moisture probes utilize radiation to quantify volumetric water percentage.

**Final Answer:** The method is Tensiometer.

**Answer: (B)**

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Q14.

**Solution****Concept:**

Plants in dryland or arid environments employ specialized morphological and physiological mechanisms to curb transpirational water loss and conserve internal moisture under high evaporative demand.

**Solution:**

- (a) Crassulacean Acid Metabolism (CAM) is a highly efficient metabolic adaptation found in certain succulent xerophytic species to maximize water-use efficiency.
- (b) These plants practice scotoactive stomatal behavior, meaning their stomata open exclusively during cooler night hours to fix carbon dioxide into organic acids.
- (c) During daytime, the stomata remain tightly closed to prevent transpirational water loss, while the stored carbon dioxide is released internally to complete photosynthesis.
- (d) Other options like broad leaf blades, high stomatal density on upper surfaces, or shallow root systems increase drought vulnerability and are absent in typical xerophytes.

**Final Answer:** The adaptation is stomata opening exclusively during the night.

**Answer: (C)**

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Q15.

**Solution****Concept:**

Canopy management in high-biomass cash crops involves removing older vegetative organs to balance internal microclimates and limit the spread of pests and diseases.

**Solution:**

- (a) As sugarcane matures, lower leaves turn yellow and lose their photosynthetic capacity, yet they continue to restrict air circulation within the dense crop rows.
- (b) Detrashing is the systematic removal of these dry, senescent, or unproductive lower leaves from the sugarcane stalk, typically executed 150–180 days after planting.
- (c) This practice improves ventilation, reduces relative humidity within the crop canopy, and minimizes breeding habitats for insect pests like pyrilla, whiteflies, and scale insects.
- (d) Propping involves tying stalks together to prevent lodging, earthing up provides soil support around the base, and topping removes the green apex to induce ripening.

**Final Answer:** The process is detrashing.

**Answer: (B)**

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Q16.

**Solution****Concept:**

Crop physiological efficiency is assessed by measuring how effectively a plant partitions its total accumulated dry matter into economically valuable reproductive organs.

**Solution:**

- (a) The total biomass accumulated by a crop through photosynthesis is termed its biological yield, which includes both vegetative parts and grain parts.
- (b) Harvest index is calculated by dividing the economic yield (marketable product like grain) by the total biological yield (grain plus straw), multiplied by one hundred to express it as a percentage.
- (c) Mathematical representation:  $\text{Harvest Index} = (\text{Economic Yield} / \text{Biological Yield}) \times 100$ . This serves as a vital index for crop improvement programs.
- (d) Land equivalent ratio assesses intercropping performance, while crop index or consumptive use efficiency measures structural or water-use parameters instead of dry matter partitioning.

**Final Answer:** The index is Harvest Index.

**Answer:** (C)

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Q17.

**Solution****Concept:**

Low pH soils alter the solubility of mineral ions. In highly leached soils of heavy-rainfall zones, specific metallic ions become highly soluble, reaching concentrations that hurt plant growth.

**Solution:**

- (a) High rainfall leaches basic cations like calcium, magnesium, and potassium down past the root zone, allowing hydrogen ions to dominate and lower soil pH below 5.5.
- (b) At these low pH levels, aluminum-bearing minerals dissolve, releasing trivalent aluminum ions into the soil solution alongside high amounts of divalent manganese ions.
- (c) Excess aluminum blocks root cell division and elongation, while manganese toxicity induces chlorosis and structural distortions, heavily limiting nitrogen-fixing pulses.
- (d) Elements like calcium, magnesium, sodium, and potassium are deficient rather than toxic in acid soils, while zinc and iron toxicities follow distinct alkaline or anaerobic conditions.

**Final Answer:** The twin elements are Aluminum and Manganese.

**Answer:** (C)

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Q18.

**Solution****Concept:**

Sub-surface drainage systems are engineered networks installed below the ground surface to draw off excess water from the root zone and lower high water tables.

