Rajasthan JET Agriculture Sample Paper-4

Duration: 40 Minutes **Maximum Marks: 160**

Instructions

- This paper contains **40** Multiple Choice Questions (Single Correct).
- Each correct answer carries **+4 marks**.
- Each incorrect answer carries: **−1 mark**.
- Use of mobile phones, smartwatches, calculators, or any electronic gadgets is strictly prohibited.

Q1. Which type of soil erosion is considered most destructive and is characterized by the formation of deep channels by concentrated surface runoff that cannot be repaired by normal tillage operations?

(A) Sheet erosion, which removes a thin, relatively uniform layer of soil from the surface

(B) Gully erosion, which forms deep V- or U-shaped channels by concentrated runoff and causes permanent loss of topsoil and subsoil

(C) Rill erosion, which forms small shallow channels that can be removed by ordinary cultivation

(D) Splash erosion, which is caused by raindrop impact and displaces individual soil particles

Q2. Which nutritional disorder of rice is known as “Khaira disease,” characterised by rusty-brown spots on leaves and stunted growth, and is most commonly found in alkaline or waterlogged paddy soils?

(A) Excess nitrogen application, causing yellowing and lodging of rice plants

(B) Iron deficiency, causing interveinal chlorosis on young leaves of rice

(C) Zinc deficiency, which causes Khaira disease with rusty-brown spots; corrected by soil application of $ZnSO_4$ at 25 kg/ha

(D) Boron deficiency, which causes white panicle and empty grain syndrome in rice

Q3. Why is soil organic carbon (SOC) considered a primary indicator of soil health, and what is its relationship with soil water-holding capacity?

(A) SOC is a key indicator of soil health because it improves water-holding capacity by forming water-stable aggregates, enhances nutrient supply through mineralization, and supports microbial activity

(B) Soil organic carbon reduces water-holding capacity by blocking soil pores and increasing bulk density

(C) Soil organic carbon affects only soil pH and has no direct relationship with water retention in the soil profile

(D) Inorganic carbon compounds are the primary indicator of soil fertility in tropical and subtropical soils

Q4. What are the primary adverse effects of waterlogging on crop plants, and how are subsurface and surface drainage systems used to manage it?

(A) Waterlogging increases soil aeration through capillary action and promotes deeper root penetration

(B) Surface drainage alone is sufficient to manage waterlogging in all soil types including heavy clay soils

(C) Waterlogged soils become more fertile due to accumulation of soluble nutrients leached from the upper layers

(D) Waterlogging depletes soil oxygen causing root hypoxia and anaerobic conditions; managed by subsurface tile drains (pipe drainage) for chronic waterlogging or open surface drainage channels for temporary flooding

Q5. How does the water use efficiency of drip (pressurized) irrigation compare to surface (flood) irrigation, and what accounts for the difference in conveyance and field application losses?

(A) Surface irrigation achieves approximately 80% water use efficiency due to uniform water distribution in all soil types

(B) Drip irrigation achieves approximately 90% efficiency compared to only 40% for surface irrigation, because drip eliminates conveyance losses, runoff, and deep percolation by delivering water directly to the root zone

(C) Sprinkler irrigation achieves only 30% efficiency due to wind drift and high evaporation losses under field conditions

(D) Surface irrigation is inherently more efficient than drip irrigation for row crops grown in loamy soils

Q6. What are the main agronomic and economic advantages of zero-tillage (no-till) wheat cultivation after paddy harvest compared to conventional tillage in the Indo-Gangetic Plains?

(A) Zero tillage increases weed pressure in wheat because undisturbed soil allows buried weed seeds to germinate more readily

(B) Zero tillage requires more fuel than conventional tillage because the zero-till ferti-seed drill operates at higher draft

(C) Zero tillage for wheat after paddy conserves residual soil moisture, reduces fuel cost by approximately 70%, allows timely sowing using a zero-till ferti-seed drill, and reduces Phalaris minor infestation

(D) Zero tillage is recommended only for sandy loam soils in arid western Rajasthan and is unsuitable for alluvial plains

Q7. How are grassy weeds distinguished from broadleaved weeds in field crops, and why do selective herbicides differ for each group?

(A) Grassy weeds are monocots (e.g., Phalaris minor, wild oat in wheat); broadleaved weeds are dicots (e.g., Chenopodium, Bathua); selective herbicides like isoproturon target only grassy weeds while 2,4-D targets broadleaved weeds

(B) All agricultural weeds belong to the same plant family and a single non-selective herbicide effectively controls both types

(C) Broadleaved weeds are monocots and require the same active ingredient class as graminicide herbicides

(D) Phalaris minor is a broadleaved dicot weed found mainly in paddy fields in the kharif season

Q8. How does black plastic mulch differ from organic mulch (straw or sugarcane trash) in terms of weed control, moisture retention, and long-term soil fertility effects?

(A) Organic straw mulch raises soil temperature more effectively than black plastic mulch, which reflects solar radiation

(B) Black plastic mulch promotes weed growth by maintaining soil moisture at the surface where light can penetrate the edges

(C) Organic mulch does not decompose under field conditions and therefore provides no additional organic matter or nutrient benefit to the soil

(D) Black plastic mulch suppresses weeds by blocking light and retains soil moisture effectively; organic mulch (straw, sugarcane trash) additionally decomposes to add organic matter, improving long-term soil fertility

Q9. What are the recommended seed rate, sowing depth, and row spacing for irrigated wheat to achieve the optimum plant population per unit area?

(A) Wheat seed rate is 150–175 kg/ha, sowing depth 8–10 cm, and row spacing 30 cm for optimal stand establishment

(B) Wheat seed rate is 100–125 kg/ha, sowing depth 5–6 cm, and row spacing 22.5 cm for optimal plant density under irrigated conditions

(C) Wheat seed rate is 50–75 kg/ha, sowing depth 2–3 cm, and row spacing 45 cm for wide-row mechanized systems

(D) Wheat seed rate is 200 kg/ha, sowing depth 10 cm, and row spacing 15 cm to compensate for low germination in calcareous soils

Q10. What are the key management principles that distinguish the System of Rice Intensification (SRI) from conventional transplanted paddy cultivation?

(A) SRI uses 30-day-old seedlings transplanted at 3–4 per hill at 15 cm $\times$ 15 cm spacing with continuous flooding for maximum yield

(B) SRI requires continuous flooding throughout the crop season to prevent soil hardening and maintain anaerobic conditions

(C) SRI transplants 8–12 day old single seedlings per hill at wider spacing (25 cm $\times$ 25 cm), with alternate wetting and drying to enhance root growth, increase tillering, and reduce water use by up to 30%

(D) SRI is applicable only to long-duration indica varieties grown in coastal deltaic regions with high natural rainfall

Q11. Why does a single-cross hybrid in maize generally give higher and more uniform yield than a double-cross hybrid?

(A) A single-cross hybrid (inbred A $\times$ inbred B) exhibits maximum hybrid vigour because both parents are pure lines; the resulting F1 is genetically uniform with high and consistent yield

(B) A double-cross hybrid (AB $\times$ CD) yields more than a single-cross hybrid because four parental lines contribute greater genetic diversity and buffering

(C) Single-cross hybrids are cheaper to produce than double-cross hybrids because they require four parental inbred lines for seed production

(D) Double-cross hybrids have more uniform grain size and maturity than single-cross hybrids due to greater heterozygosity

Q12. What is the recommended NPK fertilizer dose for bajra (pearl millet) in normal kharif cultivation, and at what growth stage is the top-dressing of nitrogen applied?

(A) Bajra requires 40:20:20 kg N:P:K per hectare with the entire nitrogen dose applied as basal before sowing

(B) Bajra requires 120:60:60 kg N:P:K per hectare with phosphorus and potassium applied in multiple split doses

(C) Bajra is a low-nutrient-requiring crop needing only 20 kg N/ha with no phosphorus or potassium application

(D) Bajra requires 80:40:40 kg N:P:K/ha; half the nitrogen is applied as basal, and the remaining nitrogen is top-dressed at 25–30 days after sowing (knee-high stage) for better uptake and tiller formation

Q13. Why is seed inoculation with Rhizobium ciceri essential for chickpea, and what is the approximate nitrogen fixation benefit it provides?

(A) Any generic Rhizobium strain available in the soil can effectively nodulate chickpea and fix atmospheric nitrogen

(B) Rhizobium ciceri is a host-specific strain that forms effective nodules only on chickpea roots, fixing approximately 70–80 kg N/ha per season and significantly reducing chemical nitrogen fertilizer requirement

(C) Chickpea is a non-leguminous crop that does not form root nodules and must rely entirely on soil mineral nitrogen

(D) Rhizobium inoculation reduces grain yield in chickpea by diverting photosynthate to nodule maintenance instead of grain filling

Q14. In mustard + chickpea intercropping, what row ratio is commonly used, and what does a Land Equivalent Ratio (LER) greater than 1 indicate about this system?

(A) Mustard and chickpea intercropping is practised in a 3:1 row ratio and always produces an LER less than 1, indicating yield loss compared to sole cropping

(B) Intercropping mustard with chickpea is not agronomically recommended because the two crops compete intensely for light and soil nutrients

(C) Mustard + chickpea intercropping in a 6:2 row ratio (6 mustard rows: 2 chickpea rows) gives an LER greater than 1, meaning the

intercropped system produces more total output per unit area than growing either crop alone

(D) Chickpea should never be intercropped with oilseed crops because chickpea root exudates are allelopathic to mustard

Q15. How does the bunch type of groundnut differ from the spreading (runner) type in terms of growth habit and suitability for mechanized harvesting?

