Rajasthan JET Agriculture Sample Paper-10

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. Arbuscular mycorrhiza (AM fungi) benefit the host plant primarily by:

(A) Fixing atmospheric nitrogen directly in root nodules

(B) Enhancing phosphorus uptake through an extended hyphal network

(C) Producing indole acetic acid to promote root elongation

(D) Acting as biocontrol agents against soil-borne pathogens only

Q2. Blossom end rot of tomato is caused by:

(A) Calcium deficiency, because Ca is immobile in phloem and cannot be redistributed to fast-growing fruits

(B) Boron deficiency affecting cell wall carbohydrate metabolism

(C) Magnesium deficiency leading to disrupted chlorophyll synthesis

(D) Iron toxicity causing excess free radicals in developing tissue

Q3. Which combination of practices is most effective for reclaiming saline soils?

(A) Deep ploughing + lime application + growing acid-tolerant crops

(B) Gypsum application + ponding water + growing legumes

(C) Leaching with good quality water + installing drainage + growing salt-tolerant crops such as barley

(D) Flooding with brackish water + adding organic manure + green manuring with sunnhemp

Q4. The main agronomic purpose of subsoiling (deep ploughing to 30–50 cm) is to:

(A) Increase soil pH by exposing fresh mineral layers

(B) Stimulate earthworm population and improve aggregate stability

(C) Mix surface organic matter uniformly throughout the profile

(D) Break the compacted hardpan to improve water infiltration and root penetration

Q5. In evaluating irrigation water quality, the Sodium Adsorption Ratio (SAR) is used to assess:

(A) Salinity hazard by measuring total dissolved solids

(B) Sodicity hazard, indicating the risk of sodium-induced soil structural deterioration

(C) Bicarbonate hazard that causes calcium precipitation in soil

(D) Chloride toxicity to sensitive crops such as stone fruits

Q6. The most fundamental moisture conservation strategy in rainfed farming is:

(A) In-situ moisture conservation through contour ploughing and tied ridges to harvest rainfall where it falls

(B) Installing drip irrigation systems in every field

(C) Growing high water-requirement crops like sugarcane to maximize water use

(D) Deep drainage by providing open field channels every 10 m

Q7. Which post-emergence herbicide is specifically recommended for weed management in transplanted rice?

(A) Atrazine applied 3 days after transplanting at 1.0 kg a.i./ha

(B) Pendimethalin applied as pre-emergence within 3 days of sowing

(C) Bispyribac-sodium applied 15–20 days after transplanting at 25 g a.i./ha

(D) 2,4-D amine applied during active tillering stage at 0.75 kg a.i./ha

Q8. Biochar is best described as:

(A) A nitrogenous fertilizer produced by anaerobic fermentation of green biomass

(B) A microbial inoculant containing phosphate-solubilizing bacteria

(C) A composted mixture of animal dung and crop residues activated by vermicomposting

(D) A charred organic material produced by pyrolysis that sequesters carbon and improves soil water-holding capacity

Q9. The Rajasthan Agricultural Research Institute (RARI) responsible for developing heat-tolerant wheat varieties for Rajasthan is located at:

(A) Kota (Rajasthan)

(B) Durgapura, Jaipur

(C) Sriganganagar (Rajasthan)

(D) Udaipur (Rajasthan)

Q10. Compared to traditional paddy varieties (e.g., Basmati), High Yielding Varieties (HYVs) such as IR-36 are characterized by:

(A) Higher yield potential but greater requirement for inputs such as fertilizers, water, and pesticides

(B) Superior aroma and longer grain, commanding a higher market premium

(C) Longer crop duration of 150–160 days suitable for single-cropping systems

(D) Greater drought tolerance and ability to perform well under low-input conditions

Q11. Aflatoxin contamination in stored maize grain is caused by the fungus:

(A) Fusarium moniliforme during pre-harvest kernel infection

(B) Alternaria alternata producing alternariol mycotoxin

(C) Aspergillus flavus thriving under high humidity and temperature in inadequately dried grain

(D) Penicillium citrinum producing citrinin under cold storage conditions

Q12. In pearl millet (bajra), downy mildew disease is caused by:

(A) Peronospora manshurica causing systemic infection in leaves

(B) Plasmopara viticola, the same pathogen as grape downy mildew

(C) Bremia lactucae producing white sporangiophores on lower leaf surface

(D) Sclerospora graminicola; varieties HHB-67 and HHB-234 carry resistance genes critical in Rajasthan

Q13. Ascochyta blight of chickpea, caused by *Ascochyta rabiei*, is best managed chemically by spraying:

(A) Propiconazole at 0.1% applied at pre-flowering stage

(B) Mancozeb or carbendazim + mancozeb mixture, especially during dew and foggy conditions in rabi season

(C) Metalaxyl + mancozeb for systemic control of oomycete pathogen

(D) Trifloxystrobin for management of powdery mildew confusion

Q14. White rust of mustard, caused by *Albugo candida*, produces a characteristic symptom on the inflorescence known as:

(A) Staghead, a deformity in which the inflorescence becomes hypertrophied and distorted

(B) Witches' broom, caused by phytoplasma infection in the floral tissue

(C) Fasciation, due to bacterially-induced stem fasciation

(D) Sclerotinia stem rot producing cottony white mycelium inside the stem

Q15. Castor (*Ricinus communis*) is an important industrial oilseed crop of Rajasthan. The major fatty acid in castor oil responsible for its industrial utility is:

(A) Erucic acid, which is also the key acid in mustard oil

(B) Linolenic acid, a common polyunsaturated acid in many oilseeds

(C) Ricinoleic acid, a hydroxy fatty acid used in lubricants and cosmetics

(D) Palmitic acid, the most abundant saturated fatty acid in tropical oils

Q16. Fennel (*Foeniculum vulgare*), locally known as Saunf, is an important spice crop in Rajasthan. Its inflorescence type is:

(A) Capitulum (head) with ray and disc florets, as in sunflower

(B) Spike with sessile florets along a central axis

(C) Corymb with unequal pedicels reaching the same level

(D) Compound umbel, typical of the Apiaceae (Umbelliferae) family

Q17. In Rajasthan, the preferred rootstock for grafting sapota (Chiku, *Manilkara zapota*) is:

(A) Jamun (*Syzygium cumini*) for its drought hardiness in arid zones

(B) Khirni (*Manilkara hexandra*), a wild relative with strong compatibility

(C) Ber (*Ziziphus mauritiana*) for its tolerance to alkaline soils

(D) Custard apple (*Annona squamosa*) for its shallow root system

Q18. Drumstick (*Moringa oleifera*) leaves are nutritionally significant because they contain:

(A) One of the highest nutrient densities among vegetables, being rich in iron, calcium, and Vitamin A

(B) Very high starch content making them a good energy food like cassava

(C) High oxalic acid that chelates calcium, similar to spinach

(D) Cyanogenic glucosides that require boiling before consumption

Q19. Which of the following correctly describes onion variety N-53?

(A) A red-skinned variety developed by IARI for kharif season with pungent flavour

(B) A kharif variety with high TSS developed for the domestic market only

(C) A white-skinned variety suitable for export quality, harvested in the rabi season (March–April)

(D) A yellow-skinned hybrid with late maturity, developed for northern plains only

Q20. Epicotyl grafting in mango differs from veneer grafting primarily in that:

(A) Epicotyl grafting uses mature two-year-old rootstock while veneer uses seedling rootstock

(B) Veneer grafting is done in the nursery under shade while epicotyl is done in the field

(C) Epicotyl grafting requires a cleft cut on the rootstock stem, unlike the angled slice in veneer grafting

(D) Epicotyl grafting uses a very young seedling rootstock at the cotyledon stage, resulting in faster bearing

Q21. The Pradhan Mantri Kisan SAMPADA scheme was launched with the primary objective of:

(A) Providing direct income support to farmers under PM-KISAN

(B) Reducing post-harvest losses and creating modern food processing infrastructure to benefit farmers

(C) Supplying free drip irrigation equipment to small and marginal farmers

(D) Extending crop insurance coverage under PMFBY to all rabi crops

Q22. Turmeric (*Curcuma longa*) is propagated commercially by:

(A) Rhizomes (mother rhizome + finger rhizomes), which are the planting material used for vegetative propagation

(B) True seeds produced from cross-pollinated flowers

(C) Stem cuttings treated with IBA rooting hormone

(D) Air layering on two-year-old mother plants

Q23. Speed breeding technology accelerates plant generation by:

