IBPS AFO MAINS

Professional Knowledge – Agriculture

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Priority order of subjects (by usual weightage)

#	Subject
1	Agronomy (incl. crop production, weeds, irrigation, current crop data & MSP)
2	Government Schemes & Agri Current Affairs (last 12 months)
3	Agri Finance & Banking (RBI, NABARD, KCC, PSL)
4	Soil Science (incl. fertiliser nutrient %)
5	Plant Pathology & Entomology
6	Horticulture
7	Animal Husbandry & Dairy
8	Agricultural Economics & Extension
9	Agricultural Engineering
10	Fisheries
11	Forestry
12	One-Page Last-Day Revision Summary

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1. Agronomy

NOTE

Why first: Agronomy is usually the largest single block of the AFO Mains Professional Knowledge paper. Expect questions on critical stages, seed rates, varieties, herbicides, cropping systems, irrigation terms and current production/MSP figures.

1.1 Basic Concepts, Indices & Formulae ★★★

- **Agronomy** = Greek *agros* (field) + *nomos* (manage). Father of Agronomy: **Pietro de Crescenzi**. Father of weed science / tillage: **Jethro Tull** ("Horse Hoeing Husbandry").
- **Law of Minimum** – **Liebig (1840)**; **Law of Limiting Factors** – **Blackman (1905)**; **Law of Diminishing Returns / yield** – **Mitscherlich (1909)**.
- **Criteria of essentiality** – **Arnon & Stout (1939)**. **16/17 essential nutrients** (Ni is the 17th).
- **Leaf Area Index (LAI)** = leaf area ÷ ground area (**Watson, 1947**). Ceiling LAI → net photosynthesis zero.
- **Harvest Index (HI)** = economic yield ÷ biological yield × 100 (**Donald, 1962**). Also called coefficient of effectiveness (Nichiporovich).
- **Land Equivalent Ratio (LER)** = (Yield of A in intercrop ÷ sole A) + (Yield of B in intercrop ÷ sole B). **LER > 1 → intercropping is advantageous**.
- **Cropping Intensity** = Gross cropped area ÷ Net sown area × 100. India ≈ **155%**.
- **Crop Rotation Intensity** = No. of crops ÷ duration (years) × 100. Rice–wheat in 1 year = **200%**.
- **Multiple Cropping Index** (Dalrymple) = Σ area of crops ÷ net area × 100.
- **Sorghum sickness**: wide C:N stubble immobilises soil N; give **~25% extra N** to the next crop.
- **Plant rectangularity** = row-to-row ÷ plant-to-plant spacing. **Square planting (1:1)** gives the most even use of space.
- **Furrow slice** (0–15 cm, 1 ha) ≈ **2.24 million kg** soil.
- **Cardinal temperatures** concept – **Sachs (1860)**. Base temperature: wheat **~4–5 °C**, rice/sorghum **~10 °C**.
- **Growing Degree Days (GDD)** = Σ [(Tmax + Tmin)/2 – Tbase].

MEMORY TRICK

Memory trick – "LBM" in time order: Liebig (minimum, 1840) → Blackman (limiting factors, 1905) → Mitscherlich (diminishing returns, 1909).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- LER > 1 indicates? → Yield advantage of intercropping.
- HI concept given by? → C.M. Donald.
- Cropping intensity formula? → GCA/NSA × 100.
- Law of limiting factors? → Blackman.

1.2 Agro-climatic Zones & Dryland Agriculture ★★☆

- **Planning Commission (1988–89, 7th Plan)**: **15 agro-climatic regions**. Trans-Gangetic plains (Punjab, Haryana) have the highest irrigated area and cropping intensity.
- **NARP (ICAR)**: **127 agro-climatic sub-zones**.
- **NBSS&LUP (ICAR, Nagpur)**: **20 agro-ecological regions (AERs), 60 sub-regions**, based on soil, physiography, bio-climate and length of growing period.

Type	Annual rainfall	Region / key issue
Dry farming	< 750 mm	Arid; crop failure common; moisture conservation is the key
Dryland farming	750–1150 mm	Semi-arid; in-situ conservation, drainage in black soils
Rainfed farming	> 1150 mm	Humid/sub-humid; water erosion is the main problem

- **Drought (IMD)**: seasonal rainfall deficiency of **20–59% = deficient**, **≥ 60% = large deficient**. Older textbook definition: rainfall < 75% of normal; > 50% deficiency = severe drought.
- **Moisture Availability Index (MAI)** = assured rainfall (at 50% probability) ÷ PET.
- **Moisture Deficit Index (MDI)** = (P – PET)/PET × 100. Arid < –66.6; semi-arid –33.3 to –66.6; sub-humid 0 to –33.3.
- **Antitranspirants** (4 types): **stomata-closing** (PMA, atrazine low dose); **film-forming** (mobileaf, hexadecanol, wax); **reflecting** (**kaolin 5%**); **growth retardants** (**cycocel/CCC**).

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- **Windbreak/shelterbelt** protects roughly **5–10 × tree height** on the windward side and up to **~30 ×** on the leeward side.
- **CRIDA** is at Hyderabad; **CAZRI** at Jodhpur; **ICRISAT** at Patancheru (Hyderabad).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Kaolin is which type of antitranspirant? → Reflecting.
- Number of agro-ecological regions by NBSS&LUP? → 20.
- Dry farming rainfall limit? → < 750 mm.

1.3 Agrometeorology & Instruments ★★☆

- **Atmosphere (by volume)**: N_2 **78.08%**, O_2 **20.95%**, Ar **0.93%**, CO_2 ≈ **0.042% (~420 ppm, rising)**. Soil air has **~10× more CO_2** than the atmosphere.
- **Troposphere** (0–8/18 km): all weather happens here; normal lapse rate **6.5 °C/km**; dry adiabatic lapse rate **9.8 ≈ 10 °C/km**.
- **Stratosphere** (up to ~50 km): **ozone layer** absorbs UV; temperature rises with height.
- **Mesosphere** (50–80 km): the coldest layer. **Thermosphere** (80 km+): contains the **ionosphere** (radio waves).
- **PAR** = **400–700 nm**, measured with a quantum sensor. **Solar constant** ≈ **1.94–2.0 cal/cm²/min (~1361 W/m²)**.
- **Albedo** = reflected ÷ incident radiation.
- **SW monsoon** reaches Kerala around **1 June** and brings **~75%** of annual rain. All-India LPA (1971–2020) for June–Sept = **87 cm**. The **NE monsoon** (Oct–Dec) mainly benefits Tamil Nadu and coastal AP.
- **Forecasts**: short range **≤ 3 days**; medium range **3–10 days** (NCMRWF, Noida); long range **> 10 days**.
- **Cloud seeding**: cold clouds – **silver iodide / dry ice**; warm clouds – **NaCl**.

Instrument	Measures
Anemometer	Wind speed
Wind vane	Wind direction
Campbell–Stokes recorder	Sunshine duration
Pyranometer	Total (global) solar radiation
Pyrheliometer	Direct solar radiation
Psychrometer / hygrometer	Relative humidity
Tensiometer	Soil moisture tension (up to ~0.85 bar)
Lysimeter	Evapotranspiration, leaching
Neutron probe	Soil moisture in situ
Piezometer	Water-table depth
Porometer	Stomatal conductance
Potometer	Transpiration rate
Crescograph	Plant growth (J.C. Bose)
Parshall flume / V-notch	Flow of irrigation water
Infra-red thermometer	Crop canopy temperature

- **Iso-lines**: isohyet (rainfall), isobar (pressure), isotherm (temperature), isohel (sunshine), isotach (wind speed), isophene (phenological events).

MEMORY TRICK

Pyr**H**eliometer = **H**ead-on (direct) beam;
Pyr**A**nometer = **A**ll (global) radiation.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Sunshine hours are measured by? → Campbell–Stokes recorder.
- Line joining places of equal rainfall? → Isohyet.
- Wavelength range of PAR? → 400–700 nm.

1.4 Soil & Water Conservation ★★☆

- **Land capability classes**: **8 classes (I–VIII, USDA)**. **I–IV** are fit for cultivation (I = no limitation); **V–VIII** are for pasture, forestry or wildlife.
- **Agronomic measures** (slope **< 2%**): contour cultivation, strip cropping, mulching, cover crops.
- **Mechanical measures** (slope **> 2%**):

Measure	Slope / condition
Contour bunding	Up to **6%**, low rainfall (< 600–800 mm), permeable soils
Graded bunding	**2–10%**, rainfall **> 800 mm**
Zingg terrace	**3–10%**, medium–deep soils
Bench terracing	**16–33%**, hilly areas
Broad Bed & Furrow (BBF)	Deep black soils (ICRISAT); beds **~1.2–1.5 m**, furrows **~45 cm**

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Measure	Slope / condition
Vertical mulching	Black/heavy soils, coffee gardens

- **Vetiver (khus) grass** is the best vegetative barrier.
- **Erosion-permitting crops**: maize, sorghum, cotton (wide rows). **Erosion-resisting crops**: cowpea, groundnut, grasses.
- **Wind erosion processes**: **saltation (50–75%)** > surface creep > suspension.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Bench terracing is done on slopes of? → 16–33%.
- Most common process of wind erosion? → Saltation.
- BBF is developed for? → Vertisols (ICRISAT).

1.5 Irrigation & Water Management ★★★

- **Soil moisture constants**:

Constant	Tension (bar)	pF
Saturation	0	0
Field capacity (FC)	–0.1 to **–1/3**	**2.54**
Permanent wilting point (PWP)	**–15**	**4.18**
Hygroscopic coefficient	**–31**	**4.5**
Oven dry	–10,000	7.0

- **Available water** = FC – PWP (**Veihmeyer & Hendrickson**). PWP concept – **Briggs & Shantz (1912)**, indicator plant: dwarf sunflower.
- **Irrigation scheduling approaches**: critical growth stage; soil-moisture depletion (**25–50% ASM**); **IW/CPE ratio** (**Parihar et al., 1974**; usual ratio 0.6–1.0); plant indices.
- **Water units**: **1 ha-cm = 1,00,000 L**; **1 cusec = 28.3 L/s**; 1 cumec = 1000 L/s; 1 ha = 2.47 acre.
- **Delta** = depth of water a crop needs; **Duty** = area irrigated per unit discharge; **Base period** = days of supply.
- **Irrigation projects (by CCA)**: Major **> 10,000 ha**; Medium **2,000–10,000 ha**; Minor **< 2,000 ha**.
- **Class-A pan evaporimeter**: **121 cm** diameter, **25.5 cm** deep. **Penman (1948/1950)** – most accurate ET formula; FAO uses **Penman–Monteith**.
- **Consumptive use** = ET + water used in metabolism (~1%).

Method	Key facts
Check basin	Most common; close-growing crops (wheat, groundnut)
Border strip	Slope 0.5–1%; close-growing crops; not for sandy soils
Furrow	Row crops (cotton, sugarcane, potato, maize)
Sprinkler	Undulating land, sandy soils; saves **25–50%** water; pressure **~2.5–4 kg/cm²**; **not for rice and jute**; frost protection
Drip (trickle)	From **Israel**; saves **30–70%**; emitter **1–4 L/h**; fertigation; wide-spaced and high-value crops
Surge	Intermittent flow; cuts deep percolation

- **WUE** (kg/ha-mm): highest – **finger millet / wheat**; lowest – **rice (~3.7)**.
- Rice needs **3,000–5,000 L of water per kg** of grain. **AWD (alternate wetting & drying)** saves water and cuts methane.
- **Drainage**: surface drains, tile drains, **mole drains (clay soils)**, vertical drainage (wells).
- **PMKSY "Per Drop More Crop"** – micro-irrigation component (now under RKVY; see Schemes chapter).

UPDATED 2025-26

Critical stages for irrigation (very high-yield table)

Crop	Most critical stage(s)
Rice	**Panicle initiation, booting & flowering**
Wheat	**CRI (21 DAS)** > jointing > flowering > milking
Maize	**Tasselling–silking**
Sorghum / bajra	Booting, flowering
Gram / pea	Pre-flowering, pod filling
Groundnut	**Pegging**, flowering, pod development
Soybean	Flowering, pod filling
Mustard	Flowering, siliqua formation
Sunflower	**Star bud**, flowering
Cotton	**Flowering, boll formation**
Sugarcane	**Formative (tillering) phase, 60–130 days**
Potato	**Stolonisation & tuberisation**
Onion	Bulb development

- **Wheat** with only **1 irrigation** → give it at **CRI**; with **2** → CRI + flowering/late jointing.

MEMORY TRICK

Wheat stages "**C**ats **T**ake **J**am **F**or **M**ilky **D**essert" → CRI (21) – Tillering (45) – Jointing (65) – Flowering (85) – Milking (105) – Dough (120) DAS.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Most critical stage of wheat for irrigation? → CRI, 21 DAS.
- Field capacity tension? → –1/3 bar; PWP? → –15 bar.
- Sprinkler is not suitable for? → Rice and jute.
- 1 hectare-cm = ? → 1 lakh litres.