(A) Spreading (runner) type groundnut suits mechanized harvesting best because all pods cluster tightly along the main stem

(B) Bunch type groundnut has a trailing growth habit with widely distributed pods, making mechanized harvesting difficult

(C) Both bunch and spreading types have identical pod distribution and harvest index, making them equally suited to any harvesting method

(D) Bunch type groundnut (e.g., JL-24, TG-26) has an erect, compact growth habit with pods concentrated near the base, making it suited to mechanized lifting; spreading (runner) types (e.g., Chandra, M-13) spread widely and require manual harvesting

Q16. Why is jowar (Sorghum bicolor) described as a "dual-purpose" crop, and which improved varieties are commonly cultivated in Rajasthan?

(A) Jowar is a dual-purpose crop that yields both grain for human consumption and high-quality fodder (stover) for livestock; improved varieties CSV-13 and CSV-15 are high-yielding cultivars widely grown in Rajasthan

(B) Jowar is grown exclusively as a fodder crop in Rajasthan and produces no harvestable grain due to moisture stress

(C) CSV-13 is a rabi jowar variety suitable only for irrigated conditions in Peninsular India, not for Rajasthan

(D) Jowar cannot be grown in Rajasthan because it is highly sensitive to high temperatures during the flowering stage

Q17. What distinguishes Allahabad Safeda from L-49 (Lucknow-49) in guava, particularly regarding flesh colour and Vitamin C content?

(A) L-49 (Lucknow-49) has white flesh and is the highest Vitamin C-containing variety; Allahabad Safeda has pink flesh

(B) Allahabad Safeda has white flesh with very high Vitamin C content (approximately 300 mg/100 g); L-49 (Lucknow-49) has slightly pinkish flesh and softer texture, making it preferred for processing and canning

(C) Both Allahabad Safeda and L-49 have identical flesh colour and nutritional composition, differing only in tree size

(D) Guava "Shweta" is the only commercially important white-fleshed variety; all other guava cultivars including Safeda have red flesh

Q18. Which pomegranate variety is best suited for commercial cultivation in arid Rajasthan, and what characteristics make pomegranate suitable for low-water farming?

(A) Pomegranate requires high atmospheric humidity and cannot be grown commercially in the arid regions of Rajasthan

(B) Anardana is the primary commercial variety of pomegranate adopted for desert conditions in Rajasthan

(C) Bhagwa is the leading commercial pomegranate variety suited to Rajasthan's arid conditions due to its drought tolerance, deep root system, high fruit quality, and excellent response to drip irrigation

(D) Pomegranate must be grown under polyhouse conditions in Rajasthan because open-field heat stress causes cracking of all fruits

Q19. How is date palm (Phoenix dactylifera) commercially propagated, and why is this method preferred over seed propagation for commercial orchards in Rajasthan?

(A) Date palm is propagated by seeds because seed-derived trees maintain the superior fruit quality of the mother plant uniformly

(B) Date palm is best propagated by T-budding or patch budding on root-stocks, similar to other fruit trees

(C) Date palm suckers are not used for propagation because they carry soilborne diseases from the mother plant's root zone

(D) Date palm is propagated vegetatively by offshoots (suckers) arising at the base of the mother palm; this preserves sex (female fruiting trees) and fruit quality; it is important in Rajasthan's Thar Desert where dates provide food and income in extreme arid conditions

Q20. What are the critical irrigation stages for chili (Capsicum annuum cv. Pusa Jwala), and which fungal disease causes wet rotting of fruits in humid conditions?

(A) Critical irrigation stages for chili are flowering and fruit set; Choanephora fruit rot, caused by Choanephora cucurbitarum, produces water-soaked lesions with grey-black fungal growth on fruits in high-humidity conditions

(B) Pusa Jwala chili is resistant to all fungal diseases and requires irrigation only at the transplanting stage

(C) Choanephora fruit rot of chili is a bacterial disease effectively controlled by copper-based bactericides applied weekly

(D) Pusa Jwala is a sweet bell-pepper variety grown exclusively under protected greenhouse cultivation

Q21. Which muskmelon varieties are widely cultivated in India, and what visual signs indicate the correct harvest maturity?

(A) Muskmelon should be harvested when fruits are uniformly dark green with no netting (reticulation) visible on the skin surface

(B) Widely grown muskmelon varieties include Hara Madhu and Punjab Sunehri; harvesting is indicated by the development of net (reticulation) on the fruit skin, colour change from green to yellowish-cream, and a faint aroma

(C) Punjab Sunehri is a dark red-fleshed muskmelon variety suited to cultivation under high-altitude hill conditions only

(D) Muskmelon is harvested only by measuring refractometer Brix value above 15%; all visual cues are unreliable for determining harvest maturity

Q22. Among calcium carbide and ethephon, which is the legally permitted fruit-ripening agent in India, and why is the other banned?

(A) Calcium carbide is the legally permitted and safest ripening agent approved by FSSAI for use on all commercially ripened fruits in India

(B) Both calcium carbide and ethephon are completely banned in India and no form of artificial fruit ripening is legally permitted

(C) Ethephon (which releases ethylene gas) is the legally permitted ripening agent in India under FSSAI regulations; calcium carbide is banned because it often contains arsenic and phosphorus impurities that produce toxic phosphine gas

(D) Ethephon is banned in India under the Prevention of Food Adulteration Act and only calcium carbide is approved for commercial ripening

Q23. How are colchicine and gamma rays used in mutation breeding, and what types of genetic changes do they induce in crop plants?

(A) Colchicine inhibits chromosome replication and reduces ploidy levels in plants by preventing DNA synthesis

(B) Gamma rays are used exclusively to improve fruit skin colour and have no documented effect on plant genome structure

(C) Mutation breeding with colchicine produces only vegetative (somatic) mutations in stem tissue with no heritable effect on seed characters

(D) Colchicine blocks spindle-fibre formation during cell division, causing chromosome doubling (polyploidy) and increased cell/organ size; gamma rays (ionizing radiation) induce random point mutations or

chromosomal rearrangements, e.g., NP-836 in rice was developed using gamma-ray mutagenesis

Q24. What is the genomic constitution of bread wheat, and how has its polyploid nature contributed to its superior grain size and wide adaptability?

(A) Bread wheat (Triticum aestivum) is hexaploid (2n = 42) with AABBDD genome originating from hybridization of three wild diploid progenitors; polyploidy increased grain size, endosperm protein content, and adaptability to diverse environments

(B) Bread wheat is a tetraploid (2n = 28) with AABB genome derived from two diploid progenitor species

(C) All cultivated wheat species are diploid (2n = 14) and polyploidy occurs only in wild Aegilops relatives

(D) The hexaploid nature of bread wheat reduces grain quality due to gene redundancy causing incomplete protein expression

Q25. What does the concept of "totipotency" mean in the context of plant tissue culture, and how is callus produced from an explant?

(A) Only shoot apical meristem cells retain totipotency; all other mature differentiated plant cells have permanently lost the capacity to regenerate into whole plants

(B) Totipotency is the capacity of any living plant cell to regenerate into a complete plant under appropriate culture conditions; callus is an undifferentiated proliferating cell mass induced from an explant on Murashige and Skoog (MS) medium by adjusting auxin:cytokinin balance

(C) Callus is a differentiated tissue that already contains pre-formed shoot and root primordia before in-vitro culture begins

(D) Totipotency is a property unique to animal embryonic stem cells; plant cells do not exhibit this capacity under normal laboratory conditions

Q26. What causes physical and physiological seed dormancy, and what methods are used to break each type?

(A) Physical dormancy in legumes is caused by ABA accumulation in the seed coat and is broken by cold stratification at 4°C

(B) Physiological dormancy is due to a hard, impermeable seed coat and is broken only by mechanical scarification with sandpaper

(C) Physical dormancy (hard, impermeable seed coat in legumes such as moth bean and guar) is broken by mechanical or chemical scarification, or hot water soaking; physiological dormancy (ABA-mediated inhibition of germination) is broken by after-ripening, cold stratification, or exogenous gibberellin (GA_3) treatment

(D) All types of seed dormancy, whether physical or physiological, are broken solely by exposure to continuous light for 24–48 hours

Q27. What are the characteristic symptoms of pink bollworm infestation in cotton, and how are pheromone traps used in its management?

(A) Pink bollworm feeds externally on cotton leaves, causing shot-hole damage that is visible from outside the plant canopy

(B) Pink bollworm overwinters as adult moth in soil cracks and completes only one generation per year in Rajasthan

(C) Pink bollworm is a sucking pest controlled exclusively by systemic insecticide sprays applied to the foliage

(D) Pink bollworm (Pectinophora gossypiella) larvae bore into cotton bolls causing “rosetted bolls” (petals stuck together) and internal seed damage; managed by gossyplure pheromone traps (mass trapping, mating disruption) and cultivation of Bt-cotton hybrids

Q28. Which virus does whitefly (Bemisia tabaci) transmit in cotton, and how is insecticide resistance in whitefly populations managed?