(A) Using colchicine to double chromosomes and compress two generations into one

(B) Applying vernalization treatments that eliminate the juvenile phase entirely

(C) Providing extended photoperiod (16–22 hours of light) and optimized temperature to complete the life cycle in 45 days for wheat instead of 110 days

(D) Using gamma radiation to induce early flowering mutations in breeding lines

Q24. In genomic selection (GS), the breeding value of an individual is predicted using:

(A) Pedigree records alone, without any molecular marker information

(B) RAPD markers at 5–10 loci associated with the target trait

(C) SSR fingerprinting of parental lines to calculate genetic distance

(D) Genome-wide SNP markers that simultaneously capture small effects across the entire genome without requiring phenotyping of every individual

Q25. Under the Protection of Plant Varieties and Farmers' Rights Act (PPVFRA) 2001, farmers are entitled to:

(A) Sell branded and labelled seeds of protected varieties freely in the open market

(B) Save, use, exchange, and sell seeds of protected varieties for their own farming purposes, but not as branded/labelled commercial seed

(C) Challenge the validity of any plant variety certificate in a civil court without paying any fee

(D) Claim a share of benefits from any variety developed using their farm-saved seeds without prior documentation

Q26. In the seed certification system, breeder seed is distinguished from other seed classes primarily by:

(A) Its golden yellow tag and the highest genetic purity (99.9%), produced directly under the supervision of the plant breeder at ICAR/SAU

(B) Its blue tag indicating foundation class seed suitable for large-scale multiplication

(C) Being produced by registered seed companies under state seed corporation supervision

(D) Its availability in large quantities to all farmers through FCI godowns

Q27. Which of the following correctly distinguishes American bollworm (*Helicoverpa armigera*) from Pink bollworm (*Pectinophora gossypiella*)?

(A) American bollworm is monophagous on cotton while Pink bollworm attacks many crops

(B) Both species are identical in host range but differ only in larval colour

(C) American bollworm is polyphagous and bores into young green bolls of many crops; Pink bollworm is oligophagous, attacking mainly cotton and causing rosette boll symptoms

(D) Pink bollworm produces a hibernating diapause only in northern India while American bollworm does not diapause

Q28. The reproductive strategy of aphids in summer (warm season) is best described as:

(A) Sexual reproduction producing overwintering eggs on bark of host plants

(B) Viviparous parthenogenesis in which wingless females give birth to live nymphs without mating

(C) Obligate sexual reproduction triggered by long-day conditions in June–July

(D) Anholocyclic reproduction involving only male individuals

Q29. Sclerotinia stem rot of rapeseed-mustard, caused by *Sclerotinia sclerotiorum*, is best identified by:

(A) Yellow vein mosaic symptoms caused by whitefly-transmitted begomovirus

(B) Angular lesions with water-soaked margins that turn grey, typical of bacterial leaf spot

(C) Powdery white coating on upper leaf surface with rapid defoliation under dry conditions

(D) Cottony white mycelium on stem exterior with black sclerotia formed inside the hollow stem cavity under cool humid conditions

Q30. Aflatoxin B1 contamination in groundnut is associated with:

(A) *Aspergillus flavus* infection during pod development or post-harvest storage under high temperature and humidity; controlled by rapid drying and sorting

(B) *Sclerotium rolfsii* causing collar rot, which produces no mycotoxin

(C) *Cercospora arachidicola* causing early leaf spot, which spreads to pods

(D) *Phoma arachidicola* producing phoma mycotoxin during transit

Q31. The regulatory body in India responsible for the appraisal and approval of genetically engineered organisms for environmental release is:

(A) FSSAI (Food Safety and Standards Authority of India) under the Ministry of Health

(B) ICAR (Indian Council of Agricultural Research) through its biosafety committee

(C) GEAC (Genetic Engineering Appraisal Committee) under the Ministry of Environment, Forest and Climate Change

(D) CIBRC (Central Insecticide Board and Registration Committee) under the Insecticides Act 1968

Q32. Which legislation governs the registration and regulation of pesticides in India?

(A) Pesticides Management Bill 2020, already enacted as law

(B) Insecticides Act 1968, under which CIBRC approves pesticide registration and label claims

(C) Seeds Act 1966, which also covers biopesticide registration

(D) Environment Protection Act 1986, which regulates all agrochemicals

Q33. In-situ conservation of the Tharparkar cattle breed involves:

(A) Establishing pedigree herds in university campuses across India

(B) Maintaining cryopreserved semen and embryo banks at NBAGR Karnal

(C) Setting up breed multiplication farms in Maharashtra and Gujarat only

(D) Conserving the breed in its native tract (Barmer, Jaisalmer districts of Rajasthan) through community-based conservation programmes

Q34. The Sahiwal is regarded as the best indigenous dairy cattle breed in India primarily because:

(A) It produces 1800–2500 litres per lactation with good heat tolerance, originating from the Montgomery district (now Pakistan) and well-adapted to north Indian conditions

(B) It is a dual-purpose breed with the highest draft power among zebu breeds

(C) It produces A2 milk with a beta-casein mutation unique to Rajasthan herds

(D) It is the only breed with polled (hornless) genetics found naturally in India

Q35. The National Research Centre on Camel (NRCC) is located at:

(A) Jodhpur (Rajasthan), adjacent to the Desert National Park

(B) Jaisalmer (Rajasthan), to utilize the Thar Desert ecosystem

(C) Bikaner (Rajasthan), conducting research on camel breeds, milk processing, leather, and camel genomics

(D) Barmer (Rajasthan), focused on camel wool and transport utility

Q36. Blackquarter (BQ) disease in cattle is caused by:

(A) *Bacillus anthracis*, which also causes anthrax with sudden death and dark tarry blood

(B) *Clostridium chauvoei*, producing emphysematous swelling in the thigh muscles; managed by annual BQ vaccine

(C) *Clostridium botulinum*, causing flaccid paralysis due to botulinum toxin

(D) *Pasteurella multocida*, producing haemorrhagic septicaemia in cattle and buffaloes

Q37. The Commission for Agricultural Costs and Prices (CACP) recommends MSP to the government. The current official policy announces MSP at:

(A) Cost A2 only, covering out-of-pocket paid-out expenses

(B) Cost B2, which adds rental value of owned land to A2+FL

(C) Cost C2, the comprehensive cost including interest on fixed capital

(D) A2+FL cost plus 50% margin, which the government has adopted as the MSP formula since 2018

Q38. A key advantage of contract farming for the farmer is:

(A) Price certainty and guaranteed buyback at a pre-determined price, reducing market price risk

(B) Complete freedom to sell produce to any buyer if market prices rise above the contract price

(C) Ownership of the processing plant jointly with the contracting company

(D) No restriction on crop choice in subsequent seasons after fulfilling one contract

Q39. Under the National Food Security Act (NFSA) 2013, priority households are entitled to:

(A) 10 kg of foodgrain per person per month at market-linked prices under the PDS

(B) 7 kg of foodgrain per family per month at Rs. 2/kg for all below poverty line families

(C) 5 kg of foodgrain per person per month at highly subsidized prices (Rs. 1–3/kg), covering 67% of India's population

(D) Free foodgrain (zero price) for all households under the Antyodaya Anna Yojana scheme extended to all citizens

Q40. Participatory Rural Appraisal (PRA) is an extension methodology in which:

(A) Extension officers design and implement all farm interventions without consulting farmers

(B) A classroom-based training approach where farmers attend lectures by agricultural scientists

(C) A single technical expert assesses the village resource base and prescribes a uniform package of practices

(D) Farmers are treated as experts in local knowledge, using community tools such as transect walks, resource mapping, and seasonal diagrams to co-create solutions

Detailed Solutions

Q1.

Solution

Arbuscular mycorrhiza (AM fungi) form a mutualistic symbiosis with about 80% of land plant species. The fungal partner extends its hyphae far beyond the root depletion zone (up to 10–15 cm from the root surface), dramatically increasing the effective absorbing surface area for immobile nutrients.