1.6 Cropping Systems & Crop Terminology ★★★

- **Multiple cropping** = intercropping + mixed cropping + sequential cropping (**double, triple, relay, ratoon**).
- **Intercropping**: definite row ratio. **Mixed cropping**: no row pattern. **Relay cropping**: next crop sown before the standing crop is harvested.
- **Paira / Utera** cropping = relay of lentil, lathyrus or linseed into standing rice (eastern India).
- **Major cropping system**: **rice–wheat (~10 Mha, IGP)**, then rice–rice and cotton–wheat.

Term	Meaning / example
Catch crop	Short crop after main crop failure / in a short gap – moong, urd, cowpea
Cover crop	Protects soil – cowpea, groundnut, sweet potato
Smother crop	Suppresses weeds – cowpea, sorghum, mustard
Trap crop	Attracts pests – **marigold in tomato** (fruit borer); **mustard in cabbage** (DBM)
Nurse crop	Supports another – mustard with pea
Companion crop	Grown together without competition
Augmenting crop	Mustard with berseem (increases first cut)
Ley crop	Grass/legume for grazing in rotation
Restorative crop	Legumes
Exhaustive crop	Sorghum, maize, sugarcane (cereals/grasses)
Alley cropping	Crops between hedge rows of Leucaena/Gliricidia
Avenue crop	Along roads/fences

- **Recommended intercropping ratios**: wheat + mustard **9:1**; groundnut + pigeonpea **4:1 (or 6:1)**; sorghum + pigeonpea **2:1**; chickpea + mustard **4:1**; sugarcane + potato/onion (autumn cane).
- **Integrated Farming System (IFS)**: crop + livestock + fish + poultry + horticulture; recycles residues and raises income per unit area.
- **Conservation agriculture**: 3 principles – **minimum soil disturbance, permanent soil cover, crop rotation**.
- **Happy Seeder / Super Seeder** sow wheat into rice stubble (fights residue burning). **PUSA decomposer** – fungal consortium developed by IARI.
- **SRI (System of Rice Intensification)** – developed by **Fr. Henri de Laulanié (Madagascar, 1983)**; **8–12-day seedlings, single seedling per hill, 25 × 25 cm**, AWD, cono-weeder.
- **DSR (Direct Seeded Rice)** saves water and labour; weeds are the main problem.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Paira/Utera cropping is associated with? → Rice.
- Trap crop for diamondback moth in cabbage? → Mustard.
- Wheat + mustard intercrop ratio? → 9:1.
- SRI originated in? → Madagascar.

1.7 Seeds & Seed Production ★★☆

Class	Produced by	Tag colour
Nucleus	Breeder (original)	No tag
Breeder	Breeder / ICAR / SAUs	**Golden yellow**
Foundation	NSC, SSCs (certified by SSCA)	**White**
Certified	Seed agencies, farmers	**Azure blue**
Truthfully labelled (TL)	Private companies	**Opal green**

- **Seed replacement rate**: varieties of self-pollinated crops – **33%**; cross-pollinated – **50%**; hybrids – **100%**.
- **Seed laws**: **NSC (1963)**; **Seeds Act 1966**; Seeds Rules 1968; Seeds (Control) Order 1983; **PPV&FR Act 2001**.
- **Seed viability**: **tetrazolium (TZ) test** – viable embryo stains red.

- **Isolation distances (certified seed)**: wheat/rice ~3 m; maize **200 m**; hybrid sorghum ~200 m; cotton 30–50 m.

UPDATED 2025-26

Draft Seeds Bill, 2025 (released **12 Nov 2025** for comments): would replace the **Seeds Act 1966** and the **Seeds (Control) Order 1983**. Proposals include a National Register of varieties, mandatory **QR-code traceability**, decriminalised petty offences, and up to **₹30 lakh fine / 3 years' jail** for spurious seed. Farmers may keep saving and exchanging farm-saved seed (unless sold under a brand name).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Tag colour of certified seed? → Azure blue. Breeder seed? → Golden yellow.
- Seeds Act enacted in? → 1966.
- TZ test is used for? → Seed viability.

1.8 Weed Science & Herbicides ★★★

- Of all crop losses caused by pests, **weeds cause the largest share (~33%)** – more than diseases (~26%) or insects (~20%). Directorate of Weed Research: **Jabalpur**.
- **Allelopathy** = harmful chemical effect of one plant on another (Molisch).
- **Weed types**: **Absolute** weeds (e.g. *Cyperus rotundus* – "world's worst weed"); **relative** weeds (barley in wheat); **rogue** (off-type plants of the same crop); **volunteer** (from the previous crop's seed).
- **Mimicry weeds**: ***Phalaris minor*** (canary grass) and ***Avena fatua*** (wild oat) in wheat; ***Echinochloa*** and **wild rice** in rice.
- **Parasitic weeds**:

Weed	Type	Hosts
Cuscuta (dodder)	Total stem parasite	Lucerne, niger, berseem
Loranthus	Partial stem parasite	Fruit and forest trees
Orobanche (broomrape)	Total root parasite	Mustard, tobacco, tomato, brinjal
Striga (witch weed)	Partial root parasite	Sorghum, maize, sugarcane

- **Toxic weeds**: ***Argemone mexicana*** → epidemic **dropsy** (sanguinarine) from adulterated mustard oil; ***Parthenium*** (congress grass) → dermatitis/allergy; **Lathyrus** grain → lathyrism (BOAA/ODAP).
- **Stale seed bed**: irrigate, let weeds germinate, kill them, then sow.
- **Biological control of weeds**:

Weed	Bio-agent
Parthenium	*Zygogramma bicolorata* (beetle, from Mexico, 1983)
Water hyacinth	*Neochetina eichhorniae*, *N. bruchi* (weevils)
Salvinia molesta	*Cyrtobagous salviniae* (weevil)
Lantana	*Teleonemia scrupulosa* (lace bug)
Opuntia (prickly pear)	*Dactylopius* cochineal (India); *Cactoblastis cactorum* (Australia)

- **Herbicide classification**:

Group	Examples
Phenoxy (auxin type)	**2,4-D**, MCPA
Substituted ureas	Isoproturon, diuron
Sulfonylureas	**Metsulfuron, sulfosulfuron** (very low doses, g/ha)
Triazines	**Atrazine** (maize, sugarcane), simazine, metribuzin
Dinitroanilines	**Pendimethalin**, fluchloralin (volatile → PPI)
Chloroacetamides	**Butachlor**, alachlor, pretilachlor
Bipyridyliums	**Paraquat, diquat** (contact, non-selective)
Glycine derivative	**Glyphosate** (systemic, non-selective; EPSP synthase)
Aryloxyphenoxy (fops)	Clodinafop, fenoxaprop (grassy weeds)
Others	**Bispyribac-sodium** (DSR), **pinoxaden**, oxyfluorfen, imazethapyr (soybean/legumes)

- **Crop-wise herbicides (most asked)**: rice – butachlor, pretilachlor, bispyribac; wheat (*Phalaris*) – **clodinafop, sulfosulfuron, pinoxaden** (*Phalaris* is **resistant to isoproturon** in Punjab/Haryana); wheat broadleaf weeds – **2,4-D, metsulfuron**; maize/sugarcane – **atrazine**; soybean – imazethapyr, metribuzin; groundnut – pendimethalin.
- **Trade names**: Roundup (glyphosate), Gramoxone (paraquat), Machete (butachlor), Stomp (pendimethalin), Basalin (fluchloralin), Lasso (alachlor), Sencor (metribuzin), Leader

(sulfosulfuron), Algrip (metsulfuron), Topik (clodinafop), Axial (pinoxaden), Nominee Gold (bispyribac), Pursuit (imazethapyr), Goal (oxyfluorfen).

UPDATED 2025-26

Paraquat & glyphosate are restricted: glyphosate may be applied only by **Pest Control Operators** (GoI notification, Oct 2022). Several older molecules have been banned. Check the CIB&RC banned list before the exam.

MEMORY TRICK

Phalaris killers = "**C-S-P**" (think "**C**lear **S**tubborn **P**halaris") → **C**lodinafop, **S**ulfosulfuron, **P**inoxaden.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Herbicide for *Phalaris minor* resistant to isoproturon? → Clodinafop / sulfosulfuron / pinoxaden.
- Bio-agent of *Parthenium*? → *Zygogramma bicolorata*.
- Total root parasite of mustard? → *Orobanche*.
- Glyphosate inhibits which enzyme? → EPSP synthase.

1.9 Cereals – Rice ★★★

- *Oryza sativa*, **2n = 24**, Poaceae, origin **Indo-Burma / SE Asia**. *O. glaberrima* = African rice. Ecotypes: indica, japonica, javanica.
- **C3, short-day plant**; panicle; fruit = **caryopsis**. Test weight ~**20–25 g**. Hulling/milling out-turn ~**66–67%**.
- **Seasons (eastern India)**: **Aus** (autumn, sown Apr–May), **Aman** (winter/kharif, Jun–Jul – main crop), **Boro** (summer, sown Nov–Dec).
- **Nursery**: ~**1/10th (0.1 ha) nursery per ha** of field; transplant **21–25-day** seedlings, spacing **20 × 10/15 cm**, **2–3 seedlings/hill**. **Dapog** (Philippines): seedlings ready in **11–14 days**; mat nursery for mechanised transplanters.
- **Puddling** cuts percolation and weeds; raises bulk density. Puddled soil has a thin **oxidised zone** over a **reduced zone** → place NH_4-N fertiliser deep in the **reduced zone**; avoid nitrate fertilisers.
- **Fertiliser (HYV)**: **100–120 : 60 : 60** NPK; **25 kg/ha $ZnSO_4$**. NUE in rice is only **30–40%** (denitrification losses).
- **Disorders**: **Khaira = Zn deficiency** (Y.L. Nene, Pantnagar, **1966**); **Akiochi = H_2S toxicity**; **bronzing = Fe toxicity**; white tip (B); silicon deficiency (droopy leaves).
- **Bio-fertilisers**: **Azolla–Anabaena** and BGA (blue-green algae).
- Rice fields emit **methane** (from anaerobic methanogens).
- **Parboiling** retains **vitamin B1 (thiamine)** and gives more head rice. Polished rice → thiamine loss → beriberi.
- **Varieties & firsts**: **TN-1** (Taiwan, first semi-dwarf to India, 1964); **IR-8** ("miracle rice", IRRI 1966; dwarf gene *sd1* from **Dee-geo-woo-gen**); **Jaya** – first Indian semi-dwarf HYV (1968); **Pusa Basmati-1** (1989), **Pusa Basmati 1121** (longest grain), **PB 1509, 1692**, **PB 1885/1886** (bacterial-blight-resistant basmati); **Swarna Sub-1** (submergence tolerant, *Sub1* gene); **CSR** series (salinity); **Improved Samba Mahsuri** (bacterial blight).
- **Hybrid rice**: China first (1970s, Yuan Longping, CMS – WA cytoplasm). India's first hybrids came in **1994** (APHR-1, APHR-2, MGR-1, KRH-1, CORH-1). First private hybrid: **PHB-71**.
- **Weeds**: *Echinochloa crus-galli* (barnyard grass) is the main weed. **Beushening** = cross-ploughing standing rice (Odisha, MP).

UPDATED 2025-26

World's first genome-edited rice varieties (ICAR, released **4 May 2025**): **DRR Dhan 100 (Kamala)** – from **Samba Mahsuri**, ~20 days earlier maturity; **Pusa DST Rice 1** – from **MTU 1010**, tolerates drought and salinity. Both use **SDN-1** genome editing (CRISPR-Cas). Ministry claims **20–30%** higher yield.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Khaira disease is due to? → Zn deficiency.
- Dapog nursery originated in? → Philippines.
- Gas emitted from paddy fields? → Methane.
- Parboiling conserves which vitamin? → B1 (thiamine).

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1.10 Cereals – Wheat, Barley & Triticale ★★★

- *Triticum aestivum* (bread wheat, hexaploid **2n = 42**, **~87–90%** of area); *T. durum* (macaroni, 2n = 28, ~10%); *T. dicoccum* (emmer, 2n = 28). Origin **SW Asia**.
- **C3, long-day plant**; inflorescence = spike/ear. Test weight **~40 g**.
- **Dwarfing genes**: ***Rht1, Rht2*** from Japanese **Norin-10** (via Borlaug, Mexico). Mexican varieties **Lerma Rojo 64A and Sonora 64** (1963–65) drove the Green Revolution; Kalyan Sona and Sonalika were selections.
- **Sowing**: **1st–15th Nov** (timely, NW India); seed rate **100 kg/ha** (late sowing **125 kg/ha**); row spacing **22.5 cm**; depth ~5 cm (deeper for tall varieties).
- **Fertiliser**: **120 : 60 : 40** NPK – half N + full P, K at sowing; rest of N at first irrigation (CRI).
- **Irrigation**: 6 critical stages; **CRI is the most critical**.
- **Weeds**: grassy – *Phalaris minor*, *Avena ludoviciana*; broadleaf – *Chenopodium album*, *Melilotus*, *Convolvulus*.
- **Gluten** = gliadin + glutenin (bread quality). Safe storage moisture **10–12%**.
- **Recent popular / climate-resilient varieties**: **HD 2967, HD 3086, DBW 187 (Karan Vandana), DBW 303 (Karan Vaishnavi), DBW 222, HD 3226, PBW 826, HD 3385 (heat tolerant), DBW 327 (Karan Shivani)**; biofortified **WB 2 (Zn)**, **HPBW 01**.
- **Barley**: *Hordeum vulgare* (6-row), *H. distichum* (2-row, malting); most **salt/alkali tolerant** cereal; **no gluten** for baking.
- **Triticale** = wheat × rye – first man-made cereal.