(A) Whitefly (Bemisia tabaci) is the vector of Cotton Leaf Curl Virus (CLCuV), a begomovirus causing leaf curling and stunting; resistance to insecticides is managed by rotating insecticide classes (e.g.,

alternating neonicotinoids with pyriproxyfen or spiromesifen) to delay resistance development

(B) Whitefly in cotton transmits Cotton Boll Rot, a soilborne bacterial pathogen, through feeding wounds on the fruit surface

(C) Whitefly in cotton transmits only non-persistent viruses that cause a mild mosaic pattern with no significant yield loss

(D) Whitefly resistance to insecticides is managed by using the same chemical class repeatedly throughout the season to maintain consistent selection pressure on the population

Q29. How does cutworm (Agrotis ipsilon) damage field crops, and what are the recommended management measures?

(A) Cutworm larvae feed exclusively on leaves and growing tips in the plant canopy and do not damage roots or stem bases

(B) Cutworm (Agrotis ipsilon) larvae live in the soil and cut seedlings at or just below ground level at night, causing sudden wilting; managed by soil drench with chlorpyrifos or broadcasting poison bait (wheat bran mixed with insecticide) near affected plants

(C) Cutworm is a sucking insect pest that transmits plant viruses and is controlled by systemic insecticide sprays

(D) Cutworm is a stored-grain pest that damages seeds in silos and has no pest status in standing field crops

Q30. How does loose smut of wheat (Ustilago tritici) spread in the field, and what is the most effective seed treatment method?

(A) Loose smut of wheat is a soilborne disease spread by infected soil particles and managed by fungicide soil drenching before sowing

(B) Loose smut spores infect wheat seedlings at the soil surface and can be eliminated by surface spray of Thiram suspension

(C) Loose smut (Ustilago tritici) is internally seed-borne; airborne teliospores infect flowers (ovary) at anthesis and remain dormant in the em-

bryo; managed by hot water seed treatment (52°C for 10 minutes) or carboxin/vitavax seed treatment that penetrates the seed coat

(D) Loose smut of wheat produces black pustules on leaves and stem similar to stem rust and affects only surface tissues

Q31. What is the host range of Fusarium oxysporum, and why is growing resistant varieties considered the best management strategy for Fusarium wilt?

(A) Fusarium wilt is caused by a bacterial pathogen and is effectively controlled by copper-based bactericide sprays applied at sowing

(B) Fusarium wilt affects only one host species per forma specialis and does not persist in soil between cropping seasons

(C) Fusarium wilt is managed by annual soil fumigation with methyl bromide before every cropping season on all susceptible crops

(D) Fusarium oxysporum causes vascular wilt through forma specialis: f.sp. cubense (banana), f.sp. lycopersici (tomato), f.sp. ciceri (chick-pea); resistant varieties are the best management tool because the fungus persists in soil for many years and fungicide treatment of wilted plants is ineffective

Q32. How does azadirachtin (the active compound in neem-based pesticides) act on insect pests, and why is it approved for use in certified organic farming?

(A) Azadirachtin acts as an insect growth regulator by disrupting ecdysone-mediated moulting, and as an antifeedant by reducing feeding behaviour; it is effective against aphids, whitefly, and leaf miners and is permitted under the National Programme for Organic Production (NPOP) because it is botanically derived with no persistent residues

(B) Azadirachtin is a contact nerve poison with the same biochemical mode of action as organophosphates and is therefore prohibited in certified organic farming

(C) Neem-based pesticides act only as repellents with no effect on insect mortality, reproduction, or population growth

(D) Azadirachtin must be combined with a synthetic petroleum-based adjuvant to be field-effective and therefore cannot carry organic certification

Q33. How is the Tharparkar cattle breed distinguished from the Kankrej breed in terms of body conformation, horn shape, and coat colour?

(A) Tharparkar and Kankrej are heat-tolerant breeds with identical body conformation, horn shape, and milk yield, differing only in geographic name

(B) Tharparkar is a medium-framed dual-purpose (milk + draft) breed with lyre-shaped horns and a white to grey-white coat, native to the Thar Desert; Kankrej is a larger-framed breed with iron-grey colour and sickle-shaped lyrate horns, from the Kankrej region of Gujarat–Rajasthan border

(C) Kankrej and Tharparkar are the same breed registered under two different names by different state animal husbandry departments

(D) Tharparkar is a pure dairy-purpose breed with no draft utility; Kankrej is used exclusively for heavy draft and ploughing

Q34. Which wool category does the Nali sheep breed produce, and in which states is it primarily found?

(A) Nali sheep produce fine Merino-type wool and were introduced from Australia; they have no native distribution in Rajasthan

(B) Nali sheep produce black lustre wool used in superfine textile manufacturing and are found along the coastal regions of Rajasthan near the Rann of Kutch

(C) Nali sheep are a carpet-wool breed native to the Rajasthan–Haryana border region (Ganganagar, Churu, Jhunjhunu districts); they produce semi-lustre medium-coarse white wool prized for durability and bulk in carpet weaving

(D) Nali sheep are primarily classified as a meat breed and their wool has no recognized commercial value in the Indian textile industry

Q35. What are the key characteristics and desert adaptations of the Marwari goat breed of Rajasthan?

(A) Marwari goat is a high-milk-yielding breed introduced to Rajasthan from Switzerland for crossbreeding with local stock

(B) Marwari goat produces fine pashmina-quality fleece identical to the Changthangi (Kashmir pashmina) goat and is valued exclusively for fibre

(C) Marwari goat is reared exclusively for milk production and cannot survive extended dry periods without daily supplemental feeding

(D) Marwari goat is a hardy desert breed of Rajasthan reared primarily for meat and coarse hair; desert adaptations include a browsing habit (ability to use shrubs and dry vegetation), heat tolerance, efficient water utilisation, and capacity to travel long distances between water sources

Q36. What distinguishes the Dromedary camel from the Bactrian camel, and which species is found in Rajasthan?

(A) Dromedary (Camelus dromedarius) has one hump and is the camel found in Rajasthan and other Indian arid regions; Bactrian camel (Camelus bactrianus) has two humps and is native to Central Asia and China, not found in India

(B) Bactrian camel has one hump and is native to Rajasthan; Dromedary has two humps and is found in Central Asian steppes

(C) Both Bactrian and Dromedary camels are found in equal numbers across Rajasthan and serve as draft and milk animals

(D) Dromedary camels are found in the southern states of India; Bactrian camels are the working camel of Rajasthan and Pakistan

Q37. How is B2 cost defined in agricultural cost accounting, and why is it important for determining the Minimum Support Price (MSP) of crops?

(A) B2 cost includes only actual cash expenditures such as seeds, fertilizers, and hired labour wages, and excludes all imputed costs

(B) B2 cost = A1 cost (all paid-out hired input costs including seeds, fertilizers, hired labour, irrigation charges) + A2 cost (imputed rent of owned land + depreciation on farm assets) + family labour cost; it is used as a basis for MSP calculation to ensure comprehensive cost coverage for farmers

(C) B2 cost is identical to C2 cost, which additionally includes interest on fixed capital and rental value of land at current market rates

(D) B2 cost includes only imputed costs (family labour value and land rent) and excludes all actual cash expenditures on variable inputs

Q38. What is the three-tier structure of the AMUL cooperative model (Anand Pattern), and what factors contributed to its success?

(A) AMUL operates as a single-tier cooperative where individual farmers sell milk directly to the national federation, bypassing district-level processing structures

(B) AMUL follows a two-tier model consisting of village milk collection societies and a national processing and marketing federation

(C) AMUL's Anand Pattern has three tiers: village-level Dairy Cooperative Societies (DCS) collect and chill raw milk from farmers; district-level milk unions process milk into products; the state-level federation (GCMMF) manages marketing, branding, and exports under the Amul brand

(D) AMUL is a central government enterprise managed by the Ministry of Fisheries, Animal Husbandry and Dairying with no farmer ownership or representation

Q39. What are the farmer premium rates under Pradhan Mantri Fasal Bima Yojana (PMFBY) for kharif and rabi crops, and how is the remaining

premium cost shared?

(A) Under PMFBY, farmers pay a uniform flat 5% premium for both kharif and rabi crops, with no additional government subsidy component

(B) PMFBY is a voluntary insurance scheme open only to loanee farmers; the central government bears 10% of the total actuarial premium

(C) Under PMFBY, the farmer premium is 3% for kharif crops and 2.5% for rabi crops; state and central governments share the remaining premium in equal halves

(D) Under PMFBY, farmer premium is capped at 2% of the sum insured for kharif crops and 1.5% for rabi crops; the remaining actuarial premium above these caps is shared equally between state and central governments, making it one of the largest subsidised crop insurance schemes globally

Q40. Under which Act were Regional Rural Banks (RRBs) established, who sponsors them, and what is the equity structure governing their ownership?

(A) RRBs were established under the Regional Rural Banks Act 1976 on the recommendations of the Narasimham Committee to provide rural credit; the equity is shared as: 50% Government of India, 15% state government, and 35% sponsor commercial bank

(B) RRBs were established in 1991 under the NABARD Act and are wholly owned by the Reserve Bank of India as rural development banks

(C) RRBs are district-level cooperative banks with no sponsoring commercial bank and are governed by state government cooperative acts

(D) RRBs were established under the Banking Regulation Act 1949 and function as urban commercial bank branches extended to rural service areas

Detailed Solutions

Q1.

Solution

Among the four types of water erosion, gully erosion is the most destructive. Sheet erosion removes a thin, uniform layer of topsoil across a slope and may go unnoticed for several seasons. Rill erosion forms small channels (rills) on the soil surface that are less than 30 cm deep and can still be smoothed out by ordinary tillage. Gully erosion, by contrast, results from the concentration of runoff into fast-moving streams that cut deep V- or U-shaped channels into the soil, removing both topsoil and subsoil. Gullies cannot be repaired by normal tillage and, if left unchecked, progressively enlarge with each rainfall event, permanently taking land out of agricultural production. Control measures include check dams, vegetative barriers (e.g., vetiver grass), and gully-plugging structures.