Mechanism of phosphorus uptake:

- Soil phosphorus (P) exists mostly as inorganic orthophosphate ($H_2PO_4^-$), which is poorly mobile and quickly depleted around roots
- AM fungal hyphae (2–5 μm diameter) explore soil pores too fine for root hairs, accessing P-rich microsites
- P is transported via the hyphae to the arbuscule – a tree-like branching structure inside the root cortex cell – where it is transferred to the plant
- This can supply up to 80% of the plant's P requirement, especially on P-deficient soils

Why other options are incorrect:

- (A) N_2 fixation is performed by *Rhizobium* (legumes) and *Frankia* (non-legumes), NOT by AM fungi
- (C) IAA production is an additional secondary benefit in some strains, not the primary role
- (D) Biocontrol is a secondary benefit; the primary role is nutrient acquisition

Ectomycorrhiza (forest trees like pine, oak) differ from AM fungi – they form a mantle around roots but do NOT penetrate cells. **Final Answer:** AM fungi enhance phosphorus uptake through an extended hyphal network that accesses soil pores too fine for root hairs.

Answer: (B) Go Back to Q1

Q2.

Solution

Blossom end rot (BER) is a physiological disorder of tomato, pepper, and watermelon caused by calcium deficiency in the developing fruit tissue.

Why calcium causes BER:

- Calcium moves in the plant only via the **xylem** (transpiration stream) – it is essentially immobile in the phloem
- Fruits have very low transpiration rates; they depend on phloem supply for most nutrients
- Rapidly expanding fruit tissue cannot receive sufficient Ca through xylem alone
- Ca deficiency leads to failure of cell membrane integrity and cell wall rigidity in the blossom end tissue
- Cells collapse, producing the characteristic dark leathery sunken lesion at the blossom end

Management:

- Foliar spray of $CaCl_2$ (0.5–1%) directly delivers Ca to leaves/fruit
- Regular uniform irrigation prevents drought stress that reduces xylem flow
- Avoid excess ammonium-N or potassium, which compete with Ca uptake

Tip burn in lettuce is also a calcium deficiency disorder of inner leaves where transpiration is minimal. **Final Answer:** Blossom end rot results from calcium deficiency because Ca is phloem-immobile and cannot reach rapidly expanding fruit tissue relying on phloem supply.

Answer: (A) Go Back to Q2

Q3.

Solution

Saline soils ($EC_e > 4$ dS/m) accumulate soluble salts mainly of Na, Ca, Mg, Cl, SO_4, and HCO_3.

Reclamation steps in order:

(a) **Leaching:** Apply excess good-quality water (EC $<$ 1 dS/m) to dissolve and push salts below the root zone – leaching fraction = 15–20% of applied water

(b) **Drainage:** Install surface or subsurface tile drains to carry away the salt-laden water; without drainage, water table rises and salts return through capillary rise

(c) **Salt-tolerant crops:** Grow barley, sugar beet, Karnal grass (*Diplachne fusca*), dhaincha during reclamation period when EC is still elevated

Key distinction – Saline vs Sodic soil:

- **Saline** (white alkali): EC $>$ 4, pH $<$ 8.5, ESP $<$ 15 – reclaimed by leaching
- **Sodic** (black alkali): ESP $>$ 15, pH $>$ 8.5 – reclaimed by gypsum (which replaces Na^+ with Ca^{2+}) then leaching

Option (B) is incorrect because gypsum is used for *sodic* soils, not saline soils. **Final Answer:** Saline soil reclamation requires leaching with good-quality water to dissolve salts, combined with subsurface drainage and salt-tolerant crops such as barley during the reclamation period.

Answer: (C) Go Back to Q3

Q4.

Solution

A compacted hardpan or plough pan forms at 25–35 cm depth through repeated tillage at the same depth over many years, compressing soil particles into a dense impermeable layer.

Problems caused by hardpan:

- Water infiltration drops dramatically (ponding and runoff in heavy rain)
- Roots cannot penetrate – crops become shallow-rooted and drought-susceptible

- Poor aeration leads to waterlogging and denitrification

Subsoiling (deep ploughing):

- A chisel plough or subsoiler is pulled to 30–50 cm depth, shattering the hardpan
- Infiltration rate can improve 3–5 times after subsoiling
- Root depth increases from 20–30 cm to 60–80 cm, accessing deeper moisture reserves
- Recommended frequency: once in 3–5 years (more frequent subsoiling re-compacts easily)
- Best done in dry soil conditions (hard) for maximum shattering effect

Options (A), (B), and (C) describe secondary or unrelated effects – subsoiling does not primarily target pH, earthworms, or mixing of organic matter. **Final Answer:** Subsoiling shatters the compacted hardpan at 30–50 cm depth, restoring water infiltration and allowing roots to access deeper moisture reserves.

Answer: (D) Go Back to Q4

Q5.

Solution

Key irrigation water quality parameters:

Parameter	Measures	Unit
EC (Electrical Conductivity)	Salinity hazard	dS/m
SAR (Sodium Adsorption Ratio)	Sodicity hazard	dimensionless
RSC (Residual Sodium Carbonate)	Bicarbonate hazard	me/L
Boron	Boron toxicity	mg/L

SAR formula:

$$\text{SAR} = \frac{[\text{Na}^+]}{\sqrt{\frac{[\text{Ca}^{2+}]+[\text{Mg}^{2+}]}{2}}}$$

(concentrations in me/L or mmol_c/L)

Interpretation:

- SAR < 10: Low sodicity hazard – safe for most soils
- SAR 10–18: Medium hazard

- SAR 18–26: High hazard – structural deterioration (clay dispersion, loss of permeability)
- SAR $>$ 26: Very high – avoid for sensitive fine-textured soils

In Rajasthan's arid conditions, groundwater often has high SAR due to sodium-rich geological formations – a critical parameter for tube-well irrigated crops like wheat and mustard. **Final Answer:** SAR quantifies the sodicity hazard of irrigation water by measuring the ratio of sodium to the square root of the mean calcium and magnesium concentration, predicting risk of clay dispersion and structural deterioration.

Answer: (B) Go Back to Q5

Q6.

Solution

Rainfed farming in Rajasthan faces:

- Annual rainfall of 200–600 mm concentrated in 2–3 months (July–September)
- High evaporation (potential ET = 1800–2500 mm/year)
- Sandy to loamy soils with low water retention

In-situ moisture conservation techniques:

- **Contour ploughing:** Ploughing along contour lines (not up-down slope) creates natural water barriers that slow runoff and increase infiltration time
- **Tied ridges:** Cross-ties (earthen plugs) in furrows every 2–3 m create small water-retaining basins (ponding effect)
- **Broad bed and furrow (BBF) system:** Raised beds drain excess water while furrows retain moisture
- **Zero tillage in wheat:** Conserves soil moisture by reducing surface disturbance and preventing capillary evaporation

Supplementary strategies:

- Drought-resistant varieties (bajra, moth bean, cluster bean)
- Mulching to reduce soil evaporation by 30–50%

- Farm ponds and check dams for run-on water harvesting

Drip irrigation (option B) is a supplemental irrigation technology – not applicable to purely rainfed areas where no water supply exists. **Final Answer:** In rainfed farming, in-situ moisture conservation through contour ploughing and tied ridges maximizes infiltration of each rainfall event directly where crops grow.

Answer: (A) Go Back to Q6

Q7.

Solution

Weed management in transplanted (puddled) rice requires careful herbicide selection to avoid crop injury at early growth stages.

Bispyribac-sodium:

- Chemical class: Pyrimidinyloxybenzoate (ALS inhibitor – inhibits acetolactate synthase)
- Dose: 25 g a.i./ha
- Timing: 15–20 days after transplanting (DAT) as post-emergence spray
- Spectrum: Effective against sedges (*Cyperus* spp.), grasses (*Echinochloa* spp., barnyard grass), and broadleaf weeds
- Key advantage: Selective – does not injure rice transplants

Other weed management options in transplanted rice:

- **Butachlor** (pre-emergence, 3–5 DAT): Controls grasses and small sedges
- **Hand weeding:** At 20 and 40 DAT, labour intensive but effective
- **Conoweeder:** Mechanical inter-row weeder for straight-row transplanted rice
- **2,4-D amine:** Used later (active tillering, 30–35 DAT) for broadleaf weeds and sedges ONLY; do not use before tillering

Pendimethalin (pre-emergence) and atrazine are NOT registered for transplanted paddy – they would damage young transplants. **Final Answer:** Bispyribac-sodium, an ALS inhibitor applied at 25 g a.i./ha at 15–20 days after transplanting, selectively controls grasses, sedges, and broadleaf weeds in transplanted rice without crop injury.