MEMORY TRICK

Wheat recipe "**100-22.5-120**" → 100 kg seed, 22.5 cm rows, 120 kg N.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Dwarfing gene source of wheat? → Norin-10.
- Wheat seed rate for timely sowing? → 100 kg/ha.
- Macaroni wheat? → *T. durum*.
- First man-made cereal? → Triticale.

1.11 Cereals – Maize & Millets (Shree Anna) ★★★

- **Maize** (*Zea mays*, 2n = 20, **C4**, origin **Mexico/Central America**): monoecious and **protandrous** (tassel appears first); cross-pollinated. Called the **"Queen of cereals"** because it has the highest genetic yield potential.
- **Maize types**: **dent** (most common, USA), **flint** (India), sweet (*saccharata*), **pop** (*everta*), waxy, flour, pod corn.
- **Quality**: protein **zein** is low in **lysine & tryptophan** → **QPM (opaque-2)**: **Shaktiman-1, HQPM-1**. Yellow colour = **cryptoxanthin**. Maize-only diets → **pellagra** (niacin).
- **Hybrids**: single-cross hybrids now dominate (e.g. **HQPM-1, DHM 117, Vivek QPM 9**). First double-cross hybrids (1961): **Ganga-1, Ganga-101, Ranjit, Deccan**. First AICRP was on maize (**1957**).
- **Agronomy**: seed rate **20–25 kg/ha**; spacing **60–75 × 20 cm**; population **65,000–75,000 plants/ha**; most critical stage **tasselling–silking**. Maize is very sensitive to waterlogging. **White bud = Zn deficiency**. Herbicide: **atrazine**.
- **Sorghum (jowar)** (*Sorghum bicolor*, 2n = 20, C4, origin **Africa**): "**camel crop**"; young plants contain **HCN (dhurrin)** – feed fodder only after **50% flowering**. Parasitic weed: **Striga**. First hybrid: **CSH-1 (1964)**. Rabi variety: **M 35-1**. Seed rate **10–12 kg/ha**.
- **Pearl millet (bajra)** (*Pennisetum glaucum*, 2n = 14, C4, **protogynous**): most drought-tolerant cereal. First hybrid in the world: **HB-1 (1965, Tift 23A CMS)**. **Rajasthan** is the largest grower. Biofortified (high Fe): **Dhanshakti**, **HHB 299**.
- **Finger millet (ragi)**: richest in **calcium (~344 mg/100 g)**; Karnataka leads.
- **Shree Anna** = millets brand (UN **International Year of Millets 2023** was India's proposal). **IIMR Hyderabad** is the Global Centre of Excellence on millets.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Maize protein deficient in? → Lysine & tryptophan.
- Protogynous cereal? → Pearl millet.
- HCN poisoning in sorghum is due to? → Dhurrin.
- Richest cereal source of calcium? → Finger millet.

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1.12 Pulses ★★★

- India is the **largest producer, consumer and importer** of pulses. **Gram** has the largest share of pulse production (~**45%**), followed by **tur**.

Crop	Botanical name	Key facts
Chickpea (gram)	*Cicer arietinum*	Origin SW Asia; **desi** (brown, 2n = 16) vs **kabuli** (white); malic + oxalic acid in leaf hairs; **nipping at 30–40 DAS**; seed rate **75–100 kg/ha**; pest *Helicoverpa*; wilt (*Fusarium*)
Pigeonpea (tur/arhar)	*Cajanus cajan*	Origin India/Africa; often cross-pollinated (~20–30%); deep-rooted; seed rate **12–15 kg/ha**; first hybrid in world **ICPH-8 (ICRISAT, 1991)**; wilt, sterility mosaic (mite vector)
Green gram (moong)	*Vigna radiata*	Summer/spring crop after wheat; YMV (whitefly); varieties **SML 668, IPM 02-3, Virat**
Black gram (urd)	*Vigna mungo*	YMV-prone; varieties **T-9, PU-31**
Lentil (masur)	*Lens culinaris*	Rabi; utera crop in rice; Madhya Pradesh/UP
Field pea	*Pisum sativum*	Powdery mildew; **Arkel** (vegetable)
Lathyrus (khesari)	*Lathyrus sativus*	**BOAA/ODAP neurotoxin → lathyrism**; low-ODAP **Ratan, Prateek**
Cowpea	*Vigna unguiculata*	"**Vegetable meat**"; drought hardy

- **Protein**: soybean ~40%; pulses ~**20–25%**. Pulses are low in **methionine**; cereals are low in **lysine** → eat them together.
- **Rhizobium** inoculation; ***Bradyrhizobium japonicum*** for soybean. Pulses need **S** and **Mo**.
- **Gram** is sensitive to frost and to irrigation at flowering.

UPDATED 2025-26

Mission for Aatmanirbharta in Pulses (Cabinet, **1 Oct 2025**): **₹11,440 crore**, **2025-26 to 2030-31**. Targets: production **350 lakh t**, area **310 lakh ha** (incl. +35 lakh ha, mainly **rice fallows**), yield **1,130 kg/ha**. Includes **100% MSP procurement of tur, urad and masoor** for 4 years (NAFED/NCCF), **88 lakh free seed kits** and **1,000 processing units** (₹25 lakh subsidy each).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Nipping in gram is done to? → Increase branching and pods (30–40 DAS).
- Lathyrism is caused by? → BOAA/ODAP.
- First pigeonpea hybrid? → ICPH-8.
- Vegetable meat? → Cowpea.

1.13 Oilseeds ★★★

- India ranks among the top **vegetable-oil importers** (palm, soybean, sunflower oil). **Edible oil** is the largest agri import.

Crop	Botanical name	Oil %	Key facts
Groundnut	*Arachis hypogaea*	**45–50**	Origin Brazil; **pegging**; gypsum at pegging (**Ca → avoids "pops"**); aflatoxin (*Aspergillus flavus*); bunch (**non-dormant**) vs spreading (dormant)
Rapeseed–mustard	*Brassica juncea* etc.	**38–42**	Pungency = **allyl isothiocyanate** (glucosinolates); **"double zero" (canola)** = low erucic acid + low glucosinolate; **Pusa Jai Kisan** (somaclonal variant); GM mustard **DMH-11**; Rajasthan **~45%**
Soybean	*Glycine max*	**~20** (protein ~40%)	"Golden bean"/miracle crop; origin China; **short-day**; *Bradyrhizobium japonicum*; MP and Maha-rashtra lead
Sunflower	*Helianthus annuus*	**40–45**	Photo-insensitive; **star bud** critical stage; Karnataka
Sesame (til)	*Sesamum indicum*	**~50**	"Queen of oilseeds"; highest oil content among annual oilseeds
Safflower	*Carthamus tinctorius*	**~30**	Drought hardy; rich in linoleic acid
Castor	*Ricinus communis*	**~50**	**Gujarat** produces the most; **ricin** toxin; India is the top exporter
Linseed	*Linum usitatissimum*	**~35–45**	Omega-3 (α-linolenic acid); fibre = flax
Niger	*Guizotia abyssinica*	**~38**	Tribal areas; host of *Cuscuta*

Crop	Botanical name	Oil %	Key facts
Oil palm	*Elaeis guineensis*	Highest oil per ha	NMEO–Oil Palm (2021)

- **Mustard**: aphid (*Lipaphis erysimi*), white rust, *Orobanche*. Sow in **October**; seed rate **4–5 kg/ha**; 45 × 15 cm.
- **Groundnut**: seed rate **100–120 kg/ha** (bunch); spacing 30 × 10 cm; gypsum **~400–500 kg/ha** at pegging.
- **Soybean**: seed rate **70–80 kg/ha**; 45 × 5 cm; **yellow mosaic** (whitefly) and girdle beetle.

UPDATED 2025-26

National Mission on Edible Oils – Oilseeds (NMEO-OS): approved **Oct 2024**, **₹10,103 crore**, 2024-25 to 2030-31; target primary oilseed output **69.7 million t by 2030-31** (from 39 Mt). **NMEO–Oil Palm** launched in 2021 (₹11,040 crore), focused on the North-East and Andaman & Nicobar.

MEMORY TRICK

Oil-content ranking "**S**even **G**ood **S**unny **M**ornings" → **S**esame (~50) ≥ **G**roundnut (45–50) > **S**unflower (40–45) > **M**ustard (~40) > safflower > soybean (~20).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Pungency of mustard is due to? → Allyl isothiocyanate.
- Pops in groundnut are due to deficiency of? → Calcium.
- Queen of oilseeds? → Sesame.
- India's first GM food crop approved for environmental release? → GM mustard DMH-11 (2022).

1.14 Fibre, Sugar & Cash Crops ★★☆

- **Cotton** ("white gold"): *Gossypium hirsutum* (American, 2n = 52), *G. barbadense* (Egyptian/Sea Island – longest staple), *G. arboreum* and *G. herbaceum* (desi, 2n = 26). **India grows all 4 species + hybrids**. First cotton hybrid in the world: **H-4 (Dr C.T. Patel, Surat, 1970)**; first interspecific hybrid: **Varalaxmi**. **Bt cotton** (*cry1Ac*, *cry2Ab* = Bollgard II) was approved in **2002**. Bale = **170 kg**; ginning out-turn **~33–35%**; seed contains **gossypol**. **Pink bollworm** has developed resistance to Bt.
- **Jute**: *Corchorus olitorius* (tossa) and *C. capsularis* (white); **West Bengal ~80%**; **retting** (pectin breakdown); bale = **180 kg**.
- **Sugarcane** (*Saccharum officinarum*, "noble cane", 2n = 80, **C4**, origin **New Guinea**): **Sugarcane Breeding Institute, Coimbatore (1912)** – *nobilisation* (T.S. Venkatraman, Co varieties). **Co 0238** is a hugely popular variety in the north; **Co 86032** in the south. 3-budded setts, **~35,000–40,000 setts/ha**. Planting seasons: **Adsali** (Jul–Aug, 18 months, Maharashtra), **Eksali/spring** (Jan–Mar, 12 months), **autumn** (Oct). Mature when **Brix ≥ 18%** (hand refractometer). Formative phase is most critical. Ratoon only **1–2 times**. Trash mulching; **detrashing, propping**. By-products: **bagasse** (fuel/paper), **molasses** (ethanol), **press mud** (manure). **E20 blending** target achieved in 2025.
- **Tobacco**: *Nicotiana tabacum* (cigarette/bidi) and *N. rustica* (hookah/chewing; more nicotine). FCV (flue-cured Virginia) – AP and Karnataka. **Topping and de-suckering**; curing. Chloride harms leaf burning quality.
- **Potato** (*Solanum tuberosum*, origin Peru/Andes): tuber = **modified stem**; **seed plot technique (Pushkarnath, 1967)**; CPRI Shimla; **Kufri** series (Kufri Chipsona – processing, **Kufri Bahar**). Tuberisation needs **short days and cool nights (~17–20 °C)**. **Black heart** (O_2 shortage in storage); hollow heart.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Bale weight of cotton? jute? → 170 kg; 180 kg.
- Maturity index of sugarcane? → Brix ≥ 18% (hand refractometer).
- First cotton hybrid of the world? → H-4.
- Seed plot technique is associated with? → Potato (Pushkarnath).

1.15 Master Table – Crops at a Glance ★★★

Crop	2n	Origin	C3/ C4	Photoperiod
Rice	24	SE Asia (Indo-Burma)	C3	Short day
Wheat	42	SW Asia	C3	Long day

Crop	2n	Origin	C3/ C4	Photoperiod
Maize	20	Mexico	C4	Day neutral
Sorghum	20	Africa	C4	Short day
Pearl millet	14	Africa	C4	Short day
Chickpea	16	SW Asia	C3	Long day
Pigeonpea	22	India/Africa	C3	Short day
Groundnut	40	Brazil	C3	Day neutral
Soybean	40	China	C3	Short day
Mustard (juncea)	36	Asia (China/India)	C3	Long day
Sunflower	34	N. America	C3	Day neutral
Cotton (hirsutum)	52	C. America (*G. arboreum* – India)	C3	Short day
Sugarcane	80	New Guinea	C4	Short day
Potato	48	Peru (S. America)	C3	Short day (tuber)

- **Families**: Poaceae – cereals, sugarcane; **Fabaceae** – pulses, groundnut, soybean; **Brassicaceae** – mustard; **Asteraceae** – sunflower, safflower, niger; **Malvaceae** – cotton, okra; **Pedaliaceae** – sesame; **Euphorbiaceae** – castor; **Linaceae** – linseed; **Solanaceae** – potato, tobacco; Tiliaceae/Malvaceae – jute.
- **Practices by crop**: **topping** – cotton, tobacco; **de-suckering** – tobacco; **earthing up** – potato, sugarcane, maize; **nipping** – gram; **propping** – sugarcane, banana; **trashing** – sugarcane; **ratooning** – sugarcane, sorghum, rice; **retting** – jute.

MEMORY TRICK

C4 crops – "**M**y **S**ugar **S**tays **B**right **A**lways" → **M**aize, **S**ugarcane, **S**orghum, **B**ajra, **A**maranthus.