Final Answer: Gully erosion is the most destructive form because concentrated runoff carves deep V- or U-shaped channels that permanently remove topsoil and subsoil and cannot be repaired by ordinary tillage.

Answer: (B) Go Back to Q1

Q2.

Solution

Khaira disease of rice is caused by zinc (Zn) deficiency. It is one of the most common micronutrient disorders in rice grown on alkaline (high-pH), calcareous, or waterlogged soils, where Zn becomes unavailable despite adequate total soil Zn. Symptoms appear 2–4 weeks after transplanting: newly emerging leaves show rusty-brown to orange-brown spots and streaks, the mid-rib may turn pale, and plant growth is severely stunted (hence the name "Khaira," meaning yellowish-brown in Hindi). The disorder is corrected by soil application of zinc sulphate ($ZnSO_4$) at 25 kg/ha before transplanting, or by foliar spray of 0.5% $ZnSO_4$ solution. Options A, B, and D describe symptoms of nitrogen excess, iron deficiency, and boron deficiency respectively, none of which produce the rusty-brown spotting of Khaira.

Final Answer: Khaira disease is caused specifically by zinc deficiency in alkaline or waterlogged paddy soils, producing rusty-brown spots and stunting that are corrected by $ZnSO_4$ application.

Answer: (C) Go Back to Q2

Q3.

Solution

Soil organic carbon (SOC) is considered the single best integrative indicator of soil health because it influences multiple physical, chemical, and biological soil properties simultaneously. Regarding water-holding capacity: organic matter has a high specific surface area and can hold up to 20 times its own weight in water. As SOC increases, it promotes the formation of stable soil aggregates (through microbial glues and fungal hyphae), which creates a porous structure that holds more plant-available water. SOC also acts as a slow-release nutrient source (providing N, P, and S through mineralization), improves cation exchange capacity, buffers pH, and provides energy for the soil microbial community. Declining SOC is therefore an early warning sign of soil degradation. Options B, C, and D are factually incorrect statements.

Final Answer: Soil organic carbon is the primary soil health indicator because it simultaneously builds water-stable aggregates that raise water-holding capacity, supplies nutrients through mineralization, and sustains the soil microbial community.

Answer: (A) Go Back to Q3

Q4.

Solution

When soil pores are saturated with water, soil oxygen (O_2) is rapidly consumed by microbial respiration and is not replenished because gas diffusion in water is approximately 10,000 times slower than in air. Roots require O_2 for aerobic respiration to generate ATP for active nutrient uptake. Under waterlogged (anaerobic) conditions, roots suffer hypoxia, switch to inefficient fermentative metabolism, accumulate ethanol, and eventually die. Additionally, reducing conditions cause accumulation of toxic compounds such as Fe^{2+}, Mn^{2+}, H_2S, and organic acids. Management options include: (i) surface drainage – open field channels or land grading to remove excess surface water; (ii) subsurface tile/pipe drainage – perforated pipes laid 0.9–1.5 m below the surface intercept and carry away excess groundwater before it reaches the root zone. Subsurface drainage is the standard solution for irrigated canal-command areas.

Final Answer: Waterlogging depletes root-zone oxygen causing hypoxia and toxic reducing conditions, managed by combining surface drainage channels for temporary flooding and subsurface tile drains for chronic groundwater problems.

Answer: (D) Go Back to Q4

Q5.

Solution

Irrigation efficiency is the ratio of water beneficially used by the crop to the total water diverted from the source. Surface (flood or furrow) irrigation achieves only approximately 35–45% overall efficiency because large volumes are lost to: (i) seepage and evaporation during conveyance in unlined channels; (ii) deep percolation beyond the root zone; and (iii) surface runoff at the tail end. Drip (pressurized) irrigation, by contrast, delivers water through a network of pipes and emitters directly at the root zone of each plant, achieving 85–95% field application efficiency. Conveyance losses are eliminated because the distribution network is enclosed, and deep percolation is minimised by applying small, frequent doses matched to crop demand. This difference in efficiency makes drip irrigation critical for water-scarce regions and high-value crops. Sprinkler irrigation achieves an intermediate efficiency of approximately 70–80%.

Final Answer: Drip irrigation achieves roughly 90% water use efficiency versus only about 40% for surface irrigation because it delivers water directly to the root zone through enclosed pipes, eliminating conveyance losses, runoff, and deep percolation.

Answer: (B) Go Back to Q5

Q6.

Solution

Zero tillage (ZT) or no-till farming for wheat after paddy in the rice-wheat system of the Indo-Gangetic Plains offers multiple advantages. First, it conserves residual soil moisture from the paddy season, which is crucial during early wheat establishment. Second, it allows earlier sowing – the ZT ferti-seed drill sows wheat within 1–2 days of paddy harvest, avoiding the yield penalty of late sowing; every week's delay after the optimum sowing date reduces wheat yield by approximately 1.5%. Third, fuel and machinery cost is reduced by about 70% compared to conventional ploughing (2–3 tillage passes). Fourth, it has been observed that the Phalaris minor weed, whose seeds are brought to the surface by tillage, is less problematic under ZT. The technique is promoted under the CIMMYT-led projects and by state governments across Punjab, Haryana, and western Uttar Pradesh.

Final Answer: Zero tillage for wheat after paddy conserves residual moisture, cuts fuel costs by about 70%, enables timely sowing within days of paddy harvest, and reduces Phalaris minor weed pressure compared to conventional tillage.

Answer: (C) Go Back to Q6

Q7.

Solution

Weeds are classified into two major categories based on leaf morphology and botanical affinity: (1) Grassy weeds – monocotyledonous plants (one seed leaf, parallel leaf venation, hollow round stems), e.g., Phalaris minor and Avena fatua (wild oat) in wheat, Echinochloa crus-galli (jungle rice) in paddy. (2) Broadleaved weeds – dicotyledonous plants (two seed leaves, reticulate venation, solid stems), e.g., Chenopodium album (bathua), Rumex dentatus (rumex), Convolvulus arvensis (wild morning glory). Selective herbicides exploit physiological and biochemical differences between crop and weed: isoproturon (photosynthesis inhibitor) selectively controls grassy weeds in wheat; 2,4-D (synthetic auxin) selectively kills broadleaved weeds in cereal crops without harming the monocot crop. This selectivity is the basis of integrated weed management in cereals.

Final Answer: Grassy weeds are monocots (e.g., Phalaris minor) controlled by isoproturon, while broadleaved weeds are dicots (e.g., Chenopodium) controlled by 2,4-D, because the two groups differ in their biochemical susceptibility to each herbicide class.

Answer: (A) Go Back to Q7

Q8.

Solution

Mulching involves covering the soil surface with a material to modify the soil environment. Black plastic mulch: the opaque black colour absorbs solar radiation and warms the soil (beneficial in winter crops), but more importantly, it completely blocks light transmission to the soil surface, preventing germination and growth of annual weeds. It also forms a physical barrier against soil-moisture evaporation, reducing irrigation frequency. However, it does not decompose and therefore adds no organic matter. Organic mulches (paddy straw, sugarcane trash, dry leaves): these reduce evaporation by creating a barrier between soil and atmosphere; they also moderate soil temperature (insulating effect). Crucially, as the organic material decomposes, it adds organic carbon and nutrients to the soil, improving soil structure over time. Option D correctly captures both the weed-control advantage of plastic mulch and the soil-fertility advantage of organic mulch.

Final Answer: Black plastic mulch excels at suppressing weeds by blocking light and conserving moisture but adds no organic matter, whereas organic mulch (straw, sugarcane trash) achieves similar moisture retention and additionally improves long-term soil fertility as it decomposes.

Answer: (D) Go Back to Q8

Q9.

Solution

Optimum crop geometry is critical for wheat yield. Seed rate: 100–125 kg/ha is recommended for bold-seeded irrigated wheat varieties (e.g., HD-3086, PBW-343); lower rates may be used for early sowing and higher rates for late sowing to compensate for reduced tillering. Sowing depth: 5–6 cm is the optimum; shallower placement risks poor emergence due to surface drying; deeper placement delays emergence and weakens coleoptile. Row spacing: 22.5 cm (standard) or 20 cm (narrow-row) facilitates uniform seed placement, effective fertilizer banding, and better light interception during canopy development. This combination typically gives a target plant population of 45–55 plants/m^2, which is optimal for producing 450–600 productive tillers/m^2 for high yield. Options A, C, and D contain incorrect values that would result in sub-optimal plant density.

Final Answer: The recommended geometry for irrigated wheat is 100–125 kg/ha seed rate, 5–6 cm sowing depth, and 22.5 cm row spacing, which together achieve the optimal plant population of 45–55 plants/m^2 for high yield.

Answer: (B) Go Back to Q9

Q10.

Solution

The System of Rice Intensification (SRI) was developed by Fr. Henri de Laulanié in Madagascar and modifies all four major management factors of paddy: (1) Seedling age: 8–12 days (2-leaf stage) vs the conventional 21–30 days; younger seedlings have undamaged root systems and higher phytohormone levels, resulting in vigorous re-establishment after transplanting. (2) Plant density: one seedling per hill at wider spacing (25 cm $\times$ 25 cm or more) vs 3–5 seedlings per hill, allowing greater tiller development per plant. (3) Water management: alternate wetting and drying (AWD) – the field is irrigated to approximately 2 cm depth, allowed to dry until the soil shows hairline cracks, then re-irrigated; this promotes aerobic root growth, reduces methane emissions, and saves 25–30% water. (4) Organic enrichment of soil and mechanical weeding. SRI consistently increases yields by 20–50% over conventional transplanting.