Answer: (C) Go Back to Q7

Q8.

Solution

Biochar production:

- Raw material: Any organic biomass – crop residues, wood chips, animal manure, rice husk
- Process: **Pyrolysis** – heating at 300–700° C in limited or zero oxygen (incomplete combustion)
- Products: Biochar (solid) + bio-oil (liquid) + syngas (gaseous)

Properties and benefits of biochar:

- **Highly porous structure:** Surface area 50–700 m^2/g (much higher than regular organic matter)
- **Carbon sequestration:** Recalcitrant aromatic carbon resists microbial decomposition for centuries (mean residence time 100–1000 years) – qualifies as a *negative emission technology*
- **Improved water retention:** Pores retain water and create habitat for soil microbes
- **Soil pH increase:** Alkaline pH (7–10) of biochar raises acidic soil pH
- **Nutrient retention:** High CEC (cation exchange capacity) reduces leaching of K, Ca, Mg

Biochar vs Vermicompost vs Compost:

- Biochar is a *carbon amendment*, not a nutrient source (low N, P, K)
- It functions as a *soil conditioner* that improves the performance of other fertilizers
- It does NOT directly supply plant nutrients like compost does

Final Answer: Biochar is a recalcitrant, porous carbon material produced by pyrolysis that sequesters atmospheric carbon for centuries while improving soil water-holding capacity and nutrient retention.

Answer: (D) Go Back to Q8

Q9.

Solution

Rajasthan Agricultural Research Institute (RARI):

- Location: Durgapura, Jaipur (Rajasthan)
- Affiliation: Swami Keshwanand Rajasthan Agricultural University (SKRAU), Bikaner / under Rajasthan state
- Key mandate: Developing crop varieties suited to arid and semi-arid Rajasthan conditions

Contributions to wheat research:

- Developed heat-tolerant wheat varieties adapted to Rajasthan's hot, dry spring conditions
- Notable varieties: Raj 3765, Raj 4037, Raj 4238 – suitable for timely and late sowing
- Focused on reducing terminal heat stress impact on grain filling period (March–April)

Other important research stations in Rajasthan:

- **CAZRI, Jodhpur:** Central Arid Zone Research Institute – dryland farming, agroforestry
- **NRCC, Bikaner:** National Research Centre on Camel
- **MPUAT, Udaipur:** Maharana Pratap University of Agriculture and Technology – tribal/hilly zone research
- **SKRAU, Bikaner:** Main university campus for arid zone crops

Final Answer: RARI, located at Durgapura, Jaipur, is the principal research institution in Rajasthan that develops heat-tolerant wheat varieties adapted to the state's hot, dry spring conditions.

Answer: (B) Go Back to Q9

Q10.

Solution

Comparison: HYVs vs Traditional Varieties

Character	HYVs (IR-36, PR-106)	Traditional (Basmati)
Yield	6–8 t/ha	2–3 t/ha
Duration	100–120 days (short)	140–160 days (long)
Inputs needed	High (N, water, pesticides)	Low
Aroma/Quality	None/Low	Excellent
Market price	Lower (commodity)	Premium (Rs. 6000–10000/quintal)
Lodging resistance	Good (semi-dwarf)	Poor (tall, lodges easily)

Green Revolution and HYVs:

- HYVs were developed as part of the Green Revolution (1960s–70s) under Dr. Norman Borlaug (wheat) and International Rice Research Institute (rice)
- The *semi-dwarf gene* (Dee-geo-woo-gen in rice; Norin-10 in wheat) allowed more energy allocation to grain rather than straw
- Yield response to N fertilizer is very high in HYVs but they are susceptible to lodging at high N if not managed

Final Answer: HYVs like IR-36 achieve 6–8 t/ha yield potential but require high inputs of nitrogen fertilizer, water, and pesticides compared to traditional varieties.

Answer: (A) Go Back to Q10

Q11.

Solution

Aflatoxin facts:

- Produced primarily by *Aspergillus flavus* and *A. parasiticus*
- Major aflatoxins: B1, B2, G1, G2 (B1 is the most toxic and most common)
- Aflatoxin B1 is classified as a **Group 1 carcinogen** (hepatotoxic, causes liver cancer)
- Permissible limit: 10–30 ppb total aflatoxins in food commodities (India/FSSAI)

Conditions favouring aflatoxin development in stored maize:

- Grain moisture $>$ 15% at harvest (fungi grow when aw $>$ 0.78)
- Temperature 25–35° C
- Physical kernel damage (insect, mechanical)
- Poor storage hygiene

Prevention strategies:

- Harvest at correct maturity; dry to $<$ 12% moisture before storage
- Store in hermetic (airtight) bags – deprives fungi of oxygen
- Use Aflasafe (biocontrol using atoxigenic strains of *A. flavus*) in the field
- Sort and remove damaged/discoloured kernels before storage

Final Answer: Aflatoxin contamination in stored maize is caused by *Aspergillus flavus*, which proliferates when grain moisture exceeds 15% and temperature is 25–35° C, producing the potent Group 1 carcinogen aflatoxin B1.

Answer: (C) Go Back to Q11

Q12.

Solution

Pearl millet downy mildew (Green ear disease):

- Causal organism: *Sclerospora graminicola* (obligate oomycete pathogen)
- **Symptoms:**
  - Systemic infection: chlorotic leaves with white sporulation on lower surface
  - **Green ear:** The most diagnostic symptom – inflorescence (ear) leaves revert to vegetative state and remain green, failing to produce grain
- Disease cycle: Oospores in soil survive for years; seedling infection through soil or air-borne sporangia

Significance in Rajasthan:

- Rajasthan grows $>$ 50% of India's pearl millet area (Barmer, Jalore, Pali, Jodhpur districts)

- Downy mildew epidemics wiped out susceptible hybrids in 1971–72
- HHB-67 (Haryana Hybrid Bajra): First downy mildew resistant hybrid, still widely grown
- HHB-234: Released with multiple DM resistance genes, suitable for early kharif sowing

Management:

- Grow resistant varieties/hybrids
- Seed treatment with Metalaxyl (Apron 35 SD) at 6 g/kg seed
- Crop rotation to reduce oospore load

Final Answer: Pearl millet downy mildew is caused by the oomycete *Sclerospora graminicola*, producing the diagnostic green ear symptom where the inflorescence reverts to vegetative growth; resistant hybrids HHB-67 and HHB-234 are key management tools in Rajasthan.

Answer: (D) Go Back to Q12

Q13.

Solution

Ascochyta blight of chickpea:

- Causal organism: *Ascochyta rabiei* (teleomorph: *Didymella rabiei*)
- **Symptoms:** Circular to irregular lesions with concentric rings and pycnidia on leaves, stems, pods; blighting and premature drying in severe cases
- **Favourable conditions:** Cool temperatures (15–25° C), dew, fog, and high humidity – typical of North India rabi season in December–February

Chemical management:

- **Mancozeb** (0.25%): Broad-spectrum contact fungicide, multi-site inhibitor – effective preventive spray
- **Carbendazim + Mancozeb** combination: Adds systemic (carbendazim, MBC fungicide) + contact protection; spray at first sign of disease and repeat at 10–15 day intervals
- 2–3 sprays during critical period

Why other options are wrong:

- Metalaxyl + mancozeb (option C) targets oomycetes (Pythium, Phytophthora) – *Ascochyta* is a true fungus (ascomycete), not an oomycete
- Propiconazole is used for rusts and powdery mildew in wheat/other crops

Resistant varieties: Pusa 391, DCP 92-3 have moderate resistance; new ICRISAT lines show tolerance. **Final Answer:** Ascochyta blight of chickpea is best managed chemically with mancozeb or a carbendazim + mancozeb combination sprayed during cool, dewy rabi conditions when the ascomycete pathogen *Ascochyta rabiei* is most active.

Answer: (B) Go Back to Q13

Q14.