**Solution:**

- (a) In fields experiencing high water tables or waterlogging, drainage networks are installed beneath the plowing zone to safeguard root systems from oxygen starvation.
- (b) A tile drainage system uses perforated corrugated plastic or concrete pipes buried horizontally at predetermined depths and spacings to intercept and carry off sub-surface water via gravity.
- (c) Water enters the buried pipes through the perforations or joints and flows toward a central drainage collector ditch or outlet, safely lowering the water table.
- (d) Open ditches occupy surface land, surge drainage relates to surface irrigation methods, and border strips represent a surface irrigation field layout.

**Final Answer:** The sub-surface drainage system is tile drainage.

**Answer: (A)**

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Q19.

**Solution****Concept:**

Quality standards in oilseed cultivation focus on reducing antinutritional chemical compounds that impair oil health value or reduce the utility of the residual seed meal.

**Solution:**

- (a) Rapeseed and mustard (Brassica species) naturally synthesize erucic acid, a monounsaturated fatty acid localized in the oil fraction that is linked to cardiac risks at high levels.
- (b) Additionally, their seed meal contains glucosinolates, sulfur-rich compounds that impart a pungent, bitter taste and can cause thyroid issues in livestock when fed as oil cake.
- (c) Breeding programs focus on creating double-low or Canola-equivalent varieties that minimize both erucic acid in oil and glucosinolates in the residual meal.
- (d) Groundnut, sunflower, and sesame contain different fatty acid profiles and do not naturally possess this specific pairing of erucic acid and glucosinolates.

**Final Answer:** The oilseed crop is Rapeseed and Mustard.

**Answer: (B)**

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Q20.

**Solution****Concept:**

Mechanical management of sloping fields requires orienting tillage passes to interrupt the physical downslope movement of water and soil particles.

**Solution:**

- (a) Tilling fields up and down a slope creates vertical paths that channel rainwater, accelerating runoff velocity and worsening rill or gully erosion.
- (b) Contour tillage involves conducting plowing, harrowing, and planting operations across the slope, following natural elevation lines.
- (c) Each horizontal ridge and furrow acts as a small dam that slows down surface water flow, giving it more time to infiltrate into the soil profile.
- (d) This cross-slope orientation primarily aims to curb water runoff and soil erosion, rather than reducing wind speed, evaporation loss, or weed seed germination.

**Final Answer:** The main objective is to reduce water runoff and soil erosion.

**Answer: (B)**

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Q21.

**Solution****Concept:**

Dryland agroforestry systems rely on multipurpose tree species that fix atmospheric nitrogen, survive extreme moisture stress, and produce high-quality protein fodder along with fuelwood to improve smallholder farm resilience in semi-arid environments.

**Solution:**

- (a) *Leucaena leucocephala*, commonly referred to as Subabul, is known globally as a wonder plant or miracle tree due to its exceptional growth rates, deep rooting systems, and versatile applications in alley cropping systems.
- (b) As a leguminous tree species, it forms symbiotic relationships with *Rhizobium* bacteria in the soil, allowing it to fix heavy amounts of nitrogen and significantly enrich poor dryland soil horizons.
- (c) Its highly nutritious, protein-rich green foliage serves as an excellent supplemental fodder resource for livestock, while its dense wood offers premium domestic fuel and organic structural timber.
- (d) Other listed tree species like *Azadirachta indica* provide medicinal properties, *Eucalyptus tereticornis* has high transpirational demand unsuitable for drylands, and *Dalbergia sissoo* prefers humid, deep alluvial channel beds.

**Final Answer:** The botanical name is *Leucaena leucocephala*.

**Answer: (B)**

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Q22.

**Solution****Concept:**

Calcareous and alkaline soil systems alter the chemical availability and valence states of essential micronutrients, creating acute metabolic deficiencies that induce structural anomalies in sensitive field crops.