Final Answer: SRI distinguishes itself by transplanting single 8–12-day-old seedlings at wide spacing (25 cm $\times$ 25 cm) and using alternate wetting and drying instead of continuous flooding, which together promote vigorous tillering and reduce water use by up to 30%.

Answer: (C) Go Back to Q10

Q11.

Solution

In maize hybrid breeding, a single-cross hybrid (SCH) is produced by crossing two unrelated inbred lines (A $\times$ B). Because both parents are highly homozygous (pure lines developed by 6–8 generations of selfing), the resulting F1 is completely heterozygous at all loci, maximising heterosis (hybrid vigour). The genetic uniformity of the two parents translates to high uniformity in the commercial hybrid – all seeds produce plants of identical genotype. In contrast, a double-cross hybrid (DCH) is produced by crossing two single-cross hybrids (AB $\times$ CD). While DCH was historically used because single-cross seed production on weak inbreds was expensive, DCH plants are less uniform (because the parents AB and CD are themselves heterogeneous). With modern inbred development and hybrid seed production technology, SCH has replaced DCH as the dominant hybrid type because it gives higher and more uniform yield and better adaptation. The statement in option B is incorrect.

Final Answer: A single-cross hybrid (inbred A $\times$ inbred B) gives higher and more uniform yield than a double-cross hybrid because crossing two completely homozygous pure lines produces an F1 that is maximally heterozygous and genetically identical across all plants.

Answer: (A) Go Back to Q11

Q12.

Solution

Pearl millet (Pennisetum glaucum) is a moderately nutrient-demanding crop. The standard recommended NPK dose for irrigated/normal kharif bajra in Rajasthan is 80 kg N : 40 kg P_2O_5 : 40 kg K_2O per hectare. Phosphorus and potassium, being less mobile, are applied as a single basal dose at sowing (incorporated into the soil). Nitrogen, because of its high mobility and leaching risk, is applied in split doses: 40 kg N/ha as basal (combined with P and K) and the remaining 40 kg N/ha as top-dressing at 25–30 days after sowing, which corresponds to the knee-high stage (V5–V6), just before the rapid vegetative growth phase when N demand is highest. This split application improves nitrogen use efficiency, reduces leaching loss, and supports adequate panicle development. Options A, B, and C contain incorrect dose values.

Final Answer: Bajra requires 80:40:40 kg N:P:K/ha with basal P and K plus half the N at sowing, and the remaining nitrogen top-dressed at the knee-high stage (25–30 DAS) when crop demand peaks for tiller and panicle development.

Answer: (D) Go Back to Q12

Q13.

Solution

Biological nitrogen fixation in legumes depends on the formation of a symbiosis between the host plant and specific Rhizobium species. This symbiosis is highly host-specific – the strain that nodulates chickpea (Cicer arietinum) is Mesorhizobium ciceri (formerly Rhizobium ciceri), and it does not effectively nodulate other legumes such as soybean or groundnut. In the absence of adequate populations of this specific strain in soil (which is common in soils where chickpea has not been grown recently), seed inoculation with a commercial culture of M. ciceri is essential to ensure nodule formation. Effective nodulation can fix 70–80 kg N/ha over the crop season, which is equivalent to the nitrogen supplied by 400 kg urea/ha, significantly reducing the need for chemical nitrogen fertilizer. This also lowers cost of production and improves soil nitrogen balance for the next crop. Options A, C, and D contain factual errors.

Final Answer: Seed inoculation with the host-specific Rhizobium ciceri is essential for chickpea because this strain forms effective nodules only on chickpea roots and can fix 70–80 kg N/ha per season, substantially replacing chemical nitrogen fertilizer.

Answer: (B) Go Back to Q13

Q14.

Solution

Intercropping combines two or more crops on the same land to make more efficient use of resources (light, water, nutrients) and reduce risk. In the mustard + chickpea system, a common and well-validated row arrangement is 6 rows of mustard alternating with 2 rows of chickpea (6:2 ratio). This works because: (i) tall mustard acts as a partial windbreak for chickpea; (ii) chickpea (a legume) fixes atmospheric nitrogen, improving soil fertility; (iii) the crops occupy different canopy layers and root depths, reducing direct competition. The Land Equivalent Ratio (LER) quantifies the advantage: LER = (yield of mustard in IC / yield of mustard in sole crop) + (yield of chickpea in IC / yield of chickpea in sole crop). An LER > 1 means the intercropped system needs less land area than two separate sole-crop systems to produce the same total output, demonstrating a genuine productivity advantage. Reported LER values for this combination typically range from 1.1 to 1.3.

Final Answer: Mustard + chickpea intercropping in a 6:2 row ratio gives an LER greater than 1 because the two crops exploit different canopy layers and root depths, so their combined output per unit area exceeds that of either crop grown

alone.

Answer: (C) Go Back to Q14

Q15.

Solution

Groundnut varieties are classified by growth habit into two main types. Bunch (erect) type: plants grow upright with a compact canopy; pods are borne close to the main stem and are concentrated near the crown of the plant. This concentrated pod distribution makes it easy for mechanical pod lifters/diggers to harvest them without excessive pod loss. Popular bunch varieties include JL-24 (short duration), TG-26, and GG-20. Spreading (runner) type: plants spread along the ground, with a main stem and several lateral branches covering a large area; pods are distributed along the entire length of the laterals, sometimes up to 1 metre from the crown, making mechanical harvesting very difficult because the digger cannot recover pods from all areas without heavy losses. Spreading types such as Chandra, M-13, and SB-XI are typically harvested manually. The critical distinction in this question is that mechanized harvesting is a feature of bunch-type groundnut.

Final Answer: Bunch-type groundnut (e.g., JL-24, TG-26) suits mechanized harvesting because its erect habit concentrates pods near the plant base, whereas spreading types distribute pods over a wide lateral area that mechanical diggers cannot fully recover.

Answer: (D) Go Back to Q15

Q16.

Solution

Jowar (Sorghum bicolor) is called a dual-purpose crop because it provides both grain for human food/animal feed and nutritious stover (stem and leaves) as livestock fodder. This dual utility makes it especially important in semi-arid regions like Rajasthan where a single crop meeting two needs is economically valuable. The crop is well adapted to limited rainfall (400–600 mm), high temperatures, and moderately deep soils. Improved varieties CSV-13 and CSV-15, developed by ICAR-Indian Institute of Millets Research (formerly AICSIP), are high-yielding kharif varieties that give both good grain yield (2.5–3.0 t/ha) and high fodder yield. They are widely recommended for cultivation in Rajasthan, Gujarat, Maharashtra, and Karnataka. CSV-13 has good drought tolerance, making it particularly suitable for Rajasthan's variable rainfall conditions.

Final Answer: Jowar is a dual-purpose crop because it simultaneously yields grain for food or feed and high-quality stover for livestock fodder, making varieties like CSV-13 and CSV-15 especially valuable in Rajasthan's semi-arid farming systems.

Answer: (A) Go Back to Q16

Q17.

Solution

Guava (Psidium guajava) is one of the richest sources of Vitamin C among tropical fruits. Allahabad Safeda is the most popular white-fleshed guava variety in India, developed at the Allahabad Agricultural Institute; it has a creamy-white pulp with small seeds, very high Vitamin C content (approximately 200–300 mg/100 g of fresh pulp), good keeping quality, and excellent flavour. It is the benchmark commercial variety against which others are compared. L-49 (Lucknow-49), developed at CISH Lucknow, has a slightly pinkish to salmon-coloured flesh (softer texture), somewhat lower Vitamin C than Allahabad Safeda, and is preferred for processing into jam, jelly, and juice due to its higher pectin content. Option A incorrectly reverses the flesh colours of the two varieties, which is a common exam distractor.

Final Answer: Allahabad Safeda has white flesh with exceptionally high Vitamin C (approximately 200–300 mg/100 g), whereas L-49 has slightly pinkish softer flesh and is preferred for processing, making their flesh colour and texture the key distinguishing traits.

Answer: (B) Go Back to Q17

Q18.

Solution

Pomegranate (Punica granatum) is inherently a drought-tolerant fruit crop that performs well in semi-arid conditions due to its deep root system, low water requirement compared to most fruit crops, and ability to withstand high temperatures and low humidity. Rajasthan's arid and semi-arid climate is therefore well suited for pomegranate cultivation. Bhagwa (also called Sindhuri) is the leading commercial variety promoted in Rajasthan, Maharashtra, and Karnataka; it is named for its bright red (bhagwa = saffron/red) aril colour, high juice content, soft seeds, and excellent export quality. Under drip irrigation, Bhagwa gives high and consistent yields even with water as low as 800–1000 mm/year applied through drip. It is promoted under the National Horticulture Mission in the dry districts of Barmer, Jaisalmer, Jodhpur, and Nagaur. Option A is factually incorrect;

option B names the wrong variety.

Final Answer: Bhagwa is the best pomegranate variety for arid Rajasthan because its inherent drought tolerance, deep root system, and excellent fruit quality under drip irrigation make it commercially viable even in districts receiving below 400 mm annual rainfall.