Solution

White rust of mustard:

- Causal organism: *Albugo candida* (oomycete, formerly classified as a fungus)
- **Symptoms:**
  - **White blisters/pustules** on lower leaf surface (chalky white spore masses = sporangia of conidia)
  - **Staghead:** Systemic infection of the inflorescence causes hypertrophy and distortion – the floral parts enlarge grotesquely, petals become thickened and green, pollen becomes non-viable; the whole inflorescence resembles a "stag's head" with twisted branches
  - Staghead causes complete yield loss in affected branches

Disease management:

- **Chemical:** Metalaxyl + mancozeb (0.3%) or mancozeb (0.25%) spray at first sign
- **Resistant varieties:** Pusa Agrani, Pusa Tarak, K-88 have moderate resistance
- **Seed treatment:** Metalaxyl 35 WS at 6 g/kg seed to delay systemic infection

Distinction from Sclerotinia stem rot:

- Sclerotinia affects stem (cottony mycelium + black sclerotia inside)

- White rust affects leaf surface + inflorescence (staghead); no internal sclerotia

Final Answer: White rust of mustard caused by *Albugo candida* produces staghead, a grotesque hypertrophy and distortion of the inflorescence that causes complete yield loss in affected branches.

Answer: (A) Go Back to Q14

Q15.

Solution

Castor (*Ricinus communis*) – Rajasthan context:

- India is the world's largest producer (>75% of global production)
- Major states: Gujarat, Rajasthan, Andhra Pradesh
- In Rajasthan: Grown in Pali, Nagaur, Jodhpur districts

Castor oil composition:

- Ricinoleic acid: 85–90% of total fatty acids
- Unique feature: Ricinoleic acid has a **hydroxyl group at C-12** position – this makes it:
  - Highly viscous and stable under extreme temperature
  - Ideal for lubricants (aircraft engines, hydraulic fluids)
  - Used in cosmetics (lipsticks, shampoos), plastics, nylon-11, pharmaceuticals

Ricin toxin:

- The seed endosperm contains **ricin** (a ribosome-inactivating protein, RIP type-II)
- Ricin is one of the most toxic naturally occurring substances known
- The press cake/meal after oil extraction must be detoxified before use as fertilizer or animal feed

Important variety: GCH-4 (Gujarat Castor Hybrid-4) is the widely grown hybrid; also NJC-1, Harco. **Final Answer:** Ricinoleic acid, comprising 85–90% of castor

oil and uniquely bearing a hydroxyl group at C-12, gives castor oil its exceptional viscosity and thermal stability for industrial lubricant and cosmetic applications.

Answer: (C) Go Back to Q15

Q16.

Solution

Fennel (*Foeniculum vulgare*) agronomy in Rajasthan:

- Rajasthan is the largest fennel producing state in India (Sirohi, Barmer, Jodhpur districts)
- **Sowing:** October–November (rabi crop)
- **Harvest:** March–April when umbels turn yellowish-green
- Major varieties: RF-101, RF-125, Rajendra Saunf, Azad Saunf-1

Inflorescence – compound umbel:

- Family Apiaceae (Umbelliferae) is characterized by a **compound umbel** inflorescence
- Structure: Main axis produces primary rays (umbel); each primary ray bears a secondary umbel (umbellule)
- Flowers are small, bisexual, pentamerous, with inferior ovary
- Other Apiaceae crops: Coriander, cumin (jeera), ajwain, dill (sowa) – all have compound umbels

Essential oil content: 1.5–3% in fruits; main components are trans-anethole (80–90%) responsible for sweet anise-like aroma.

A capitulum (option A) is characteristic of sunflower and other Asteraceae; a spike (B) is seen in wheat; a corymb (C) in cauliflower/candytuft. **Final Answer:** Fennel bears a compound umbel inflorescence, characteristic of the family Apiaceae, in which the main axis produces primary rays each carrying a secondary umbellule of small bisexual flowers.

Answer: (D) Go Back to Q16

Q17.

Solution

Sapota (Chiku) horticulture:

- *Manilkara zapota* (family Sapotaceae)
- **Varieties:** Cricket Ball (round, large), Kalipatti (oval, highest commercial value in India), CO-1, PKM-1, Pala, Kirtibarathi

Khirni as rootstock:

- *Manilkara hexandra* is a wild relative of sapota, naturally distributed in Rajasthan, Gujarat, Madhya Pradesh
- **Advantages of khirni rootstock:**
  - Graft compatibility: Same genus (*Manilkara*) – excellent tissue compatibility and union strength
  - Drought tolerance: Deep rooting habit, survives arid Rajasthan conditions
  - Soil adaptability: Tolerates shallow and stony soils of Rajasthan
  - Reduces tree height: Khirni imparts semi-dwarf habit, making harvesting easier

Grafting method used: Veneer grafting (a thin sliver of scion with bark attached is inserted into a matching cut on the rootstock stem); highly successful for sapota.

Ber (option C) and custard apple (D) are taxonomically unrelated to sapota and would be incompatible rootstocks. **Final Answer:** Khirni (*Manilkara hexandra*), a drought-tolerant wild relative in the same genus as sapota, provides excellent graft compatibility and arid-zone adaptability as the preferred rootstock for sapota in Rajasthan.

Answer: (B) Go Back to Q17

Q18.

Solution

Moringa (*Moringa oleifera*) – the "Miracle Tree":

- Family: Moringaceae
- Origin: Sub-Himalayan tracts of northwestern India; widely grown in tropical India

Nutritional profile of fresh Moringa leaves (per 100 g):

Nutrient	Moringa leaves	Comparator
Vitamin C	220 mg	7× oranges
Vitamin A	6780 μg	4× carrots
Calcium	440 mg	4× milk
Iron	28 mg	3× spinach
Protein	9.4 g	2× yoghurt

Other uses:

- Pods (drumsticks): Popular vegetable; high protein and fibre
- Seeds: Used for water purification (flocculation)
- Oil (Ben oil): High oleic acid, used in cosmetics and cooking
- Roots: Used in traditional medicine (Siddha, Ayurveda)
- Bark: Rich in glucosinolates (medicinally active compounds)

Moringa is drought-tolerant and perennial, thriving in the arid/semi-arid zones of Rajasthan. **Final Answer:** Moringa leaves have one of the highest nutrient densities among vegetables, providing extraordinary concentrations of Vitamin A, calcium, iron, and Vitamin C that far exceed conventional sources.

Answer: (A) Go Back to Q18

Q19.

Solution

Important onion varieties:

Variety	Colour	Season	Use
Pusa Red	Deep red	Kharif + Rabi	Domestic
N-53	White	Rabi	Export quality
Agrifound White	White	Rabi	Export
Pusa Madhvi	Light red	Kharif	Domestic
Agrifound Dark Red	Dark red	Rabi	Domestic

N-53 (Nasik-53):

- Developed at Directorate of Onion and Garlic Research (DOGR), Nashik (Maharashtra)
- **White skin:** Meets export quality standards for Gulf countries, Europe, Southeast Asia
- **Season:** Rabi (main crop in Rajasthan and Maharashtra)
- **Harvest:** March–April
- High TSS (total soluble solids) – pungent, good shelf life

Onion in Rajasthan:

- Rajasthan is a significant onion producing state (Sikar, Alwar, Nagaur districts)
- Rabi crop dominates; kharif onion grown on limited area due to higher disease pressure

Final Answer: Onion variety N-53, developed at DOGR Nashik, is a white-skinned rabi variety harvested in March–April that meets international export quality standards for Gulf countries and Europe.

Answer: (C) Go Back to Q19

Q20.

Solution

Comparison of mango grafting methods:

Feature	Veneer Grafting	Epicotyl Grafting
Rootstock age	3–4 month old seedling	Very young seedling at cotyledon stage (2–3 weeks old)
Rootstock size	Pencil-thick stem	Thin, tender epicotyl
Scion	Mature terminal shoot	Mature terminal shoot
Success rate	70–80%	80–90%
Time to bearing	4–5 years	2–3 years (faster)

Veneer grafting technique:

- A thin downward incision (slice) is made on rootstock stem
- A matching thin slice (scion) is inserted, cambium aligned, and tied with polythene strip
- Most widely used method for mango propagation in India

Epicotyl grafting (stone grafting):

- Germinated mango seed (cotyledons still attached) is used as rootstock
- The epicotyl is cut 1–2 cm above cotyledons; scion spliced into the cut
- Very fast bearing because the graft starts growth immediately from the seed's energy reserves
- Suitable for irrigated nurseries with controlled conditions

Final Answer: Epicotyl grafting uses a very young mango seedling at the cotyledon stage as rootstock, enabling faster bearing within 2–3 years by harnessing the seed's energy reserves for early scion establishment.

Answer: (D) Go Back to Q20

Q21.