1.16 Current Data – Production, MSP & Leading States (Exam 2026) ★★★

UPDATED 2025-26

Crop production – 3rd Advance Estimates 2025-26 (released **27 May 2026**) vs Final 2024-25

Crop	2024-25 (Final)	2025-26 (3rd AE)
Total foodgrains	357.73 Mt	**376.56 Mt (record)**
Rice	150.18 Mt	**154.02 Mt**
Wheat	117.95 Mt	**120.66 Mt**
Maize	43.41 Mt	**55.09 Mt (record)**
Nutri/coarse cereals	63.92 Mt	74.47 Mt
Total pulses	25.68 Mt	**27.41 Mt**
Gram	11.11 Mt	12.51 Mt
Tur	3.62 Mt	3.59 Mt
Total oilseeds	42.98 Mt	43.06 Mt
Groundnut	11.94 Mt	13.07 Mt (record)
Rapeseed–mustard	12.67 Mt	13.77 Mt (record)
Sugarcane	454.61 Mt	**500.06 Mt (record)**
Cotton (lakh bales of 170 kg)	297.2	290.2
Jute & mesta (lakh bales of 180 kg)	–	91.8

- In Jan 2026 India was declared to have **overtaken China as the world's largest rice producer** (150.18 Mt). India is also the **largest rice exporter** (~40% of world trade).

UPDATED 2025-26

MSP – Kharif Marketing Season 2026-27 (CCEA, **13 May 2026**, ₹/quintal)

Crop	MSP 2026-27	Increase
Paddy (Common)	**2,441**	+72
Paddy (Grade A)	2,461	+72
Jowar (Hybrid)	4,023	+324
Bajra	2,900	+125
Ragi	5,205	+319
Maize	2,410	+10
Tur/Arhar	**8,450**	+450
Moong	8,780	+12
Urad	8,200	+400
Groundnut	7,517	+254
Sunflower seed	8,343	**+622 (highest)**
Soybean (yellow)	5,708	+380
Sesamum	**10,346** (highest MSP)	+500
Nigerseed	10,052	+515
Cotton (Medium staple)	8,267	+557
Cotton (Long staple)	8,667	+557

- **Highest margin over cost**: **moong (61%)**, then bajra and maize (56%), tur (54%); all others **50%**.

UPDATED 2025-26

MSP – Rabi Marketing Season 2027-28 (CCEA, **30 Sep 2026**, ₹/quintal)

Crop	MSP 2027-28	Increase	Margin over cost
Wheat	**2,610**	+25	**106% (highest)**
Barley	2,286	+136	58%
Gram	5,958	+83	59%
Lentil (masur)	7,390	+390	92%
Rapeseed & mustard	6,613	+413	96%
Safflower	7,215	**+675 (highest)**	50%

- **MSP basics**: recommended by **CACP** (1965), approved by **CCEA**; **22 mandated crops** (14 kharif + 6 rabi + 2 commercial: jute, copra) plus **toria** and **de-husked coconut** fixed on that basis. Since **2018-19**, MSP is at least **1.5 × A2+FL cost**.

MEMORY TRICK

Cost concepts: **A2** = paid-out costs; **A2+FL** = plus family labour (the MSP benchmark); **C2** = comprehensive cost (adds rent and interest on owned capital) – the Swaminathan Commission's demand was C2 + 50%.

UPDATED 2025-26

Leading states (production, 2023-24)

Crop	1st	2nd	3rd
Rice	**Telangana**	Uttar Pradesh	West Bengal
Wheat	Uttar Pradesh	**Madhya Pradesh**	Punjab
Maize	Karnataka	Bihar	Madhya Pradesh
Nutri/coarse cereals	Rajasthan	Karnataka	Madhya Pradesh
Total pulses	Madhya Pradesh	Maha-rashtra	Rajasthan
Gram	Madhya Pradesh	Maha-rashtra	Rajasthan
Tur	**Karnataka**	Maha-rashtra	Uttar Pradesh
Total oilseeds	Rajasthan	Madhya Pradesh	Gujarat
Groundnut	Gujarat (45%)	Rajasthan	Madhya Pradesh
Rapeseed–mustard	Rajasthan (45%)	Uttar Pradesh	Madhya Pradesh
Soybean	Madhya Pradesh	Maha-rashtra	Rajasthan
Sugarcane	Uttar Pradesh (46%)	Maha-rashtra	Karnataka
Cotton	**Gujarat**	Maha-rashtra	Telangana
Jute & mesta	West Bengal (81%)	Bihar	Assam
Total foodgrains	Uttar Pradesh	Madhya Pradesh	Punjab

UPDATED 2025-26

New varieties: **184 varieties of 25 crops** (60 rice, 50 maize, 13 oilseeds) released by ICAR on **4 Jan 2026**. At ICAR's **98th Foundation Day (16 Jul 2026)**, ICAR reported **386 varieties across 44 crops** developed in the past year, **94% climate-resilient**, **29 biofortified**, plus India's first indigenous **African Swine Fever vaccine**. Earlier, the PM released **109 varieties (61 crops)** on **11 Aug 2024**.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- MSP of paddy (common) for KMS 2026-27? → ₹2,441/q.
- MSP of wheat for RMS 2027-28? → ₹2,610/q.
- Which rabi crop got the highest MSP hike for 2027-28? → Safflower (+₹675).
- Foodgrain production 2025-26 (3rd AE)? → 376.56 Mt.
- Largest rice-producing state (2023-24)? → Telangana.

1.17 Scientists, Institutes & Firsts ★☆☆

- **Father of Green Revolution**: Norman Borlaug (world), **M.S. Swaminathan** (India). **White Revolution**: Verghese Kurien. **Yellow Revolution** (oilseeds): Sam Pitroda.
- **Institutes**: IARI (New Delhi, 1905 Pusa, Bihar); **IIRR/DRR** – Hyderabad; **NRRI** – Cuttack; **IIWBR** – Karnal; **IIMR (maize)** – Ludhiana; **IIMR (millets)** – Hyderabad; **IIPR (pulses)** – Kanpur; **IIOR (oilseeds)** – Hyderabad; **DRMR (mustard)** –

Bharatpur; **IISR (sugarcane)** – Lucknow; **SBI** – Coimbatore; **CICR (cotton)** – Nagpur; **CPRI** – Shimla; **CRIDA** – Hyderabad; **DWR** – Jabalpur.

- **ICAR** founded **16 July 1929** (as Imperial Council of Agricultural Research; Royal Commission on Agriculture, 1928).
- **Firsts**: AICRP – maize (1957); hybrid pearl millet HB-1 (1965); hybrid sorghum CSH-1 (1964); hybrid cotton H-4 (1970); Bt cotton (2002); GM mustard DMH-11 (2022); genome-edited rice (2025).

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2. Government Schemes & Agri Current Affairs

> **NOTE**
> Data as on **16 Oct 2026**. Many schemes ran in the **15th Finance Commission cycle, which ended in 2025-26**. Only **PM-KISAN** has a confirmed Cabinet renewal (**to 2030-31**). The others still get money in **Budget 2026-27**, but no new validity period could be confirmed – so in the exam, answer with the **last approved period** (usually "till 2025-26").

2.1 Schemes at a Glance (Master Table) ★★★

Scheme	Year	Ministry / agency	Core feature
PM-KISAN	**2019** (24 Feb, Gorakhpur)	MoA&FW	**₹6,000/yr in 3 × ₹2,000** (DBT); now **to 2030-31**
PMFBY	**2016**	MoA&FW	Premium **2% kharif, 1.5% rabi, 5% commercial/horti**
RWBCIS	2016	MoA&FW	Weather-index insurance (same premium as PMFBY)
PM-AASHA	**2018**	MoA&FW	PSS + PDPS + MIS + PSF (price support)
PM-KMY	**2019** (12 Sep)	MoA&FW / LIC	**₹3,000/month** pension at 60; entry age **18–40**
RKVY → PM-RKVY	**2007**; revamped 2024	MoA&FW	State "cafeteria" umbrella scheme
Krishonnati Yojana	Umbrella (2024 form)	MoA&FW	NFSNM, MIDH, seeds, NE organic
Soil Health Card	**2015** (19 Feb, Suratgarh)	MoA&FW	**12 parameters**; card every **2 years**
PKVY	**2015**	MoA&FW	Organic clusters; **₹31,500/ha over 3 yrs**
PMKSY	**2015** (1 Jul)	Jal Shakti + MoA&FW	"Har Khet Ko Pani", "Per Drop More Crop"
e-NAM	**2016** (14 Apr)	MoA&FW / **SFAC**	Online mandi trading
10,000 FPOs	**2020** (29 Feb, Chitrakoot)	MoA&FW	₹6,865 cr; **₹18 lakh/FPO** support
AIF	**2020** (Jul)	MoA&FW	₹1 lakh cr; **3% subvention** up to ₹2 cr
PM-KUSUM	**2019**	**MNRE**	Solar pumps and solar plants on farms
Namo Drone Didi	**2023** (Nov)	MoA&FW + MoRD + Fertilisers	**15,000 drones** to women SHGs
Digital Agriculture Mission	**2024** (2 Sep)	MoA&FW	**AgriStack**, Krishi DSS; ₹2,817 cr
NMNF	**2024** (25 Nov)	MoA&FW	Natural farming; ₹2,481 cr; 1 crore farmers
NMEO-Oilseeds	**2024** (3 Oct)	MoA&FW	₹10,103 cr, 2024-25 to 2030-31
PM Dhan-Dhaanya Krishi Yojana	**2025** (approved 16 Jul; launched 11 Oct)	MoA&FW (36 schemes, 11 depts)	**₹24,000 cr/yr × 6 yrs, 100 districts**
Pulses Mission	**2025** (1 Oct)	MoA&FW	₹11,440 cr, to 2030-31
Mission for Cotton Productivity	**2026** (5 May)	MoA&FW + Textiles	₹5,659.22 cr, 2026-27 to 2030-31
Bharat-VISTAAR	**2026** (17 Feb, Jaipur)	MoA&FW	AI multilingual advisory

> **MEMORY TRICK**
> Year chain "**07-15-16-19-20-24-25**": RKVY (07) → SHC, PKVY, PMKSY (15) → PMFBY, e-NAM (16) → PM-KISAN, PM-KMY, KUSUM (19) → FPO, AIF (20) → DAM, NMNF, NMEO-OS (24) → PMDDKY, Pulses Mission (25).

2.2 Income & Price Support: PM-KISAN, PM-AASHA, PM-KMY ★★★

- **PM-KISAN** (Central Sector Scheme, **100% central funding**): launched **24 Feb 2019** (effective **1 Dec 2018**). **₹6,000/yr** in **3 instalments of ₹2,000** by DBT to landholding farmer families.

  - Excluded: institutional landholders, income-tax payers, constitutional post holders, pensioners (≥ ₹10,000/month), professionals.
  - **Continued for 2026-27 to 2030-31** with **₹3.15 lakh crore** (Cabinet, **31 Jul 2026**). Amount unchanged.
  - **22nd instalment**: **13 Mar 2026, Guwahati** – ₹18,640 cr to 9.32 crore farmers.
  - **23rd instalment (latest)**: **20 Jun 2026, Tarakeswar (Hooghly, WB)** – about **₹18,880 cr to 9.44 crore farmers** (2.18 crore women). Total paid so far: **> ₹4.47 lakh crore over 23 instalments**.
  - **Budget 2026-27: ₹63,500 cr** (about 45% of the Agriculture Dept budget). e-KYC is mandatory. **Kisan e-Mitra** AI chatbot answers PM-KISAN questions.
- **PM-AASHA** (Pradhan Mantri Annadata Aay SanrakshaN Abhiyan, **Sep 2018**). **Continued till 2025-26** with **₹35,000 cr** (Cabinet 18 Sep 2024). Components:

Component	What it does
PSS – Price Support Scheme	Physical procurement of pulses, oilseeds and copra at MSP (NAFED, NCCF). Cap **25% of state production**; **tur, urad, masur – 100%**
PDPS – Price Deficiency Payment	Pays the gap between MSP and market price (oilseeds). Coverage raised **25% → 40%**, period 3 → 4 months, payout cap **15% of MSP**
MIS – Market Intervention Scheme	Perishables (fruits, vegetables). Limit **20% → 25%**; for **TOP** crops (tomato, onion, potato) the Centre pays transport/storage
PSF – Price Stabilisation Fund	Merged into PM-AASHA (buffer of pulses/onion)

- **PM-AASHA guarantee**: ₹45,000 cr. **PPSS** (private procurement pilot) is not among the 2024 components.
- **PM-KMY** (Kisan Maan-Dhan, **12 Sep 2019**, Ranchi): voluntary, contributory pension. Farmers with **≤ 2 ha**, aged **18–40**, pay **₹55–200/month**, matched **50:50** by the Centre. **₹3,000/month** from age **60**; **LIC** is the fund manager. Enrolment ≈ **24.96 lakh** (6 Feb 2026).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- PM-KISAN amount and number of instalments? → ₹6,000; 3 × ₹2,000.
- Where was the 23rd PM-KISAN instalment released? → Tarakeswar, West Bengal (Jun 2026).
- Under PM-AASHA, which component pays the MSP–market price gap? → PDPS.
- PM-KMY pension and entry age? → ₹3,000/month; 18–40 years.