Answer: (C) Go Back to Q18

Q19.

Solution

Date palm (Phoenix dactylifera) is dioecious (separate male and female trees). Seed propagation is undesirable for two reasons: (i) approximately 50% of seedlings will be male (non-fruiting); and (ii) seedlings show wide genetic variability in fruit quality, ripening time, and yield. The standard commercial propagation method is removal of vegetative offshoots (suckers) that arise naturally at the base and on the trunk of mature female palms. A single mother palm produces 10–30 offshoots over its productive life. These are detached when they weigh 4–8 kg (3–5 years old), rooted, and transplanted, producing fruiting trees true to the mother's type. In Rajasthan's Thar Desert (districts of Jaisalmer, Barmer, Bikaner), date palm is a traditional crop adapted to extreme heat, low rainfall (100–250 mm), and sandy soils; it provides food security, shade, and income for desert communities.

Final Answer: Date palm is propagated by vegetative offshoots (suckers) from mature female palms because this method guarantees that every plant is a known-sex, fruit-bearing tree that reproduces the mother's quality, unlike seed propagation which produces 50% male non-fruiting plants.

Answer: (D) Go Back to Q19

Q20.

Solution

Pusa Jwala is a well-known chili (Capsicum annuum) variety developed by ICAR-IARI, New Delhi; it is characterized by long, slender, highly pungent fruits (above 70,000 Scoville Heat Units), determinate plant habit, and is used for both fresh market and drying. Critical irrigation stages for chili are: (i) at transplanting for establishment; (ii) at flowering – water stress at this stage causes blossom drop significantly reducing fruit set; (iii) at fruit development – ensures proper cell expansion and pungency development. Choanephora fruit rot (wet rot) is caused by the zygomycete fungus Choanephora cucurbitarum; it thrives under hot, humid

conditions. Infected fruits show water-soaked lesions that rapidly progress to a soft rot, covered with whisker-like grey to black fungal growth (sporangiophores). Management includes avoiding overhead irrigation, ensuring good air circulation, and application of copper fungicide or metalaxyl + mancozeb.

Final Answer: Critical irrigation stages for chili are flowering and fruit set, and Choanephora cucurbitarum causes wet fruit rot in humid conditions by producing water-soaked lesions that quickly collapse into a soft rot covered with grey-black fungal growth.

Answer: (A) Go Back to Q20

Q21.

Solution

Muskmelon (Cucumis melo) is a warm-season cucurbit grown extensively in Rajasthan, Uttar Pradesh, Punjab, and Haryana. Hara Madhu is a popular variety with light green skin and cream-coloured flesh; Punjab Sunehri (developed at PAU Ludhiana) has golden-yellow skin and orange flesh with high sugar content. Correct harvest maturity determination is critical for consumer satisfaction: (i) netting (reticulation) – the corky, raised network of cracks on the fruit skin; when fully developed (the characteristic raised netting covers most of the surface), the fruit is mature; (ii) colour change – the background colour changes from green to yellowish-cream, cream, or golden depending on variety; (iii) abscission layer – a circular crack appears at the stem-fruit junction (the fruit "slips" from the vine) in some varieties; (iv) aroma – a characteristic sweet fragrance becomes perceptible. Options A, C, and D describe incorrect harvest criteria.

Final Answer: Muskmelon varieties Hara Madhu and Punjab Sunehri are ready for harvest when full corky netting develops on the fruit skin, the background colour shifts from green to yellowish-cream, and a characteristic sweet aroma becomes perceptible.

Answer: (B) Go Back to Q21

Q22.

Solution

The artificial ripening of fruits has been a major food safety concern in India. Calcium carbide (CaC_2) reacts with atmospheric moisture to release acetylene gas, which has ripening properties similar to ethylene. However, commercial calcium carbide often contains impurities of arsenic trioxide (As_2O_3) and calcium phosphide (Ca_3P_2); the latter reacts with moisture to produce phosphine (PH_3), which is toxic to the nervous and respiratory systems. The use of calcium carbide for fruit ripening is banned under Rule 44AA of the Prevention of Food Adulteration Rules and under FSSAI Food Safety and Standards Regulations 2011. Ethephon (2-chloroethylphosphonic acid) is an ethylene-releasing compound that breaks down in plant tissue to release physiological ethylene, the natural ripening hormone. Ethephon spray or dip at concentrations of 250–500 ppm is legally permitted for use on specific fruits under FSSAI. Hence, option C is the correct statement.

Final Answer: Ethephon is the legally permitted fruit-ripening agent in India because it releases physiological ethylene with no harmful residues, whereas calcium carbide is banned because its phosphide impurities generate toxic phosphine gas.

Answer: (C) Go Back to Q22

Q23.

Solution

Mutation breeding uses physical or chemical mutagens to induce heritable changes in the crop genome. Colchicine is an alkaloid extracted from Colchicum autumnale (autumn crocus). It binds to tubulin and inhibits spindle-fibre polymerization during cell division; as a result, chromosomes that have replicated cannot be pulled to the poles, and the cell receives a doubled chromosome complement. This doubling (polyploidization) is exploited to: (i) double the chromosome number of haploid plants obtained from anther culture, restoring fertility; (ii) create amphidiploids from wide crosses between species. Gamma rays (and X-rays, fast neutrons) are ionizing radiations that induce DNA double-strand breaks, chromosomal translocations, deletions, and point mutations. Most induced mutations are recessive and deleterious, but a small proportion are useful. Notable examples include NP-836 (rice, gamma-ray mutant with early maturity) and Sharbati Sonora (wheat). The FAO/IAEA mutant variety database lists over 3,000 officially released mutant varieties worldwide.

Final Answer: Colchicine doubles chromosome number by blocking spindle-fibre formation, while gamma rays induce point mutations and chromosomal rearrangements such as in rice variety NP-836, and both tools are used in mutation

breeding to create heritable genetic variation in crop plants.

Answer: (D) Go Back to Q23

Q24.

Solution

Bread wheat (Triticum aestivum) is an allohexaploid (2n = 6x = 42) with three distinct diploid genomes: A genome (from T. urartu), B genome (from Aegilops speltoides or a close relative), and D genome (from Aegilops tauschii). It arose through two sequential allopolyploidy events: first, AB genomes combined to form emmer wheat (T. turgidum, tetraploid AABB, 2n = 28); then emmer hybridised with the D-genome diploid to give the hexaploid AABBDD. Polyploidy contributed to bread wheat's success by: (i) increasing grain size – more gene copies per cell support greater storage protein and starch synthesis; (ii) increasing adaptability – six sets of chromosomes buffer against environmental stress and allow cultivation across a wide range of climates; (iii) improving bread-making quality – D-genome encodes key gluten proteins (LMW-GS and HMW-GS subunits) that determine dough elasticity. The hexaploid state is far from reducing yield – it is the foundation of wheat's global importance as a staple food.

Final Answer: Bread wheat is hexaploid (2n = 42, AABBDD) because it arose from two sequential allopolyploidy events involving three diploid progenitors, and this six-genome constitution underlies its large grain size, high protein content, and wide adaptability.

Answer: (A) Go Back to Q24

Q25.

Solution

The concept of cellular totipotency was first articulated by Haberlandt (1902) and later experimentally demonstrated by Steward et al. (1958) using carrot root cells. It states that every living somatic cell of a plant contains the complete genetic information (the full genome) necessary to regenerate a complete, functional plant, given the appropriate physical and chemical environment. In practice, tissue culture exploits totipotency as follows: an explant (piece of leaf, stem, root, or meristem) is surface-sterilised and placed on a solid Murashige and Skoog (MS) medium. A high auxin:cytokinin ratio induces the formation of callus – a mass of rapidly dividing, undifferentiated parenchyma-like cells. When the auxin:cytokinin ratio is reduced (more cytokinin), shoot organogenesis or somatic embryogenesis is initiated, eventually giving rise to complete plantlets. Totipo-

tency is the biological basis for clonal propagation, somatic hybridization, genetic transformation, and embryo rescue in plant biotechnology.

Final Answer: Totipotency means every living plant cell carries the full genome needed to regenerate a whole plant; callus is produced by placing an explant on MS medium with a high auxin:cytokinin ratio, creating an undifferentiated proliferating cell mass that can later be directed to form shoots and roots.

Answer: (B) Go Back to Q25

Q26.

Solution

Seed dormancy is the condition in which a viable seed fails to germinate even when placed under conditions (temperature, moisture, oxygen) normally suitable for germination. Two major types are relevant in agriculture. Physical dormancy: the seed coat (testa) or fruit coat is hard, thick, and impermeable to water. This is common in legumes such as moth bean (Vigna aconitifolia), guar (Cyamopsis tetragonoloba), and horse gram (Macrotyloma uniflorum). Breaking methods include: scarification (rubbing with sandpaper), acid scarification (concentrated H_2SO_4 for 10–30 min), and hot water soaking (80°C water, then allowed to cool). Physiological dormancy: the embryo itself is inhibited from germinating, typically by high levels of abscisic acid (ABA) relative to gibberellins (GA) in the seed. This is common in freshly harvested cereals and in seeds requiring cold stratification (e.g., peach, apple). Breaking methods include: after-ripening (dry storage for weeks to months), cold moist stratification (2–5°C for 4–12 weeks), or application of exogenous gibberellin (GA_3 500 ppm).

Final Answer: Physical dormancy (impermeable hard seed coat in legumes like moth bean and guar) is broken by scarification or hot water soaking, while physiological dormancy (ABA-mediated embryo inhibition) is broken by after-ripening, cold stratification, or exogenous gibberellin treatment.