Solution

Post-harvest loss scenario in India:

- Fruits and vegetables: 15–30% losses (national average)
- Cereals and pulses: 5–10% losses
- Total estimated value of post-harvest losses: Rs. 90,000 crore/year
- Primary causes: Lack of cold storage, poor roads, inadequate packaging, poor market linkages

PM Kisan SAMPADA Yojana:

- Full name: **Pradhan Mantri Kisan Sampada Agri-processing Infrastructure and Management Scheme for Agro-Marine Products** (later renamed PM Kisan SAMPADA)
- Launched: 2017 by Ministry of Food Processing Industries (MoFPI)
- **Key components:**
  - Mega Food Parks: Integrated food processing zones with cold chain + packaging + storage
  - Integrated Cold Chain and Value Addition Infrastructure
  - Food Processing and Preservation Capacity Enhancement Schemes
  - Agro-Processing Clusters
  - Backward and Forward Linkages
- Target: Reduce post-harvest losses, double farmer income, increase food processing from 8% to 25% of agricultural output

Final Answer: PM Kisan SAMPADA, launched in 2017 by MoFPI, aims to reduce post-harvest losses and increase farmer income by creating an integrated cold chain and modern food processing infrastructure across India.

Answer: (B) Go Back to Q21

Q22.

Solution

Turmeric (*Curcuma longa*) agronomy:

- Family: Zingiberaceae
- Part used commercially: Dried rhizome (contains 3–5% curcumin)

Propagation by rhizomes:

- Turmeric is strictly propagated vegetatively using rhizomes – it rarely produces viable seeds in cultivation
- **Mother rhizome:** Large central piece (retained or replanted to produce next crop)
- **Finger rhizomes:** Smaller lateral pieces used as primary planting material
- Each piece should have 2–3 buds/eyes; treated with Mancozeb or Ridomil to prevent seed rhizome rot before planting
- **Seed rate:** 2000–2500 kg/ha
- **Planting:** April–May (kharif); crop duration 8–10 months

Major producing states: Andhra Pradesh, Telangana, Odisha, Tamil Nadu, West Bengal (not major in Rajasthan due to high water requirement of 1500–2000 mm).

Curcumin is the bioactive polyphenol responsible for the yellow colour and anti-inflammatory, antioxidant, and anti-cancer properties of turmeric. **Final Answer:** Turmeric is commercially propagated by rhizomes – mother and finger rhizomes each carrying 2–3 buds – because the crop rarely produces viable seeds under cultivation.

Answer: (A) Go Back to Q22

Q23.

Solution

Speed breeding – background:

- Developed by University of Queensland (Australia) and John Innes Centre (UK) in 2018
- Overcomes the main bottleneck in plant breeding – generation time (one crop per season per year)

How speed breeding works:

- **Extended photoperiod:** 16–22 hours of light (using LED growth lights after natural sunlight)
- Long days accelerate floral transition in long-day plants (wheat, barley, pea, canola)
- **Optimal temperature:** 17–22° C (day/night) reduces vernalization requirement
- **Harvest immature seeds:** Green seeds harvested 6–7 days after pollination; germinated in growing medium

Results in wheat:

- Normal field season: 110–120 days
- Speed breeding: 45–60 days per generation
- Result: 6–8 generations per year vs 1–2 generations in the field

Applications:

- Backcross breeding: Introduce drought tolerance gene in 3 years instead of 12–15 years
- CRISPR/gene editing: Screen edited lines rapidly
- Works for: Wheat, barley, oilseed rape, chickpea, pea, Arabidopsis

Final Answer: Speed breeding compresses wheat's life cycle to 45 days by providing 16–22 hours of artificial light to accelerate floral transition, enabling 6–8 generations per year instead of 1–2 in the field.

Answer: (C) Go Back to Q23

Q24.

Solution

Genomic Selection (GS) – concept:

- Proposed by **Meuwissen, Hayes and Goddard (2001)**
- Predicts **Genomic Estimated Breeding Value (GEBV)** using genome-wide markers

How GS works:

(a) **Training population:** A reference set of individuals genotyped (50k–1M SNPs) AND phenotyped

(b) **Statistical model:** Correlates SNP allele frequencies with phenotypic performance (methods: RR-BLUP, GBLUP, Bayesian methods)

(c) **Genomic prediction:** New candidates are genotyped only (no phenotyping needed); GEBV predicted from their SNP profile

(d) Selection decisions made on GEBV

Advantages over marker-assisted selection (MAS):

- MAS targets 1–5 QTLs (major genes only)
- GS captures all QTLs simultaneously, including hundreds of small-effect genes
- Better prediction accuracy for quantitative (polygenic) traits like yield, drought tolerance

Current use in India:

- Maize breeding programs (CIMMYT, Pioneer)
- Wheat GS trials at ICAR-IIWBR, Karnal
- Expanding to rice and sugarcane breeding

Final Answer: Genomic selection predicts an individual's breeding value using genome-wide SNP markers that collectively capture hundreds of small-effect QTLs without requiring phenotyping of every selection candidate.

Answer: (D) Go Back to Q24

Q25.

Solution

PPVFRA 2001 – Farmers' Rights:

The Protection of Plant Varieties and Farmers' Rights Act 2001 was a landmark legislation that balanced the interests of plant breeders (like PVP in most countries) with the traditional rights of Indian farmers.

Section 39 – Farmers' Rights:

- A farmer is entitled to **save, use, sow, resow, exchange, share, or sell** his farm produce including seed of a variety protected under this Act
- **Exception:** A farmer shall not sell such seed *in the form of branded packages* with the variety denomination
- In simple terms: A farmer can sell seeds loose/unlabelled but cannot sell them under a commercial brand label (that would infringe the Plant Breeder's Rights)

Other Farmers' Rights under PPVFRA:

- Right to register varieties they develop (farmers' variety, extant variety)
- Right to claim benefit sharing from commercial exploitation of their traditional varieties
- Right to seek compensation for non-performance of a protected variety
- Right to free legal services at the Plant Varieties Protection and Farmers' Rights Authority

Final Answer: Under PPVFRA 2001, farmers may freely save, use, exchange, and sell seeds of protected varieties for their own farming, but may not sell them in branded, labelled commercial packages.

Answer: (B) Go Back to Q25

Q26.

Solution

Seed certification classes in India (top to bottom of multiplication chain):

Class	Tag Colour	Min. Purity	Produced by
Nucleus Seed	NA (breeder kept)	100%	Plant breeder
Breeder Seed	Golden Yellow	99.9%	ICAR/SAU, under breeder
Foundation Seed	White	99.5%	NSC/SSSC/ICAR farms
Certified Seed	Blue (C1)/Azur (C2)	99.0%	Registered seed producers
Truthfully Labelled	TL (no certification)	Varies	Farmers/private firms

Breeder seed:

- Direct progeny of Nucleus seed
- Produced under the personal supervision of the concerned plant breeder
- **Lowest quantity** in the system (production limited to maintain genetic identity)
- **Foundation seed** is multiplied from Breeder seed; **Certified seed** is multiplied from Foundation seed

National Seeds Corporation (NSC) and **State Seed Corporations (SSSC)** handle Foundation and Certified seed production at scale. **Final Answer:** Breeder seed carries a golden yellow tag, maintains 99.9% genetic purity, and is produced directly under the plant breeder's supervision at ICAR or SAU institutions as the foundation of the entire seed multiplication chain.

Answer: (A) Go Back to Q26

Q27.

Solution

American bollworm (ABW) – *Helicoverpa armigera*:

- Order: Lepidoptera, Family: Noctuidae
- **Host range: Polyphagous** – attacks over 180 plant species: cotton, chickpea, pigeon pea, tomato, maize, sorghum, sunflower
- **Damage:** Larva bores into bolls, pods, fruits – head partially inside, rest outside

- Most important pest in India (economic losses Rs. 1500 crore/year)

Pink bollworm (PBW) – *Pectinophora gossypiella*:

- Order: Lepidoptera, Family: Gelechiidae
- **Host range: Oligophagous/Monophagous** – primarily cotton (*Gossypium* spp.)
- **Damage – two types:**
  - **Rosette boll:** Larvae feed on petals/stamens before fertilization – petals fuse and flower cannot open (lock or double blossom symptom)
  - **Boll damage:** Larvae bore into seeds, creating internal galleries; exit holes visible on boll surface
- **Now mainly Bt-resistant** in many parts of India (Bt resistance confirmed since 2009)

Final Answer: *Helicoverpa armigera* is polyphagous, boring into bolls of over 180 crop species, whereas *Pectinophora gossypiella* is oligophagous on cotton alone, causing the distinctive rosette boll and double-blossom symptoms.