2.3 Crop Insurance: PMFBY & RWBCIS ★★★

- **PMFBY** launched in **Kharif 2016**, replacing **NAIS and MNAIS**. Since **Kharif 2020** it is **voluntary for all farmers** (including loanee farmers).
- **Farmer premium**: **2% (kharif food & oilseeds)**, **1.5% (rabi)**, **5% (commercial/horticulture)**. The rest is shared by Centre and state **50:50** (**90:10 for NE & Himalayan states**).
- **Risks covered**: prevented sowing; standing crop (drought, flood, pests, disease); **post-harvest losses (up to 14 days)** from cyclonic rain, unseasonal rain or hailstorm; localised calamities (hailstorm, landslide, inundation, cloudburst, natural fire).
- **Cabinet (1 Jan 2025)**: continued **till 2025-26** with **₹69,515.71 cr** (2021-22 to 2025-26). Created **FIAT (Fund for Innovation & Technology) – ₹824.77 cr** to fund:
  - **YES-TECH** – yield estimates from remote sensing (weight up to **30–50%**);
  - **WINDS** – automatic weather stations at block level, rain gauges at panchayat level;
  - **CROPIC** – crop photographs for damage assessment.
- **Budget 2026-27: ₹12,200 cr** (PMFBY + RWBCIS).

UPDATED 2025-26

New from Kharif 2026: **wild animal attack** added as the **5th add-on cover** (localised risk); **paddy inundation restored** as a localised calamity. Report losses **within 72 hours** with geo-tagged photos on the Crop Insurance App. **West Bengal rejoined (Kharif 2026)**; Bihar returns from Rabi 2026-27. Since inception: **92.46 crore** farmer applications insured; **₹2.06 lakh cr** claims paid. Krishi Rakshak Portal & Helpline: **14447**.

MEMORY TRICK

Premium "**2-1.5-5**": **K**harif **2**, **R**abi **1.5**, **C**ommercial **5** → "**K2 R1.5 C5**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Premium for rabi crops under PMFBY? → 1.5%.
- Centre–state premium share for NE states? → 90:10.
- YES-TECH is related to? → Remote-sensing yield estimation (PMFBY).
- New add-on cover from Kharif 2026? → Wild animal attack.

2.4 Umbrella Schemes: PM-RKVY & Krishonnati Yojana ★★★

- **Cabinet, 3 Oct 2024**: all centrally sponsored schemes of the Agriculture Ministry were rationalised into **2 umbrella schemes**, total **₹1,01,321.61 cr** (Centre ₹69,088.98 cr, states ₹32,232.63 cr):
  - **PM-RKVY** – **₹57,074.72 cr**; "cafeteria" model (states pick components, can shift funds). Merged **9 schemes**, including **Soil Health & Fertility (SHC)**, **Per Drop More Crop**, **PKVY**, agri-mechanisation, crop diversification, agri start-ups (RKVY-RAFTAAR) and rainfed area development.
  - **Krishonnati Yojana (KY)** – **₹44,246.89 cr**; includes **NFSNM** (National Food Security & Nutrition Mission), **MIDH** (horticulture), seeds, **MOVCDNER** (organic value chains in NE) and **NMEO-Oil Palm**.
- **Budget 2026-27**: PM-RKVY **₹8,550 cr**; Krishonnati **₹11,200 cr (+64.7%)**.
- **RKVY** began in **2007** (11th Plan) to raise state investment in agriculture; renamed **RKVY-RAFTAAR** in 2017 (incubation of agri-startups).
- **MIDH** (2014-15) covers NHM, HMNEH, NHB, CDB, CIH; horticulture area added **15.66 lakh ha**; **58 Centres of Excellence** (mostly Indo-Israel).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Year of launch of RKVY? → 2007.
- Which umbrella scheme now includes Per Drop More Crop and Soil Health Card? → PM-RKVY.
- NFSM is now called? → National Food Security & Nutrition Mission (under Krishonnati).

2.5 New Missions 2024–2026 (Most Likely to Be Asked) ★★★

Mission	Approved	Outlay & period	Key targets / features
PM Dhan-Dhaanya Krishi Yojana (PMDDKY)	**16 Jul 2025**; launched **11 Oct 2025** (IARI, New Delhi)	**₹24,000 cr/yr for 6 yrs** (from 2025-26)	**100 districts** with low productivity, low cropping intensity and low credit (≥ 1 per state); converges **36 schemes of 11 departments**; **~1.7 crore** farmers; modelled on Aspirational Districts
Mission for Aatmanirbharta in Pulses	**1 Oct 2025**	**₹11,440 cr**, 2025-26 to 2030-31	**350 lakh t** production, **310 lakh ha**, yield **1,130 kg/ha** by 2030-31; **100% MSP procurement of tur, urad, masoor for 4 yrs**; 88 lakh seed kits
NMEO-Oilseeds	**3 Oct 2024**	**₹10,103 cr**, 2024-25 to 2030-31	Raise primary oilseed output (≈ 39 → **69.7 Mt**); rice fallows; **SATHI** seed portal
NMEO-Oil Palm	Aug 2021	**₹11,040 cr**	**6.5 lakh ha** by 2025-26 (achieved **2.73 lakh ha**); focus on **NE and A&N Islands**; viability price for FFBs
Mission for Cotton Productivity	**5 May 2026**	**₹5,659.22 cr**, 2026-27 to 2030-31	Lint yield **440 → 755 kg/ha**; **498 lakh bales**; ELS cotton; brand **"Kasturi Cotton Bharat"**; 140 districts, 14 states
National Mission on Natural Farming (NMNF)	**25 Nov 2024**	**₹2,481 cr** (Centre ₹1,584 cr), to 2025-26	**15,000 clusters, 1 crore farmers, 7.5 lakh ha**; **10,000 Bio-input Resource Centres**; **30,000 Krishi Sakhis/CRPs**; ₹4,000/acre/yr for 2 yrs
Digital Agriculture Mission	**2 Sep 2024**	**₹2,817 cr** (Centre ₹1,940 cr)	**AgriStack** (Farmer ID, Digital Crop Survey, geo-referenced village

Mission	Approved	Outlay & period	Key targets / features
			maps), **Krishi DSS**, Soil Profile Maps
Clean Plant Programme	**9 Aug 2024**	**₹1,765.67 cr** (incl. ADB loan)	**9 Clean Plant Centres** for virus-free planting material (grapes – Pune; orange – Nagpur; pomegranate – Solapur, etc.); run by NHB with ICAR

- Budget 2025-26 also announced a **National Mission on High-Yielding Seeds** and a **comprehensive programme for vegetables & fruits**. Both have **nil allocation** in 2026-27 BE.

MEMORY TRICK

PMDDKY = "**100-36-11-6-24**" → **100** districts, **36** schemes, **11** departments, **6** years, **₹24,000 cr** a year.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- How many districts are covered under PM Dhan-Dhaanya Krishi Yojana? → 100.
- Target yield of pulses under the Pulses Mission? → 1,130 kg/ha by 2030-31.
- Brand name under the Cotton Productivity Mission? → Kasturi Cotton Bharat.
- AgriStack is a component of? → Digital Agriculture Mission.

2.6 Markets & Infrastructure: AIF, e-NAM, FPOs, Cooperatives ★★★

- **Agriculture Infrastructure Fund (AIF)** – Central Sector, **Jul 2020**:
  - **₹1 lakh crore** financing facility; **3% interest subvention** on loans **up to ₹2 crore** for **7 years**; interest capped at **9%**; credit guarantee via **CGTMSE** (fee paid by GoI) and **NABSanrakshan** (for FPOs).
  - Scheme period **2020-21 to 2032-33**; loan sanction window **till 2025-26**.
  - **Aug 2024 expansion**: community farming assets, integrated primary + secondary processing, **PM-KUSUM Component A** solar plants.
  - Progress: **1,50,431 projects; ₹80,224 cr sanctioned; ₹1.27 lakh cr investment mobilised** (26 Jan 2026).
- **e-NAM** (**14 Apr 2016**; lead agency **SFAC**):
  - **1,656 mandis** in **23 states + 4 UTs**; **> 1.80 crore farmers**, 2.73 lakh traders, **4,724 FPOs** registered; cumulative trade **₹4.84 lakh cr** (Mar 2026).
  - Tradable commodities: **247** – 9 added on **9 Oct 2025** (previously 238; earlier 231).
  - Features: e-auction, assaying, **platform of platforms (PoP)**, inter-mandi and inter-state trade, warehouse-based sale (e-NWR).
- **10,000 FPO Scheme** (**29 Feb 2020**, Chitrakoot): outlay **₹6,865 cr**.
  - **₹18 lakh per FPO over 3 years**; **equity grant** ₹2,000/member (max **₹15 lakh**/FPO); credit guarantee up to **₹2 cr** (NABARD/NCDC funds).
  - Implementing agencies: SFAC, NABARD, NCDC and others; cluster-based business organisations (CBBOs) incubate FPOs. Minimum membership **300 (plains), 100 (NE/hills)**.
  - **Target of 10,000 FPOs achieved (31 Dec 2025)**. A 5-year extension (2026-31) has been announced by the Ministry; Cabinet approval not yet seen. Budget 2026-27: **₹500 cr**.
- **FPO** = legal entity of primary producers (farmers, milk producers, fishers, artisans), registered as a **Producer Company (Companies Act)** or a **cooperative society**. Gives collective input buying, marketing and scale.
- **Cooperation**: Ministry of Cooperation formed **6 Jul 2021** (Amit Shah).
  - **National Cooperative Policy 2025** (24 Jul 2025, for **2025–2045**; committee chaired by **Suresh Prabhu**): a cooperative in every village; **50 crore** members.
  - **Tribhuvan Sahkari University**, **Anand (Gujarat)** – India's first national cooperative university (Act of 2025).
  - **World's largest grain storage plan in the cooperative sector** (2023) – warehouses at PACS level.
  - **2025 = UN International Year of Cooperatives** ("Cooperatives Build a Better World"; launched in New Delhi, 25 Nov 2024).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Interest subvention and loan limit under AIF? → 3%; up to ₹2 crore for 7 years.
- Lead agency of e-NAM? → SFAC.
- Number of commodities tradable on e-NAM (Oct 2025)? → 247.
- Financial support per FPO under the 10,000 FPO scheme? → ₹18 lakh over 3 years.

2.7 Soil, Organic & Natural Farming ★★☆

- **Soil Health Card** (**19 Feb 2015, Suratgarh, Rajasthan**): **12 parameters** – N, P, K, S (macro); Zn, Fe, Cu, Mn, B (micro); pH, EC, OC (physical/chemical). Issued **every 2 years**.
  - **> 25 crore cards** issued (Jan 2026).
  - Now the "Soil Health & Fertility" component of **PM-RKVY** (since 2022-23). Village-level soil testing labs by youth/SHGs/FPOs.
- **PKVY** (Paramparagat Krishi Vikas Yojana, **2015**): organic farming in **20-ha clusters**; **₹31,500/ha over 3 years**, of which **₹15,000/ha by DBT** for organic inputs; max **2 ha** per farmer.
  - Certification by **PGS-India** (Participatory Guarantee System).
  - Achievement: **28.34 lakh farmers, 16.90 lakh ha** (Oct 2025).
- **MOVCDNER** – organic value chains in the **North-East** (Sikkim became the first fully organic state in **2016**).
- **NPOP** (APEDA, 2001) – third-party organic certification for exports; logo **"India Organic"**. PGS is for the domestic market ("Jaivik Bharat" logo – FSSAI).
- **PM-PRANAM** (Budget 2023-24): a state that **reduces chemical fertiliser use** gets **50% of the subsidy saved** as a grant (70% for assets, 30% for rewards). No grant released yet (Feb 2026).
- **Natural farming**: **BPKP** (Bhartiya Prakritik Krishi Paddhati, a PKVY sub-scheme) has been scaled up into **NMNF** (see the missions table). Key inputs: **Jeevamrit, Beejamrit, Ghanjeevamrit, mulching (Acchadana), Whapasa**. Promoted by **Subhash Palekar** (ZBNF).
- **Fertiliser policy**: **One Nation One Fertiliser – "Bharat" brand** (Oct 2022); **PM-KSK** (Kisan Samriddhi Kendras); **Nano Urea** (IFFCO, 2021) and **Nano DAP** (2023); **NBS** for P&K fertilisers since **2010**.

UPDATED 2025-26

NBS subsidy: **Rabi 2025-26 – ₹37,952.29 cr** (per kg: **N ₹43.02, P ₹47.96, K ₹2.38, S ₹2.87**); **Kharif 2026 (1 Apr–30 Sep 2026) – ₹41,533.81 cr**. **Fertiliser subsidy, Budget 2026-27: ₹1,70,944 cr**. **National Investment Policy for Urea – 2026** approved 15 Jul 2026.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- How many parameters does a Soil Health Card analyse? → 12.
- Assistance under PKVY? → ₹31,500/ha over 3 years.
- First fully organic state? → Sikkim (2016).
- PM-PRANAM gives states what share of subsidy saved? → 50%.