Answer: (C) Go Back to Q26

Q27.

Solution

Pink bollworm (Pectinophora gossypiella) is one of the most serious internal borers of cotton globally and is of quarantine importance. Life cycle: after mating, females lay eggs singly on cotton squares (flower buds), young bolls, and occasionally on leaves. Young larvae bore into the square or boll within hours of hatching. Damage symptoms: (i) "Rosetted boll" or "rosetted flower" (in Hindi: Gulabi Bagad) – infested flower petals become stuck together with silk, forming a rosette shape, a diagnostic symptom; (ii) Inside the mature boll, larvae feed on the seeds and lint, producing a characteristic double-seeded structure with the seeds stuck together ("double seed"); (iii) Heavy infestation causes premature boll shedding and reduced lint quality. Management: (a) Gossyplure (a blend of two pheromone components) is used in pheromone traps at 5 traps/ha for monitoring and mass trapping; (b) Bt-cotton (Cry1Ac gene) was historically effective against pink bollworm, though resistance has developed; (c) Crop sanitation and early harvest of mature bolls reduce carry-over population.

Final Answer: Pink bollworm larvae bore into cotton bolls causing diagnostic rosetted flowers and double-seeded bolls, and the pest is managed through gossyplure pheromone traps for mating disruption and mass trapping along with cultivation of Bt-cotton hybrids.

Answer: (D) Go Back to Q27

Q28.

Solution

Bemisia tabaci (silverleaf whitefly) is the most important insect vector of plant viruses in the world. In cotton, it is the sole vector of Cotton Leaf Curl Virus (CLCuV), a monopartite begomovirus (family Geminiviridae, single-stranded circular DNA). CLCuV causes leaf curling (upward or downward), thickening of veins, enation (leaf-like outgrowths on underside of leaf), and severe stunting, leading to 10–100% yield loss in susceptible varieties. Management of insecticide resistance is critical because B. tabaci has developed resistance to multiple chemical classes including organophosphates, pyrethroids, and neonicotinoids. Resistance management strategies include: (i) rotation of insecticide classes with different modes of action (e.g., neonicotinoids Group 4A $\rightarrow$ pyriproxyfen Group 7C $\rightarrow$ spiromesifen Group 23) to prevent build-up of resistance alleles; (ii) use of CLCuV-resistant cotton varieties (e.g., CLCuV-tolerant Bt-cotton lines) to reduce selection pressure; (iii) conservation of natural enemies (Encarsia, Eretmocerus parasitoids). Option D describes exactly the wrong strategy – using the same class repeatedly accelerates resistance.

Final Answer: Bemisia tabaci transmits Cotton Leaf Curl Virus (CLCuV), a begomovirus causing leaf curling and severe stunting, and resistance in whitefly populations is managed by rotating insecticide classes with different modes of action rather than using the same class repeatedly.

Answer: (A) Go Back to Q28

Q29.

Solution

Agrotis ipsilon (black cutworm) belongs to the family Noctuidae. Adults are night-flying moths that lay eggs in soil or on plant debris near the base of plants. First- and second-instar larvae climb onto plants and feed on leaves, but from the third instar onwards, larvae become soil-dwelling and exhibit the characteristic cutworm behaviour: at night, they emerge from the soil and sever young seedlings cleanly at or just below the soil surface. The cut seedling wilts and falls over – a sudden death that can devastate a recently established crop. Economic injury is highest in the first 3–4 weeks after sowing/transplanting. Management: (i) Soil drench with chlorpyrifos 20 EC at 2 ml/L around the base of affected plants (the larvae are in the soil near the cut stem); (ii) Poison bait – wheat bran (10 kg) + chlorpyrifos (100 ml) mixed with water and broadcast in the evening near affected patches (the nocturnal larvae eat the bait); (iii) Field sanitation – destruction of stubble and first ploughing in summer (solar disinfestation) reduces pupal population.

Final Answer: Cutworm larvae live in the soil and sever seedlings at or below ground level at night, causing sudden wilting, and are managed by soil drench with chlorpyrifos or by broadcasting poison bait (wheat bran mixed with insecticide) around affected plants at dusk.

Answer: (B) Go Back to Q29

Q30.

Solution

Loose smut of wheat, caused by Ustilago tritici (= Tilletia tritici complex / Ustilago nuda f.sp. tritici), is a classic example of an internally seed-borne pathogen. Disease cycle: teliospores (masses of dark smut spores) are released from smutted heads during the host plant's anthesis (flowering). Healthy nearby flowers are open for pollination at the same time, and airborne teliospores land on the stigma. The fungus grows into the developing embryo of the forming seed. The infected seed looks normal externally. When the infected seed is sown, the fungus grows

systemically with the host plant, reaching the ear at the time of heading. Instead of normal grain, the entire head is converted into a mass of olive-brown teliospores covered by a thin membrane that ruptures at heading, releasing the smut spores. A normal fungicide seed treatment (e.g., Thiram) does not penetrate the seed coat to reach the internally located mycelium. Hot water treatment (HWT) at 52°C for exactly 10 minutes, followed by immediate cooling, kills the mycelium inside the seed without significantly harming germination. Alternatively, systemic fungicides such as carboxin (Vitavax) or tebuconazole can penetrate the seed coat and are highly effective.

Final Answer: Loose smut is internally seed-borne because teliospores infect the wheat embryo at flowering and remain dormant inside the seed, so only hot water treatment at 52°C for 10 minutes or systemic fungicides like carboxin that penetrate the seed coat can effectively control it.

Answer: (C) Go Back to Q30

Q31.

Solution

Fusarium oxysporum is a soilborne fungal pathogen that causes vascular wilt disease. It is the most host-specific plant pathogen – each forma specialis (f.sp.) is genetically and pathologically distinct and infects only one host species or genus. Important forma specialis include: f.sp. cubense (Foc) – Panama disease of banana, causing historical devastation of Gros Michel cultivar; f.sp. lycopersici – tomato wilt, managed by resistant rootstocks and Tm-2 gene; f.sp. ciceri – chickpea wilt, managed by resistant varieties like JG-62 and WR-315. After entering through roots, the fungus colonises the xylem vessels, producing toxins and vessel-blocking polysaccharides that cause wilting. Once F. oxysporum is established in soil, it persists as chlamydospores for 10–30 years, making chemical soil fumigation an impractical and economically unfeasible management tool for field crops. Resistant varieties are the most cost-effective, durable, and environmentally sustainable management strategy. Soil solarization and biocontrol agents (Trichoderma spp.) provide supplementary management.

Final Answer: Growing resistant varieties is the best strategy against Fusarium wilt because the pathogen persists in soil as chlamydospores for up to 30 years making chemical control impractical, and each host-specific forma specialis can only be effectively countered by host resistance genes.

Answer: (D) Go Back to Q31

Q32.

Solution

Azadirachtin is a complex tetranortriterpenoid limonoid isolated primarily from neem seeds (Azadirachta indica). It has multiple modes of action that make it highly effective while being safe for non-target organisms: (1) Insect Growth Regulation (IGR): azadirachtin interferes with ecdysone (moulting hormone) signalling by blocking the release of prothoracicotropic hormone (PTTH) from the brain, preventing ecdysone synthesis. This disrupts moulting – larvae fail to moult from one instar to the next, or moult into deformed adults, breaking the life cycle. (2) Antifeedant activity: even sub-lethal doses reduce feeding behaviour in insects by acting on chemoreceptors, causing starvation in non-resistant insects. (3) Repellent effect: deters females from ovipositing on treated plants. Effective target pests include: aphids, whitefly, leafminers, thrips, and lepidopteran larvae in early instars. Being botanically derived with rapid UV degradation and no persistent toxic residues, it meets the requirements of the National Programme for Organic Production (NPOP) in India and international organic standards (IFOAM). It is widely used in organic vegetable and fruit production.

Final Answer: Azadirachtin is approved for organic farming because it is botanically derived from neem seeds, leaves no persistent toxic residues, and controls pests by disrupting ecdysone-mediated moulting and reducing feeding behaviour rather than acting as a broad-spectrum chemical nerve poison.

Answer: (A) Go Back to Q32

Q33.

Solution

Tharparkar cattle are one of the recognised dual-purpose (milk and draft) zebu (Bos indicus) breeds of India, originating from the Tharparkar district of Sindh (now Pakistan) and the bordering Barmer and Jaisalmer districts of Rajasthan. Physical characteristics: medium frame, deep body, prominent withers; coat colour is white to grey-white with a slightly darker grey on neck and hindquarters; horns are lyre-shaped (curving outward and upward); face is slightly dished; dewlap is moderate. Milk yield: approximately 1,800–2,200 litres per lactation under village conditions, with a fat percentage of 4.5–5.0%. In contrast, Kankrej cattle originate from the Kankrej taluka of Gujarat and border areas of Rajasthan. They are a large, powerful breed with distinctive iron-grey colour (darker shade than Tharparkar), broader forehead, and curved lyrate horns that sweep outward, upward, and then curve inward at the tip. Kankrej are especially valued as powerful draft bullocks for heavy field work and transport. Distinguishing the two breeds on horn shape and body size is a standard examination topic.

Final Answer: Tharparkar is a medium-framed, white to grey-white breed with lyre-shaped horns native to the Thar Desert, while Kankrej is a larger iron-grey breed with distinctively curved lyrate horns from the Gujarat-Rajasthan border, prized for heavy draft work.