Answer: (C) Go Back to Q27

Q28.

Solution

Aphid lifecycle:

Aphids have one of the most complex and fascinating reproductive strategies in insects.

Summer (warm season) – Asexual phase:

- **Viviparous parthenogenesis:** Wingless (apterous) females called *viviparae* give birth to live young (no eggs) without mating
- Rate: One female can produce 50–100 offspring in a lifetime; generation time = 7–10 days
- This rapid asexual reproduction creates exponential population growth
- **Wing development (alate forms):** When colony becomes overcrowded or host plant quality deteriorates, winged forms (alate viviparae) develop – these disperse to new host plants

Winter (cold season) – Sexual phase:

- In **holocyclic species** (complete cycle): Sexual males and females are produced; mating occurs; females lay overwintering eggs on bark/buds
- In **anholocyclic species** (incomplete cycle): Only parthenogenetic females exist year-round (no sexual reproduction); common in warm tropical climates (India, Rajasthan)

In Rajasthan – mustard aphid (*Lipaphis erysimi*) is predominantly anholocyclic – no sexual phase. **Final Answer:** In warm summer conditions, aphids reproduce by viviparous parthenogenesis in which wingless females give birth to live nymphs without mating, enabling explosive exponential population growth within days.

Answer: (B) Go Back to Q28

Q29.

Solution

Sclerotinia stem rot of rapeseed-mustard:

- Causal organism: *Sclerotinia sclerotiorum* (Lib.) de Bary
- Order: Helotiales; produces apothecia from sclerotia for ascospore discharge

Disease development:

- **Primary inoculum:** Sclerotia in soil germinate carpogenically to produce apothecia; ascospores land on senescing petals
- Petals fall on leaves/stem and fungus colonizes the petal-stem junction
- **Symptoms:**
  - Water-soaked lesions on stem at early stage
  - **Cottony white mycelium** covers the stem surface
  - Pith tissue is destroyed; stem becomes hollow
  - **Black sclerotia (0.5–5 mm)** form inside the hollow cavity (diagnostic)
- Premature ripening and lodging of affected branches

Conditions: Cool temperatures (15–18° C), high relative humidity (>80%), dew – typical of north Indian rabi season

Chemical management:

- **Iprodione** (Rovral) 0.2% spray at 50% flowering – most effective
- Carbendazim 0.1% as alternative
- 2–3 sprays at 10–15 day intervals during flowering

Final Answer: Sclerotinia stem rot of mustard is identified by cottony white mycelium on the stem exterior and black sclerotia inside the hollow stem cavity, developing under cool humid conditions during the rabi flowering stage.

Answer: (D) Go Back to Q29

Q30.

Solution

Aflatoxin contamination pathway in groundnut:

Pre-harvest infection:

- *A. flavus* infects developing pods, especially when:
  - Drought stress during pod fill (August–September) – cracks pod shell
  - High soil temperatures (>30° C) at pod zone
  - Insect damage to pods
- **Crown/collar rot:** *A. flavus* also causes seedling damping-off with crown rot symptoms

Post-harvest:

- Harvested pods with >9% moisture allow continued fungal growth and toxin production
- Aflatoxin B1 is produced within 24–48 hours of exposure to warm, humid conditions

Management:

- Harvest at correct maturity (skin of pods turns brown/black inside)
- Field dry pods for 3–5 days before storage; achieve moisture $< 9\%$
- Storage in gunny bags with good aeration; avoid stack heights > 3 m
- **Visual sorting:** Remove shrivelled, discoloured, or mouldy kernels (they contain >90% of the toxin load)

- Electronic sorting machines using near-IR or UV fluorescence
- **FSSAI limit:** 30 ppb total aflatoxins (B1+B2+G1+G2)

Final Answer: Aflatoxin B1 in groundnut originates from *Aspergillus flavus* infecting pods under drought or post-harvest high moisture conditions; rapid field drying to below 9% moisture and visual sorting of discoloured kernels are the primary controls.

Answer: (A) Go Back to Q30

Q31.

Solution

GEAC – mandate and structure:

- Full form: Genetic Engineering Appraisal Committee
- Ministry: Ministry of Environment, Forest and Climate Change (MoEFCC)
- **Function:** Apex regulatory body for appraisal of activities involving large-scale use of hazardous microorganisms and recombinants; approval for environmental release of GMOs and products of modern biotechnology
- Co-chaired by Additional Secretary, MoEFCC and a representative of Department of Biotechnology (DBT)

Bt brinjal case:

- GEAC approved Bt brinjal (Cry1Ac event EE-1) in October 2009 – it was the first GM food crop approved in India
- Union Environment Minister Jairam Ramesh imposed a **moratorium in February 2010** after public consultations expressing safety and biodiversity concerns
- No Bt brinjal is commercially grown in India as of 2026 (moratorium continues)
- Bangladesh has commercially cultivated Bt brinjal since 2014

CIBRC (option D) regulates conventional pesticides only – it has no jurisdiction over genetically engineered organisms. **Final Answer:** GEAC, operating under India's Ministry of Environment, Forest and Climate Change, is the apex regulatory body responsible for appraising and approving the environmental release of genetically engineered organisms.

Answer: (C) Go Back to Q31

Q32.

Solution

Insecticides Act 1968:

- Enacted to regulate the **import, manufacture, sale, transport, distribution, and use** of insecticides
- Note: Despite the name, "Insecticides" covers all pesticides in India (herbicides, fungicides, rodenticides, acaricides, nematicides)
- Administered by Ministry of Agriculture and Farmers' Welfare

CIBRC (Central Insecticide Board and Registration Committee):

- **Central Insecticides Board (CIB):** Advisory body on technical matters
- **Registration Committee (RC):** Grants/cancels registration certificates for pesticides
- No pesticide can be manufactured/imported/sold in India without CIB&RC registration
- **Label claims:** CIBRC approves specific crops and pests for which a pesticide can be used (label claims); off-label use is technically illegal

Current regulatory development:

- Pesticides Management Bill 2020 was drafted to replace the 1968 Act with stronger safety and environmental provisions
- As of June 2026, the 1968 Act still governs pesticide regulation in India

Final Answer: The Insecticides Act 1968 governs all pesticide registration in India through the Central Insecticide Board and Registration Committee (CIBRC), which must approve every pesticide before it can be manufactured, imported, or sold.

Answer: (B) Go Back to Q32

Q33.

Solution

Tharparkar cattle:

- Indigenous zebu breed, native to Thar Desert
- **Distribution:** Tharparkar district (Sindh, now Pakistan) + Barmer and Jaisalmer districts of Rajasthan (India)
- **Uses:** Dual purpose (milk + draft); cows yield 1400–1800 L/lactation under good management; very hardy, disease resistant
- **NBAGR registration:** Registered as Tharparkar by National Bureau of Animal Genetic Resources, Karnal

Conservation strategies:

- **In-situ conservation:** Protecting the breed *in its native habitat* – supporting pastoral communities (Rabaris, Bharvads) in Barmer and Jaisalmer to maintain herds; government support programs, breed improvement stations in native tract
- **Ex-situ conservation:** Cryopreservation of semen (frozen at -196° C in liquid nitrogen); embryo cryobanking at NBAGR Karnal; field gene banks at ICAR-NBAGR

Threat status: Not endangered currently but population declining due to cross-breeding with Holstein, mechanization replacing draft use, and land use change in Thar Desert. **Final Answer:** In-situ conservation of the Tharparkar breed means supporting pastoral communities (Rabaris and Bharvads) in the breed's native Barmer and Jaisalmer districts of Rajasthan to maintain herds in their traditional agroecological setting.

Answer: (D) Go Back to Q33

Q34.