2.8 Irrigation & Farm Energy: PMKSY, PM-KUSUM ★★☆

- **PMKSY** (**1 Jul 2015**), motto **"Har Khet Ko Pani"**. Components:
  - **AIBP** – fast-tracking major/medium irrigation projects;
  - **HKKP** – Har Khet Ko Pani (command area development, water bodies);
  - **Watershed Development** (MoRD/DoLR);
  - **Per Drop More Crop (PDMC)** – micro-irrigation; **under PM-RKVY since 2022-23**.
- **PDMC subsidy**: **55% for small/marginal farmers**, **45% for others** (up to 5 ha). Micro-irrigation coverage ≈ **115 lakh ha** (Jul 2026). The cap on water-conservation spending (20%/40%) has been removed.
- **Micro Irrigation Fund** – **₹5,000 cr** with **NABARD** (2018-19); interest subvention to states.
- **Gross irrigated area** = **55.8%** of GCA (2022-23), up from 41.7% (2001-02).
- **PM-KUSUM** (**MNRE, 2019**):
  - **Component A** – 10,000 MW decentralised solar plants (0.5–2 MW) on barren land;
  - **Component B** – **standalone solar pumps** (≤ 7.5 HP; **30% CFA + 30% state + 40% farmer**);
  - **Component C** – solarisation of grid-connected pumps / feeder-level solarisation.
- KUSUM status: extended to **31 Mar 2026**; project deadlines run to **30 Sep 2026 (B & C**

individual) and **31 Mar 2027 (A & feeder)**. The minister said **KUSUM-1 is closed** and **KUSUM 2.0** (with **10 GW agrivoltaics**) is coming – not yet approved. Progress: **11.69 lakh** standalone pumps (Jul 2026).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Motto of PMKSY? → Har Khet Ko Pani.
- PDMC subsidy for small/marginal farmers? → 55%.
- PM-KUSUM is implemented by which ministry? → MNRE.
- Micro Irrigation Fund is operated with? → NABARD (₹5,000 cr).

2.9 Digital & AI Agriculture (Hot Topic) ★★★

- **AgriStack** (DPI for agriculture; under the Digital Agriculture Mission): **Farmer Registry (Farmer ID / Kisan Pehchaan Patra)**, **Geo-referenced village maps**, **Crop Sown Registry** via the **Digital Crop Survey (DCS)**.
  - **Farmer IDs: > 10.31 crore** (3 Aug 2026; 9.20 crore in Mar 2026).
  - DCS, Rabi 2025-26: **648 districts, > 31.3 crore plots**.
- **Krishi DSS** (decision support system, geospatial – launched Aug 2024); **Soil Profile Maps** (1:10,000 scale).
- **Bharat-VISTAAR** (**Virtually Integrated System to Access Agricultural Resources**): announced in **Budget 2026-27** (₹150 cr); launched **17 Feb 2026, Jaipur**.
  - Multilingual **AI advisory** that combines **AgriStack + ICAR package of practices**: crop advice, mandi prices, weather, schemes – over a single phone call.
- **Kisan e-Mitra**: AI chatbot for **PM-KISAN** queries (2023); **11 languages**, voice-enabled; **> 95 lakh** queries answered (Mar 2026).
- **National Pest Surveillance System (NPSS)**: AI/ML pest detection from farmers' phone photos (launched **Aug 2024**).
- AI analytics on **satellite + weather + field photos** to assess the health of rice and wheat crops (**CROPIC**, YES-TECH).
- **Namo Drone Didi** (Cabinet **29 Nov 2023**): **₹1,261 cr** (2024-25 to 2025-26); **15,000 drones** to women SHGs; **80% of cost up to ₹8 lakh** from the Centre, balance via an AIF loan (3% subvention). **~500 drones** supplied under the scheme by Feb 2026.
- **Krishi Sakhi Convergence Programme** (MoA&FW + MoRD; **Jun 2024**: 30,000 Krishi Sakhis certified) – para-extension workers; part of **Lakhpati Didi**.
- **Kisan Rin Portal** (2023) – KCC & interest subvention data; **Kisan Call Centre 1800-180-1551**.
- **Kisan Drone** – drones for spraying; **SMAM** gives subsidies for drones (up to 100% for ICAR/KVKs for demonstrations).

MEMORY TRICK

AgriStack "**3 registries**" = **F-G-C** → **F**armer ID, **G**eo-referenced maps, **C**rop sown (DCS).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Bharat-VISTAAR was announced in? → Union Budget 2026-27.
- Kisan e-Mitra answers queries about? → PM-KISAN.
- Maximum central assistance per drone under Namo Drone Didi? → 80%, up to ₹8 lakh.
- Unique ID given to farmers under AgriStack? → Farmer ID (Kisan Pehchaan Patra).

2.10 Union Budget 2026-27 & 2025-26 (Agriculture) ★★★

UPDATED 2025-26

Union Budget 2026-27 (presented **1 Feb 2026**) – agriculture highlights

- **Allocation**: Dept of Agriculture & Farmers Welfare ≈ **₹1.31–1.33 lakh cr**; **DARE/ICAR ₹9,967 cr**; Ministry of Agriculture total **₹1,40,529 cr**; **DAHD ≈ ₹6,153 cr (+21%)**; **Fisheries ≈ ₹2,700–2,760 cr**; **fertiliser subsidy ₹1,70,944 cr**.
- **Scheme-wise BE 2026-27**: PM-KISAN **₹63,500 cr**; **MISS (KCC interest subvention) ₹22,600 cr**; PMFBY **₹12,200 cr**; Krishonnati ₹11,200 cr; PM-RKVY ₹8,550 cr; PM-AASHA ₹7,200 cr; AIF ₹910 cr; Namo Drone Didi ₹677 cr; FPOs ₹500 cr.
- **Bharat-VISTAAR** – AI advisory tool (see the digital topic).

- **High-value agriculture – ₹350 cr**: coconut, sandalwood, cocoa, cashew (coastal areas); **agar** (North-East); **almonds, walnuts, pine nuts** (hills).
- **Coconut Promotion Scheme** – replant old/unproductive palms; India is the **world's largest coconut producer** (~3 crore dependents).
- **Cashew & cocoa programme** – self-reliance; **premium global brands by 2030**. **Sandalwood** – Centre–state partnership.
- **Fisheries**: integrated development of **500 reservoirs & Amrit Sarovars**; fish caught by Indian vessels in the **EEZ/high seas duty-free**; duty-free inputs for seafood processing raised **1% → 3%** of export FOB.
- **Animal husbandry**: livestock ≈ **16% of farm income**; capital subsidy to add **20,000+ veterinary professionals** (private vet colleges, hospitals, labs).
- **Cooperatives**: tax deduction extended to **cattle feed and cotton seed** supplied by members; inter-cooperative dividend relief.
- **SHE-Marts** (community retail for women SHGs) and a **National Fibre Scheme** (silk, wool, jute).

UPDATED 2025-26

Budget 2025-26 announcements still asked: **PM Dhan-Dhaanya Krishi Yojana**; **Pulses Mission (tur, urad, masoor)**; **Mission for Cotton Productivity**; **National Mission on High-Yielding Seeds**; **Makhana Board (Bihar)**; programme for vegetables & fruits; **KCC (MISS) limit raised ₹3 lakh → ₹5 lakh** (7.7 crore KCC holders); **urea plant at Namrup (Assam, 12.7 LMT)**; **2nd Gene Bank** (10 lakh germplasm lines); **Western Koshi Canal** (Bihar, 50,000 ha); NIFTEM in Bihar.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Bharat-VISTAAR was announced in which Budget? → 2026-27.
- KCC loan limit under the modified interest subvention scheme (Budget 2025-26)? → ₹5 lakh.
- Makhana Board is set up in? → Bihar.
- Allocation for PM-KISAN in BE 2026-27? → ₹63,500 cr.

2.11 Economic Survey 2025-26 (Agriculture) ★★★

- Tabled **29 Jan 2026**.
- **Growth**: agriculture & allied grew about **4.4% a year (5-yr average)**; decadal growth **FY16–FY25 = 4.45%**, the best of any decade; **2024-25: 4.6%**.
- **Sub-sectors (FY16–FY25)**: **fisheries 8.8%**, **livestock 7.1%**, **crops 3.5%** → allied sectors drive growth.
- Agriculture & allied ≈ **one-fifth of national income** (current prices); employs ~**46%** of the workforce (PLFS).
- **Horticulture ≈ 33% of agri GVA**; output **367.72 Mt (2024-25)** – more than foodgrains.
- **Irrigation**: gross irrigated area **55.8% of GCA (2022-23)**.
- **Edible-oil import dependence** fell from **63.2% to 56.25%**.
- **Recommendations**: productivity and resource sustainability, more R&D, climate resilience, private investment in infrastructure and food processing, and growth in horticulture, dairy, poultry and fisheries. Use precision tools (sensors, drones, GIS, AI). Yields of maize, soybean and pulses are below world averages.
- **Later data**: MoSPI's provisional estimates (5 Jun 2026, **new base year 2022-23**) put **agriculture GVA growth at 3.0% in 2025-26** (4.2% in 2024-25).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Fastest-growing agri sub-sector? → Fisheries (8.8%).
- Gross irrigated area as % of GCA? → ~55.8%.
- New base year of national accounts (2026)? → 2022-23.

2.12 Agri Current Affairs (Oct 2025 – Oct 2026) ★★★

UPDATED 2025-26

Production records (latest official estimates)

Item	Latest figure	Year / estimate
Foodgrains	**376.56 Mt**	2025-26, 3rd AE
Horticulture	**377.78 Mt** (fruits ~121.5, vegetables ~221 Mt)	2025-26, 2nd AE

Item	Latest figure	Year / estimate
Milk	**247.87 Mt**; **485 g/person/day**; ~25% of world output	2024-25 (BAHS 2025)
Eggs	**149.11 billion**; 106 eggs/person/yr	2024-25
Meat	**10.50 Mt**	2024-25
Fish	**197.75 lakh t** (~2× of 2013-14)	2024-25
Agri exports	**US$ 52.55 bn** (record)	2025-26
Seafood exports	**~US$ 8.46 bn**	2025-26

- **Top states**: **milk** – UP > Rajasthan > MP > Gujarat; **eggs** – Andhra Pradesh; **wool** – Rajasthan (~48%); **fish** – Andhra Pradesh.
- **Sugarcane FRP 2026-27: ₹365/q** (approved 5 May 2026; at 10.25% recovery).
- **MSP**: Kharif 2026-27 paddy **₹2,441**; Rabi 2027-28 wheat **₹2,610** (see Agronomy 1.16).
- **GST reform (effective 22 Sep 2025)** – two slabs (**5% and 18%**). Cut to **5%**: **tractors (12→5%)**, tractor tyres/parts (18→5%), **drip & sprinkler systems**, harvesters/threshers, bio-pesticides and micronutrients, composting machines, **ammonia, sulphuric acid, nitric acid** (fertiliser inputs), butter and ghee. **Milk and paneer: nil**.
- **Boards**: **National Turmeric Board** – HQ **Nizamabad (Telangana)**, launched **14 Jan 2025**, first chairperson **Palle Ganga Reddy**. **National Makhana Board** – launched by the PM at **Purnea, Bihar (15 Sep 2025)**; Bihar grows **~90%** of India's makhana.
- **Trade deals touching agriculture**:
  - **India–EFTA TEPA** in force **1 Oct 2025**.
  - **India–UK CETA** in force **15 Jul 2026** (most farm exports duty-free; dairy, cereals and pulses protected).
  - **India–Oman CEPA** signed 18 Dec 2025.
  - **India–New Zealand FTA** concluded 22 Dec 2025 (dairy excluded).
  - **India–EU FTA** concluded **27 Jan 2026** (dairy, cereals, poultry excluded).
  - **India–US interim framework** (2 Feb 2026): US tariff **50% → 18%**; no concessions on rice, wheat, dairy, poultry, maize, millets.
- **Bills**: draft **Seeds Bill 2025** and draft **Pesticides Management Bill 2025** released for comments.
- **Campaigns**: **Viksit Krishi Sankalp Abhiyan** – Kharif 2025 edition (29 May–12 Jun 2025, launched from **Puri**) reached **1.42 lakh villages, 1.34 crore farmers**; Rabi edition from **3 Oct 2025**. "Lab to Land" with KVKs and ICAR scientists.
- **International Years**: **2025 – Cooperatives**; **2026 – Woman Farmer** (UNGA A/RES/78/279) and **2026 – Rangelands & Pastoralists** (FAO lead); 2023 – Millets (proposed by India).
- **Appointments**: Agriculture Secretary **Atish Chandra** (from 28 Feb 2026); ICAR DG & Secretary DARE **Dr M.L. Jat** (Apr 2025); Agriculture Minister **Shivraj Singh Chouhan**; NABARD Chairman **Shaji K.V.**
- **Awards**: **World Food Prize 2025 – Dr Mariangela Hungria (Brazil)** for biological nitrogen fixation in soybean; **2026 – Huub Lelieveld (Netherlands)** for food safety.
- **Days**: **World Food Day (16 Oct)** – 2026 theme "**Innovate today. Nourish tomorrow.**"; 2025 – "Hand in Hand for Better Foods and a Better Future". **World Soil Day (5 Dec)** – 2025 theme "**Healthy Soils for Healthy Cities**". **National Milk Day – 26 Nov** (Kurien's birthday). **Kisan Diwas – 23 Dec** (Charan Singh). **World Pulses Day – 10 Feb**. **World Bee Day – 20 May**. **ICAR Foundation Day – 16 Jul**.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Headquarters of the National Turmeric Board? → Nizamabad, Telangana.
- GST on tractors after Sept 2025? → 5%.
- 2026 is the International Year of? → the Woman Farmer (also Rangelands & Pastoralists).
- Milk production 2024-25? → 247.87 Mt (per-capita 485 g/day).
- World Food Prize 2025 winner? → Mariangela Hungria.