Answer: (B) Go Back to Q33

Q34.

Solution

Nali is a carpet-wool sheep breed of the northern arid region of India. Distribution: primarily the Ganganagar, Churu, Jhunjhunu, and Sikar districts of Rajasthan and adjoining Hisar, Fatehabad, and Sirsa districts of Haryana, with some population in southwestern Punjab. Physical characteristics: medium to large frame, white body with tan/brown markings on face and legs (ram and ewe), Roman nose, open face, pendulous ears. Wool characteristics: the wool is semi-lustre (intermediate between the lustre breeds like Corriedale and coarse carpet wools), medium staple length (6–10 cm), medium-coarse fibre diameter (32–38 microns), white colour, and has inherent resilience and elasticity that makes it ideal for carpet weaving – the finished carpet can withstand heavy foot traffic without matting. Annual greasy fleece weight: 2.5–3.5 kg per animal. The Nali sheep is the primary source of domestic carpet wool in India and contributes significantly to the hand-knotted carpet industry centred in Jaipur and Bikaner.

Final Answer: Nali sheep are a carpet-wool breed native to the Rajasthan-Haryana border region that produce semi-lustre, medium-coarse white wool (32–38 microns) valued for its resilience and bulk in carpet weaving, making them the primary domestic source of Indian carpet wool.

Answer: (C) Go Back to Q34

Q35.

Solution

Marwari goat is the predominant goat breed of Rajasthan's western arid zone, found in Jodhpur, Barmer, Jaisalmer, Bikaner, Nagaur, and Pali districts. It is named after the Marwar region (Jodhpur area). Purpose: primarily reared for meat (chevon) and coarse body hair; the hair is used for weaving coarse blankets (kambal) and rope. Milk yield is low (40–60 litres per lactation) and secondary. Physical characteristics: medium body size, compact and muscular; coat usually white with black or tan markings; ears are medium and flat; horns are twisted/spiral in males. Desert adaptations – these are critical for survival in an ex-

treme environment where daytime temperatures exceed 45°C and annual rainfall is below 300 mm: (i) highly efficient sweating and panting for thermoregulation; (ii) ability to browse on thorny shrubs, dry grass, pods of Acacia, Prosopis, and other drought-hardy plants when green fodder is unavailable; (iii) ability to tolerate saline/brackish water; (iv) efficient kidney function reducing urinary water loss; (v) ability to travel 15–20 km per day between sparse water sources.

Final Answer: Marwari goat thrives in Rajasthan's extreme arid conditions because its browsing habit, heat tolerance, efficient water use, and capacity to travel long distances between water sources make it well suited to a desert environment where no other goat breed can sustain production.

Answer: (D) Go Back to Q35

Q36.

Solution

Camels belong to the family Camelidae and there are two distinct species of Old World camels (genus Camelus): (1) Dromedary camel (Camelus dromedarius): has ONE hump (the hump stores fat, not water, as a reserve energy source); body is adapted to hot, dry desert climates (sandy deserts of North Africa, Middle East, and Indian subcontinent). In India, the dromedary is found in Rajasthan (Bikaner, Jaisalmer, Barmer, Jodhpur – the Bikaneri camel breed is the most famous Indian dromedary), Gujarat, and parts of Punjab/Haryana. In Rajasthan, camels are used for transport, ploughing sandy soils, and for camel milk, which has high nutritional value. (2) Bactrian camel (Camelus bactrianus): has TWO humps; adapted to cold, temperate deserts (Gobi desert of Mongolia and China, Bactria in Central Asia). It has a thick double winter coat for cold endurance. Bactrian camels are NOT found in India. Option A correctly identifies the geographic distribution: Dromedary = India/Rajasthan, Bactrian = Central Asia.

Final Answer: The Dromedary (one hump) is the camel of Rajasthan and the Indian subcontinent, adapted to hot sandy deserts, while the Bactrian (two humps) is native to the cold deserts of Central Asia and China and is not found in India.

Answer: (A) Go Back to Q36

Q37.

Solution

The cost of cultivation framework used by the Commission for Agricultural Costs and Prices (CACP) in India categorises farm costs into a hierarchy. A1 cost: all actual paid-out costs – seeds, fertilizers, pesticides, hired human labour, hired bullock/machine labour, irrigation charges, depreciation on implements, and other miscellaneous paid-out expenses. A2 cost: A1 cost + imputed rent of owned land (at the prevailing lease rate in the area) + depreciation on owned farm machinery and buildings. B2 cost: A2 cost + imputed value of family labour (calculated at the prevailing wage rate for hired agricultural labour). B2 is the most commonly used cost concept for MSP fixation because it covers all costs actually borne by the farmer – both out-of-pocket and imputed (opportunity cost) items – while excluding only the interest on owned capital. C2 cost (also called comprehensive cost) = B2 + interest on the value of owned fixed capital assets (land at current market value, machinery, etc.) – this is the highest cost concept.

Final Answer: B2 cost covers all paid-out costs plus imputed rent on owned land and imputed family labour value, making it the most comprehensive basis for MSP fixation as it reflects the full economic cost borne by the farmer including opportunity costs.

Answer: (B) Go Back to Q37

Q38.

Solution

The AMUL (Anand Milk Union Limited) model, also called the Anand Pattern or the "White Revolution" model, is a three-tier cooperative structure developed under the guidance of Dr. Verghese Kurien at Anand, Gujarat, in the 1950s and 1960s. Tier 1 – Village Dairy Cooperative Societies (DCS): at the village level, each member farmer brings milk twice daily to the DCS collection point; the DCS tests milk quality and fat content, pays the farmer, chills and stores the raw milk, and manages local membership. Tier 2 – District Milk Unions: e.g., the Kaira District Cooperative Milk Producers Union (KDCMPU), which operates the Amul dairy plant at Anand; the district union collects milk from all its village DCS units, processes it into pasteurised milk and value-added products (butter, ghee, cheese, ice cream, powder), and markets products regionally. Tier 3 – State Federation: Gujarat Cooperative Milk Marketing Federation (GCMMF) manages the national and international marketing of all district unions' products under the common Amul brand, negotiates bulk contracts, and handles exports. Key success factors: farmer ownership (no middlemen), professional management, economies of scale, and brand building.

Final Answer: AMUL's Anand Pattern succeeds through three tiers – village DCS for milk collection, district unions for processing, and GCMMF for national marketing under the Amul brand – with farmer ownership at every tier eliminating middlemen and ensuring fair price realization.

Answer: (C) Go Back to Q38

Q39.

Solution

Pradhan Mantri Fasal Bima Yojana (PMFBY) was launched in 2016, replacing the National Agricultural Insurance Scheme (NAIS) and the Modified NAIS, to provide comprehensive and affordable crop insurance to farmers. Key financial provisions: (i) Farmer premium is capped at 2% of the sum insured for all kharif crops (e.g., paddy, bajra, maize, soybean, cotton); (ii) Farmer premium is capped at 1.5% of sum insured for all rabi crops (e.g., wheat, mustard, gram, sunflower); (iii) Farmer premium for annual commercial/horticultural crops is 5% of sum insured; (iv) The balance between the farmer's capped premium and the actual actuarial/risk premium demanded by the implementing insurance company is subsidised equally by the State and Central Governments (50:50 share in most states). This subsidy mechanism ensures that farmers pay a very small and predictable premium while getting full sum insured coverage. PMFBY is one of the largest crop insurance programmes in the world by premium volume and is administered through designated insurance companies (public and private) selected by state governments through competitive bidding.

Final Answer: Under PMFBY, farmer premiums are capped at 2% for kharif and 1.5% for rabi crops, with the remaining actuarial premium shared equally between state and central governments, making comprehensive crop insurance affordable for all farmers including small and marginal holders.

Answer: (D) Go Back to Q39

Q40.

Solution

Regional Rural Banks (RRBs) were established by the Government of India under the Regional Rural Banks Act, 1976, following the recommendations of the Narasimham Working Group on Rural Banks (1975). The rationale was to create a new institution specifically designed to serve the rural population with lower operating costs than commercial banks, greater local area coverage, and a focus on priority sectors (small and marginal farmers, agricultural labourers, artisans,

small entrepreneurs). Equity structure (ownership pattern): 50% held by Government of India; 15% held by the concerned State Government; 35% held by the Sponsor Commercial Bank (e.g., Punjab National Bank sponsors Punjab Gramin Bank; State Bank of India sponsors multiple RRBs). The sponsor bank provides initial capital, management expertise, and staff training. RRBs operate under the dual control of NABARD (for supervision and refinancing) and the Reserve Bank of India (for banking regulation). As of 2023, there are 43 RRBs operating across India following a series of consolidation rounds (from the original 196 RRBs formed in the late 1970s and 1980s). They provide short-term and medium-term credit for agricultural operations, allied activities, and rural non-farm enterprises.

Final Answer: RRBs were established under the Regional Rural Banks Act 1976 with a 50:15:35 equity split between the central government, state government, and sponsor commercial bank respectively, to deliver low-cost institutional credit directly to small farmers and rural enterprises.

Answer: (A) Go Back to Q40

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	C	3	A	4	D	5	B
6	C	7	A	8	D	9	B	10	C
11	A	12	D	13	B	14	C	15	D
16	A	17	B	18	C	19	D	20	A
21	B	22	C	23	D	24	A	25	B
26	C	27	D	28	A	29	B	30	C
31	D	32	A	33	B	34	C	35	D
36	A	37	B	38	C	39	D	40	A