**Solution:**

- (a) Khaira disease is a widely recognized physiological disorder affecting wetland rice paddies throughout the Indo-Gangetic plains, particularly within the alkaline, calcareous soil zones of Uttar Pradesh.
- (b) The underlying cause is an acute deficiency of available zinc, which occurs because high soil pH levels and heavy applications of phosphatic fertilizers cause zinc to precipitate as insoluble zinc phosphate.
- (c) Symptoms manifest approximately two to three weeks following seedling transplanting, showing up as characteristic rusty brown spots or chlorotic lesions along the basal portions of young leaf blades.
- (d) Deficiencies of macro-elements like nitrogen cause uniform leaf yellowing, iron deficits cause prominent interveinal chlorosis, and boron anomalies lead to death of apical growing tips.

**Final Answer:** The critical nutrient deficiency is Zinc.

**Answer: (C)**

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Q23.

**Solution****Concept:**

Regional soil geography maps the spatial distribution of major geological soil orders to determine the dominant agricultural practices, cropping patterns, and fertilizer management protocols for a state.

**Solution:**

- (a) The physical geography of Uttar Pradesh is dominated by the vast Indo-Gangetic plain, which was formed by ages of continuous deposition of riverine sediments brought down by the Ganges and Yamuna river systems.
- (b) Alluvial soils comprise the most extensive soil group within this landscape, geographically covering approximately 80 percent of the total land area of the state.
- (c) These soils are subdivided into older alluvium (Bangar) situated on higher terraces and younger alluvium (Khadar) along active floodplains, both characterized by neutral to slightly alkaline pH and high natural fertility.
- (d) Lower estimates such as 25 percent, 40 percent, or 65 percent represent minor, localized soil formations like the Bundelkhand red-black complexes or sub-Himalayan Terai regions.

**Final Answer:** The absolute percentage of total geographical area is approximately 80%.

**Answer: (D)**

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Q24.

**Solution****Concept:**

Pulse crop agronomy requires careful irrigation management because excess moisture during key reproductive phases can trigger detrimental physiological imbalances and vegetative anomalies.

**Solution:**

- (a) Chickpea (*Cicer arietinum*) has a highly sensitive, deterministic response to soil water availability, requiring only two critical irrigations at the pre-flowering and pod development phases for maximum productivity.
- (b) Direct field flooding during the active flowering stage must be strictly avoided because it stimulates a sudden surge in vegetative growth at the expense of reproductive structures.
- (c) This water excess causes high rates of flower dropping and poor fertilization, and it creates a humid microclimate that increases the incidence of wilt diseases caused by *Fusarium* pathogens.
- (d) While moisture is required at germination and tillering stages, the physiological loss from water logging or flooding is most damaging during the flowering phase.

**Final Answer:** The optimum critical stage where flooding must be avoided is the flowering stage.

**Answer: (A)**

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Q25.

**Solution****Concept:**

Intercropping and companion cropping systems are structured to minimize ecological competition by pairing crops that have differing growth durations, root architectures, and nutrient requirements.

**Solution:**

- (a) Parallel cropping involves growing two distinct crops together that exhibit completely different growth peaks and canopy heights, thereby minimizing competition for solar radiation, soil nutrients, and moisture.
- (b) A classic regional example is growing short-duration mungbean or blackgram alongside long-duration autumn sugarcane, where the pulse crop matures and is harvested before the sugarcane begins its rapid vegetative elongation.
- (c) Synergistic cropping refers to combinations where the joint yield is higher than the sum of individual monoculture yields, while relay cropping involves planting a second crop before harvesting the first.
- (d) Multi-tier cropping involves growing plants of varying heights simultaneously to utilize vertical space, which is a method primarily used in tropical plantation ecosystems.

**Final Answer:** The specific companion cropping system is parallel cropping.

**Answer: (A)**

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**Answer Key**

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