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3. Agri Finance & Banking

NOTE

AFO officers are bank officers, so this chapter is directly linked to the job and to interview questions. Must-know areas: **PSL targets, KCC, NABARD funds, RRBs, NPA norms for agri loans, financial-inclusion schemes**.

3.1 Rural Credit Structure & History ★★★

- **Institutional sources**: (1) **Cooperatives**, (2) **Commercial banks (SCBs)**, (3) **RRBs**, (4) **SFBs / MFIs / NBFCs**. **NABARD** is the apex development bank.
- **Cooperative credit**:
  - **Short-term (3-tier)**: **StCB** (state) → **DCCB** (district) → **PACS** (village).
  - **Long-term (2-tier)**: **SCARDB** → **PCARDB** (agri & rural development banks).

Year	Milestone
1904	Cooperative Credit Societies Act (first credit societies)
1935	RBI set up; **Agricultural Credit Department (ACD)**
1951–54	**All India Rural Credit Survey** (A.D. Gorwala): "cooperation has failed, but it must succeed"
1969	Nationalisation of **14 banks** (19 Jul); **Lead Bank Scheme** (Gadgil Study Group; Nariman Committee)
1975	**RRBs** (2 Oct 1975, ordinance; **RRB Act 1976**) – **Narasimham Working Group**
1980	Nationalisation of 6 more banks
1982	**NABARD** (12 Jul 1982) – **CRAFICARD / B. Sivaraman Committee**
1992	**SHG–Bank Linkage Programme** (NABARD pilot, 500 SHGs)
1998	**Kisan Credit Card** (**R.V. Gupta Committee**)
2006	**Interest subvention** on crop loans begins; JLG scheme (NABARD)
2014	**PMJDY** (28 Aug 2014)
2025	**One State One RRB** – RRBs cut **43 → 28** (1 May 2025)

- **Committees to remember**: **Khusro** (agri credit review, 1989); **Vyas** (agri credit, 2004); **Vaidyanathan** (cooperative revival, 2004); **Rangarajan** (financial inclusion, 2008); **M.V. Nair** (PSL revision, 2012); **Nachiket Mor** (financial services for small businesses & low-income households, 2014).

MEMORY TRICK

Credit history "**04-35-69-75-82-92-98**" → Coop Act → RBI → Nationalisation/Lead Bank → RRB → NABARD → SHG-BLP → KCC.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- NABARD was set up on the recommendation of? → CRAFICARD (B. Sivaraman).
- RRBs were set up on the recommendation of? → Narasimham Working Group (1975).
- KCC was introduced on the recommendation of? → R.V. Gupta Committee (1998).
- Lead Bank Scheme started in? → 1969.

3.2 Priority Sector Lending (RBI Directions 2025) ★★★

- **RBI PSL Master Directions** issued **24 Mar 2025**, effective **1 Apr 2025**. 2026 amendments did **not** change agri targets.
- Targets are a % of **ANBC (Adjusted Net Bank Credit)** or **CEOBE** (Credit Equivalent of Off-Balance-Sheet Exposure), **whichever is higher**.

Target	Domestic SCBs / foreign banks ≥ 20 branches	RRBs	SFBs	UCBs
Total PSL	**40%**	**75%**	**60%**	**60%**
Agriculture	**18%**	18%	18%	–
Non-corporate farmers (within agri)	**14%**	14%	14%	–
Small & marginal farmers (within 14%)	**10%**	10%	10%	–
Micro enterprises	**7.5%**	7.5%	7.5%	7.5%
Weaker sections	**12%**	**15%**	12%	12%

- **Agriculture = 3 sub-categories**: **Farm credit** (crop loans, investment credit); **Agriculture infrastructure**; **Ancillary activities**.
- **Key loan limits (2025 directions)**:

Loan type	PSL ceiling
Agri infrastructure	**₹100 crore** per borrower
Food & agro-processing (ancillary)	**₹100 crore** per borrower
Agri start-ups	Up to **₹50 crore**
FPOs / FPCs / cooperatives of farmers	**₹4 crore** per entity (earlier ₹2 cr)
FPOs with assured marketing	**₹10 crore** (earlier ₹5 cr)

Loan type	PSL ceiling
Pledge loans against **e-NWR / NWR**	**₹90 lakh** per farmer; ₹60 lakh against other warehouse receipts
Bank loans to NBFCs for on-lending to agriculture	**₹10 lakh** per borrower

- **Small farmer**: **1–2 ha**; **marginal farmer**: **< 1 ha**. Landless labourers, tenant farmers, oral lessees and sharecroppers with small holdings also count as SMF.
- **PSLCs** (Priority Sector Lending Certificates): 4 types – **Agriculture, SF/MF, Micro Enterprises, General**; traded on **e-Kuber (RBI)**; lot size **₹25 lakh**; all expire on **31 March**.
- **Shortfall** → banks must deposit it in **RIDF (NABARD)** and other funds (SIDBI, NHB, MUDRA) at low interest: shortfall < 5 pts → **Bank Rate – 2%**; 5–10 pts → BR – 3%; ≥ 10 pts → BR – 4%.

MEMORY TRICK

"**40-18-14-10-7.5-12**" → total PSL 40 → agri 18 → non-corporate farmers 14 → SMF 10 → micro 7.5 → weaker sections 12.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Agriculture PSL target for domestic SCBs? → 18% of ANBC or CEOBE, whichever is higher.
- Sub-target for small & marginal farmers? → 10%.
- PSL target for RRBs? → 75%.
- PSL limit for loans to FPOs (2025)? → ₹4 crore (₹10 crore with assured marketing).
- Where do banks deposit a PSL shortfall? → RIDF (NABARD) and other funds.

3.3 Kisan Credit Card (KCC) ★★★

- **Introduced 1998** (NABARD model scheme; R.V. Gupta Committee). Revised in 2004 (investment credit) and **2012 (T.M. Bhasin Working Group)**: **ATM-enabled RuPay debit card**; extended to **animal husbandry & fisheries in 2018-19**.
- **Eligibility**: owner-cultivators, tenant farmers, oral lessees, sharecroppers, **SHGs/JLGs** of farmers; fishers and livestock farmers.
- **Limit calculation (first year)**: (**Scale of finance × area**) + **10%** for post-harvest/household consumption + **20%** for repairs/maintenance of farm assets + crop insurance/asset insurance premium. Then **+10% every year** for cost escalation.
- **Scale of finance** is fixed by the **District Level Technical Committee (DLTC)**; the State Level Technical Committee (SLTC) harmonises it.
- **Validity**: **5 years** (becoming **6 years** under the new RBI Directions – see box).
- **Interest (MISS – Modified Interest Subvention Scheme)**:
  - Farmers get short-term crop loans up to **₹3 lakh at 7%**.
  - Banks get **1.5% interest subvention**.
  - **3% Prompt Repayment Incentive (PRI)** → **effective rate 4%**.
  - For animal husbandry/fisheries, the limit within the ₹3 lakh is **₹2 lakh**.
  - MISS continued for **FY 2025-26** (Cabinet, 28 May 2025). BE 2026-27 **₹22,600 cr**.
  - **Budget 2025-26** announced raising the MISS limit to **₹5 lakh**; the Cabinet approval of May 2025 still uses ₹3 lakh.
- **Collateral-free agri loans**: raised **₹1.6 lakh → ₹2 lakh** from **1 Jan 2025** (RBI); up to **₹3 lakh** with a tie-up for recovery.
- **Coverage**: **> 7.7 crore operative KCC accounts**; outstanding ≈ **₹10 lakh crore**.
- **Repayment**: crop loans per the crop season (harvest + marketing period); short-term loans repaid within **12 months**.
- **Kisan Rin Portal** (2023) – digital claims for interest subvention; **e-KCC** (NABARD) is linked with **ULI** (Unified Lending Interface, RBI).

UPDATED 2025-26

RBI revised KCC Directions, 2026: draft **12 Feb 2026** → final **19 Jun 2026**, effective **1 Jan 2027** (postponed from 1 Jul 2026).

- **KCC validity: 6 years** (was 5).
- **Crop season**: 12 months for short-duration crops, 18 months for long-duration crops.
- Soil testing, weather advisories and certification costs fit within the **20%** repairs/maintenance component.
- **Flexi KCC** covers allied activities.

MEMORY TRICK

KCC formula "**SoF + 10 + 20 + Ins**" → Scale of Finance × area, +10% consumption, +20% repairs, + insurance; then +10% a year.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Effective interest rate on KCC crop loans for prompt repayers? → 4% (7% – 3% PRI).
- Interest subvention to banks under MISS? → 1.5%.
- Collateral-free agri loan limit from 1 Jan 2025? → ₹2 lakh.
- Who fixes the scale of finance? → District Level Technical Committee (DLTC).
- KCC validity under the 2026 RBI Directions? → 6 years.

3.4 NABARD ★★★

- **Established 12 Jul 1982** under the **NABARD Act 1981**, recommended by **CRAFICARD (B. Sivaraman)**. Took over ACD and RPCC of RBI and ARDC.
- **Initial capital ₹100 cr**; now **100% owned by the Government of India** (RBI's stake transferred). **Authorised capital ₹30,000 cr** (2017 amendment). HQ: **Mumbai**. Chairman: **Shaji K.V.**
- **Roles**: **Financing** (refinance, direct lending), **Development** (SHG-BLP, FPOs, watersheds, tribal development), **Supervision** (**RRBs, StCBs, DCCBs** – on-site inspection; UCBs by RBI).
- **Financials**: balance sheet **₹10.95 lakh cr (FY26)** – first time above ₹10 lakh cr; net profit **₹7,168 cr**; **CRAR 30.59%**; gross NPA **0.21%**. FY25: ₹9.85 lakh cr; profit ₹7,628 cr.
- **Refinance**:
  - **ST-SAO** (short-term seasonal agricultural operations) to StCBs and RRBs;
  - **LTRF** – long-term refinance for investment credit;
  - **STCRC** fund – Short-Term Cooperative Rural Credit refinance.
- **Funds managed by NABARD**:

Fund	Year	Purpose / key facts
RIDF (Rural Infrastructure Development Fund)	**1995 -96**	From banks' PSL shortfall; loans to states for rural roads, bridges, irrigation, etc. **Tranche XXX (2024-25): ₹35,000 cr**; XXXI (2025-26), XXXII (2026-27)
LTIF (Long Term Irrigation Fund)	**2016 -17**	Completing **99 AIBP irrigation projects** (PMKSY)
MIF (Micro Irrigation Fund)	**2019 -20**	**₹5,000 cr + ₹5,000 cr**; 2% subvention to states
FIDF (Fisheries & Aquaculture Infra)	**2018 -19**	₹7,522 cr; **3% interest subvention**; lending rate ≥ 5%
AHIDF (DIDF merged)	2020	Dairy, meat, feed infrastructure; **3% subvention**
NIDA	2011	Direct loans to state-owned institutions for infrastructure
WIF / FPF	2013 / 2014	Warehouse Infrastructure Fund; Food Processing Fund (now small)
PODF / PRODUCE Fund	2014 -15	FPO promotion (₹200 cr PRODUCE Fund)

- **Subsidiaries**: **NABKISAN** (finance to FPOs), **NABSAMRUDDHI** (non-farm), **NABFINS** (microfinance), **NABCONS** (consultancy), **NABVENTURES** (VC fund), **NABFOUNDATION**, **NABSanrakshan** (credit guarantee trustee – FPO guarantee fund).
- **NAFIS 2021-22** (NABARD All-India Rural Financial Inclusion Survey, **released 10 Oct 2024**):
  - average monthly income of **agricultural households ₹13,661** (all rural households ₹12,698; 2016-17: ₹8,059);
  - **44%** of agri households hold a valid **KCC**;
  - financial literacy **51.3%**;
  - **80.3%** of households have insurance.
- **NABARD's 45th Foundation Day**: **Jul 2026** (Dehradun).

MEMORY TRICK

NABARD funds by year "**RIDF-95, LTIF-16, FIDF-18, MIF-19, AHIDF-20**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- NABARD was established on? → 12 July 1982.
- RIDF was created in? → 1995-96 (from PSL shortfall of banks).
- NABARD supervises which banks? → RRBs, StCBs and DCCBs.
- Average monthly income of agricultural households (NAFIS 2021-22)? → ₹13,661.
- Which NABARD subsidiary is a credit-guarantee trustee for FPOs? → NABSanrakshan.