Solution

Sahiwal cattle:

- **Origin:** Montgomery district, Montgomery tehsil in the Punjab province of undivided India (now in Pakistan's Punjab province)
- **Distribution in India:** Punjab, Haryana, Uttar Pradesh, and Rajasthan

Milk production:

- Average 1800–2500 L per 305-day lactation under organized farm conditions
- Fat percentage: 4.5–5%
- Milk composition: Predominantly A2 beta-casein (like most indigenous breeds)
- Best among *all* zebu (Bos indicus) breeds for milk production

Other characteristics:

- Tick resistance: High, reducing veterinary costs
- Heat tolerance: Excellent – fewer sweat glands than exotic breeds but efficient thermoregulation
- Temperament: Docile, easy to manage

National importance: Sahiwal is used extensively in crossbreeding programs – Sahiwal $\times$ Holstein crosses produce Karan Fries; Sahiwal bulls provide the indigenous base for tropical dairy improvement. **Final Answer:** Sahiwal, originating from the Montgomery district of undivided Punjab, is India's best indigenous dairy breed, producing 1800–2500 litres per lactation with excellent heat and tick tolerance.

Answer: (A) Go Back to Q34

Q35.

Solution

National Research Centre on Camel (NRCC):

- **Location:** Jorbeer, Bikaner (Rajasthan)
- **Established:** 1984
- **Under:** Indian Council of Agricultural Research (ICAR)

Research mandate:

- **Breed characterization:** Indian camel breeds – Bikaneri (Rajasthan), Jaisalmeri, Sindhi, Kutchi (Gujarat), Mewari, Marusthali
- **Camel milk research:** Nutritional composition, processing, UHT treatment; camel milk has anti-diabetic properties (insulin-like protein)
- **Genomics:** Camel genome sequencing, SNP discovery, disease resistance markers
- **Leather and wool:** Camel hide tanning, wool fibre quality improvement
- **Reproductive technology:** Semen cryopreservation, embryo transfer in camels

Camel population in Rajasthan:

- India holds $\sim$0.25 million camels; Rajasthan has $>$80% of India's camel population
- Camel is the **State Animal of Rajasthan**
- Population declining rapidly due to mechanization of agriculture and transport

Final Answer: The National Research Centre on Camel is located at Jorbeer, Bikaner, Rajasthan, where it conducts research on camel breeds, milk processing, genomics, and leather under ICAR mandate.

Answer: (C) Go Back to Q35

Q36.

Solution

Blackquarter (BQ / Black-leg):

- **Causative organism:** *Clostridium chauvoei* (anaerobic, spore-forming, gram-positive rod)
- **Species affected:** Cattle primarily; sheep, goats, buffalo occasionally
- **Age group:** Young animals 6 months–2 years (most susceptible)

Pathogenesis and symptoms:

- Spores dormant in soil and muscle; activated by anaerobic conditions (trauma, stress)
- **Classical symptom:** Hot, painful, crepitating (gas-filled) swelling in the large muscle masses of thigh, shoulder, hip
- Crepitus on palpation due to gas (CO_2, H_2S) produced by anaerobic fermentation
- Animal is severely lame, febrile, and dies within 12–24 hours of symptoms appearing

Anthrax vs BQ:

- **Anthrax** (*B. anthracis*): Sudden death, blood from natural orifices, tarry non-clotting dark blood, no gas in tissues; zoonotic
- **BQ:** Gas crepitus in muscles, young animals, not zoonotic

Control: Annual BQ vaccine (multivalent blackleg vaccine covering multiple Clostridial species); do not open carcass (risk of soil contamination with spores).
Final Answer: Blackquarter disease in young cattle is caused by *Clostridium chauvoei*, producing hot, gas-filled crepitating swelling in the thigh or shoulder muscles, and is controlled by annual multivalent blackleg vaccination.

Answer: (B) Go Back to Q36

Q37.

Solution

CACP and MSP determination:

The Commission for Agricultural Costs and Prices (CACP) recommends MSP after analyzing different cost concepts:

Cost Concept	Components
A1	Paid-out expenses: seeds, fertilizers, pesticides, hired labour, machine hire, irrigation charges, misc. expenses
A2	A1 + rent paid for leased land
A2+FL	A2 + value of family labour (imputed)
B1	A2+FL + interest on fixed capital
B2	B1 + rental value of owned land
C2	B2 + depreciation on farm assets
C3	C2 + manager's wages (rarely used)

Government MSP policy (2018–present):

- The Union Budget 2018–19 announced MSP will be at least **1.5 times the A2+FL cost** (i.e., cost + 50% return)
- This was a long-standing demand of farm organizations (particularly M.S. Swaminathan Commission which recommended C2 + 50%)
- CACP continues to recommend MSP; Cabinet Committee on Economic Affairs (CCEA) announces it

Final Answer: Since 2018–19, the Indian government has announced MSP at a minimum of 1.5 times the A2+FL cost (paid-out expenses plus imputed family labour), providing farmers a guaranteed 50% return over production costs.

Answer: (D) Go Back to Q37

Q38.

Solution

Contract farming – overview:

Contract farming is an arrangement where a processing company/agribusiness (contractor) enters into a pre-harvest agreement with farmers to buy their produce at a specified price.

Advantages for farmer:

- **Price certainty:** Contract price is fixed before sowing – farmer knows his expected revenue regardless of market fluctuations
- **Guaranteed buyback:** Eliminates risk of market failure (no buyer at harvest)
- Input supply: Contractor often provides seeds, fertilizers, crop protection inputs on credit
- Technical guidance: Company agronomists provide extension support
- Market linkage: Direct farm-to-factory supply chain, reducing middlemen

Disadvantages for farmer:

- **Quality dispute:** Contractor may reject produce citing quality standards – farmer has no independent mechanism to contest
- **Power imbalance:** Large corporation vs. small farmer; farmer has limited bargaining power
- **Crop restriction:** Contract may restrict crop rotation; farmer locked into same crop year after year
- Price risk for contractor: If market price falls below contract price, contractor may default

Legal framework: Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act 2020 (later repealed December 2021). **Final Answer:** The key advantage of contract farming for the farmer is a pre-agreed price and guaranteed buyback that eliminates market price risk at harvest, even if open market prices fall below the contract price.

Answer: (A) Go Back to Q38

Q39.

Solution

National Food Security Act (NFSA) 2013:

Feature	Details
Enacted	September 2013
Coverage	67% of India's total population (75% rural + 50% urban)
Quantity	5 kg per person per month
Grains covered	Rice, wheat, coarse cereals (millets)
Prices	Rice: Rs. 3/kg; Wheat: Rs. 2/kg; Coarse cereals: Rs. 1/kg
Antyodaya families	35 kg per family per month (poorest of poor)

Key provisions:

- **Priority Households (PHH):** Identified by state governments; receive 5 kg/person/month
- **Antyodaya Anna Yojana (AAY):** Pre-existing scheme; 35 kg/family/month retained within NFSA
- **Maternity benefits:** Rs. 6000/- cash assistance to pregnant/lactating mothers
- **Meal entitlement:** Children 6 months–14 years get free meals through ICDS and Mid-Day Meal Scheme

2020 update: PM Garib Kalyan Anna Yojana (PMGKAY) during COVID provided additional 5 kg free grain per person per month – extended multiple times. **Final Answer:** Under NFSA 2013, priority households receive 5 kg of foodgrain per person per month at heavily subsidized prices of Rs. 1–3/kg, covering 67% of India's population through the Public Distribution System.

Answer: (C) Go Back to Q39

Q40.

Solution

Participatory Rural Appraisal (PRA):

- Developed in the 1980s–90s by Robert Chambers (Institute of Development Studies, UK) and others
- A family of approaches for **bottom-up, community-led development** in which rural people analyze their own situation and plan actions
- **Core philosophy:** "Farmers are experts in their own agroecological situation" – extension workers facilitate, not prescribe

Key PRA tools:

- **Transect walk:** Extension worker walks through the village with farmers to observe and discuss land types, cropping patterns, problems – generates a spatial cross-section diagram
- **Resource mapping:** Community draws a map of village resources (water bodies, soil types, forests, fields, roads) – identifies resource distribution and access equity
- **Seasonal diagram (Seasonal Calendar):** Matrix of months vs. farming activities, rainfall, food availability, income – reveals seasonal stress periods
- **Venn diagram (Chapati diagram):** Shows relationships between institutions important to the community
- **Problem ranking / Pair-wise ranking:** Community prioritizes problems or crop varieties
- **Wealth ranking:** Community identifies households by relative wealth – helps target programs

PRA contrasts with the older **Technology Transfer model** where experts designed solutions and farmers merely implemented them. **Final Answer:** Participatory Rural Appraisal treats farmers as the primary experts on their own situation, using community-led tools such as transect walks, resource mapping, and seasonal calendars to co-create development solutions rather than imposing prescriptions from outside.

Answer: (D) Go Back to Q40

Answer Key

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