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3.5 Regional Rural Banks (RRBs) ★★★

- Set up **2 Oct 1975** (ordinance); **RRB Act 1976**; recommended by the **Narasimham Working Group (1975)**. First RRB: **Prathama Grameen Bank, Moradabad (UP)** (sponsor: Syndicate Bank).
- **Shareholding**: **Centre 50%**, **sponsor bank 35%**, **state 15%**. Regulated by **RBI**, supervised by **NABARD**.
- **PSL target 75%** of ANBC.
- **Amalgamation**: 196 → 82 → 56 → 43 → **28** (**"One State One RRB"**, effective **1 May 2025**). 26 RRBs in 10 states + 1 UT were merged; each RRB has authorised capital of **₹2,000 cr**.
- **FY 2025-26 performance**: **record net profit ₹10,176 cr**; total business **> ₹13.5 lakh cr**; **GNPA 5.3%**, NNPA 2.1%; CD ratio 75.2%; **22,273 branches**.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Shareholding pattern of RRBs? → GoI 50 : Sponsor bank 35 : State 15.
- Number of RRBs after One State One RRB? → 28 (from 1 May 2025).
- First RRB? → Prathama Grameen Bank (2 Oct 1975).

3.6 Agri Credit Flow, Loan Appraisal & NPA Norms ★★★

- **Ground-level agri credit**: **2024-25 target ₹27.5 lakh cr – achieved ≈ ₹28.7 lakh cr**; **2025-26 target ₹32.5 lakh cr**. It was **₹7.3 lakh cr in 2013-14** (more than 4× growth).
- **Types of agri loans**:
  - **Short-term (crop loans)** – up to 12/18 months;
  - **Medium-term** – 15 months to 5 years (pump sets, livestock);
  - **Long-term** – > 5 years (land development, orchards, tractors, plantations).
- **Appraisal terms**:
  - **Unit cost** – set by NABARD/SLTC for an investment;
  - **Margin money** – borrower's share (usually **10–25%**; nil for loans ≤ ₹2 lakh / collateral-free limit);
  - **DSCR** (Debt Service Coverage Ratio) = (net surplus + interest + depreciation) ÷ (principal + interest) – should be **≥ 1.5** for agri term loans;
  - **IRR, BCR (Benefit-Cost Ratio > 1), NPV, Payback period**;
  - **3 R's of credit**: **Returns, Repayment capacity, Risk-bearing ability**; **3 C's**: Character, Capacity, Capital.
- **Repayment schedule**: matched to the crop season / income flow; **moratorium (gestation period)** for orchards and plantations (e.g. mango 5–7 yrs).
- **Security**: up to **₹2 lakh – no collateral** (hypothecation of crops/assets only); above that – mortgage of land.
- **NPA norms for agri loans (RBI IRAC)**:
  - **Short-duration crops**: NPA if principal/interest is overdue for **2 crop seasons**;
  - **Long-duration crops**: overdue for **1 crop season**.
  - "Long-duration" = crop season **> 1 year**. Crop season is defined by the **SLBC** for each crop.
  - Other loans: **90 days** overdue.
- **NPA classes**: **Sub-standard** (NPA ≤ 12 months) → **Doubtful** (> 12 months; D1/D2/D3) → **Loss**.
- **Relief for natural calamities (RBI)**: restructuring if crop loss is **≥ 33%**; moratorium of at least 1 year; restructured loans keep their asset classification.
- **Kisan Credit Card insurance**: crop loans are covered by **PMFBY** (voluntary since 2020).

MEMORY TRICK

NPA crop rule – "**Short = Two, Long = One**": short-duration crop → 2 seasons overdue; long-duration crop → 1 season.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- When does a crop loan for a short-duration crop become NPA? → When overdue for 2 crop seasons.
- Desirable DSCR for agri term loans? → 1.5 or above.
- Who decides the crop season for NPA classification? → State Level Bankers' Committee (SLBC).
- Agri credit target for 2025-26? → ₹32.5 lakh crore.

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3.7 Financial Inclusion: PMJDY & Social Security ★★★

- **PMJDY** (Pradhan Mantri Jan Dhan Yojana): launched **28 Aug 2014** (announced 15 Aug 2014). National Mission for Financial Inclusion.
  - **Zero-balance BSBD account**; **RuPay debit card** with **₹2 lakh accident insurance** (accounts opened after 28 Aug 2018; ₹1 lakh earlier).
  - **Overdraft up to ₹10,000** (raised from ₹5,000 in 2018); OD age limit **18–65 years**.
  - DBT channel → JAM trinity (**Jan Dhan–Aadhaar–Mobile**).
  - **12 years (19 Aug 2026)**: **> 59 crore accounts**; deposits **₹3.17 lakh cr** (avg ₹5,356/account); **~56% women**; **~78% rural/semi-urban**; **41.29 crore RuPay cards**.

Scheme	Year	Premium / contribution	Benefit	Age
PMJJBY (life)	2015	**₹436/yr**	**₹2 lakh** on death (any cause)	**18–50**
PMSBY (accident)	2015	**₹20/yr**	**₹2 lakh** death/full disability; ₹1 lakh partial	**18–70**
APY (pension)	2015	Age-based monthly contribution	**₹1,000–5,000/month** pension at 60	**18–40**
PM-KMY (farmers)	2019	₹55–200/month (matched by GoI)	₹3,000/month at 60	18–40

- **Enrolment (Apr 2026)**: PMJJBY **27.43 crore**; PMSBY **58.09 crore**; APY **9.04 crore** (~49% women). Income-tax payers cannot join APY (from 1 Oct 2022).
- **SHG–Bank Linkage**:
  - **144 lakh SHGs** savings-linked (₹65,089 cr savings);
  - loans outstanding **₹2.6 lakh cr** to 77 lakh SHGs (Mar 2024);
  - FY25 disbursal ≈ **₹2.08 lakh cr** to 55.6 lakh SHGs.
  - SHG = **10–20 members**; **JLG = 4–10 members** (tenant farmers, oral lessees).
- **DAY-NRLM** (Aajeevika, **2011**): women SHGs get loans at **7%**, plus **3% more subvention** for prompt repayment (in 250 districts). **Lakhpati Didi** target **3 crore**.
- **Microfinance (RBI 2022 framework)**: household income ceiling **₹3 lakh** (rural and urban); loan repayment ≤ **50% of monthly household income**; collateral-free.
- **Business Correspondents (BCs)** – banking at the doorstep (2006); **Payments Banks** (deposit ≤ ₹2 lakh, no loans); **SFBs** (75% PSL earlier; now 60%).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Overdraft limit under PMJDY? → ₹10,000.
- Premium of PMJJBY and PMSBY? → ₹436 and ₹20 a year.
- Maximum age to join APY? → 40.
- Members in a JLG? → 4–10.
- Number of PMJDY accounts (Aug 2026)? → Over 59 crore.

3.8 Warehouse Receipts, Credit Guarantees & Digital Lending ★★☆

- **WDRA** (Warehousing Development & Regulatory Authority) – under the **Warehousing (Development & Regulation) Act 2007**, set up **2010**; **negotiable warehouse receipts (NWR)**; **e-NWR** (2017) through repositories (NERL, CCRL).
- **Credit Guarantee Scheme for e-NWR-based pledge financing (CGS-NPF)** – launched **16 Dec 2024**; corpus **₹1,000 cr**:
  - covers agri loans up to **₹75 lakh** (non-agri up to ₹2 cr);
  - guarantee **85%** (loans ≤ ₹3 lakh for SMF/women/SC/ST/PwD), **80%** (₹3–75 lakh), **75%** (others);
  - fee **0.4%** for farmers.
- **Credit Guarantee Fund for FPOs**: corpus **₹1,000 cr**, managed by **NABSanrakshan** (also NCDC); **85%** cover for loans ≤ ₹1 cr; **75%** above, up to ₹2 cr.
- **CGTMSE** (SIDBI + GoI, **2000**): collateral-free guarantee for MSEs; covers **AIF** loans (fee paid by GoI).
- **ULI – Unified Lending Interface** (RBI, pilot 2023, launched **Aug 2024**): "UPI for credit"; plug-and-play access to land records, satellite data and Aadhaar e-KYC for KCC and dairy loans. **64 lenders, 136+ data services** (Dec 2025).

- **PACS computerisation** (2022): **₹2,925.39 cr**; **73,492 PACS**; common ERP; model byelaws let PACS do **25+ businesses** (CSC, LPG, petrol pumps, Jan Aushadhi, PM-KSK).
- **Credit-linked subsidy schemes (bank-financed)**:
  - **AIF** (3% subvention);
  - **AHIDF** (3%);
  - **FIDF** (3%);
  - **PMFME** (MoFPI, 2020) – **35% credit-linked subsidy**, max **₹10 lakh** per micro food unit;
  - **PMEGP** (KVIC) – 15–35% subsidy;
  - **NLM** entrepreneurship – **50% capital subsidy** (poultry, sheep, goat, pig, fodder).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- e-NWR is regulated by? → WDRA.
- Credit-linked subsidy under PMFME? → 35%, up to ₹10 lakh.
- ULI was launched by? → RBI (called "UPI for credit").

3.9 RBI Policy & Agri-Finance Current Affairs (2025–26) ★★★

UPDATED 2025-26

RBI monetary policy (63rd MPC, 7 Oct 2026): **repo rate raised 25 bps to 5.50%**; stance changed to "**calibrated tightening**". **SDF 5.25%**; **MSF & Bank Rate 5.75%**. Governor: **Sanjay Malhotra**.

- **Revised KCC Directions** (final 19 Jun 2026; effective **1 Jan 2027**): **6-year KCC**; 12/18-month crop seasons; Flexi KCC.
- **PSL Directions 2025** in force from **1 Apr 2025**; FPO limits raised (₹4 cr / ₹10 cr).
- **One State One RRB**: 28 RRBs from **1 May 2025**; RRBs' record profit **₹10,176 cr (FY26)**.
- **NABARD** balance sheet crosses **₹10 lakh cr (FY26)**; **45th Foundation Day (Jul 2026)**.
- **PMJDY completes 12 years** (Aug 2026) – **59 crore+ accounts**.
- **Collateral-free agri loan limit ₹2 lakh** (from 1 Jan 2025).
- **Budget 2026-27**: MISS **₹22,600 cr**; credit-linked subsidy for livestock; **High Level Committee on Banking for Viksit Bharat**; tax relief for cooperatives.
- **Agri credit**: 2025-26 target **₹32.5 lakh cr**; KCC outstanding ≈ **₹10.2 lakh cr** (7.7 crore accounts).
- **RBI Governor** Sanjay Malhotra (from **11 Dec 2024**); **NABARD Chairman** Shaji K.V.; **Finance Minister** Nirmala Sitharaman.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Current repo rate (Oct 2026)? → 5.50%.
- Effective date of the revised KCC Directions? → 1 Jan 2027.
- Record net profit of RRBs in FY 2025-26? → ₹10,176 crore.

Nandyal Banking Coaching Center

4. Soil Science

> **NOTE**
> Soil Science gives sure marks: the **fertiliser nutrient %**, **problem soils**, **deficiency symptoms**, **biofertilisers** and **soil test methods** tables below cover most questions.

4.1 Soil Formation, Profile & Classification ★★☆

- **Soil** – from Latin *solum* (floor). **Pedology** (origin, classification) – father **V.V. Dokuchaev**; **Edaphology** (soil as a medium for plants).
- **Rocks**: igneous (granite, basalt), sedimentary (limestone, sandstone, shale), metamorphic (**granite → gneiss; limestone → marble; sandstone → quartzite; shale → slate**).
- **Earth's crust**: O (~47%) > Si (~28%) > Al (~8%) > Fe (~5%). **Feldspars** are the most abundant minerals; **quartz** is the main constituent of sand. Weathering resistance: **quartz > muscovite > feldspar > biotite > calcite**.
- **Factors of soil formation (Jenny, 1941)**: **S = f (Cl, O, R, P, T)** – climate & organisms (**active**); relief, parent material, time (**passive**). Mnemonic **"CLORPT"**.
- **Soil-forming processes**: **podzolisation** (cold humid; Fe/Al move down), **laterisation** (hot humid; silica leached, Fe/Al stay), **calcification** (arid), **salinisation**, **gleization** (waterlogging).
- **Profile**: **O** (organic; absent in arable soils) – **A** (eluvial, zone of leaching) – **E** (maximum eluviation) – **B** (illuvial, accumulation) – **C** (parent material) – **R** (bedrock). **Solum = A + B**; **regolith = A + B + C**.
- **Pedon** = smallest 3-D soil unit (1–10 m²); **polypedon** = group of pedons; **soil series** = basic unit of classification.
- **Soil Taxonomy (USDA)**: **12 orders**. Sequence: **order → suborder → great group → subgroup → family → series**.

Order	Key feature / Indian soil
Entisols	Youngest, no horizons – **alluvial** (new)
Inceptisols	Young, weakly developed – **most extensive in India (~40%)**
Vertisols	Swelling clays, deep cracks – **black cotton soil (regur)**
Alfisols	Medium base status – **red soils**
Ultisols	Low base status, acidic – laterite/red
Oxisols	Most weathered, Fe/Al oxides – **laterite**
Aridisols	Desert soils
Mollisols	Dark, base-rich grassland soils (most fertile)
Histosols	Organic soils (**> 20% OM**) – peat
Spodosols	Podzols (cold humid)
Andisols	Volcanic ash soils
Gelisols	Permafrost soils (newest order, 1998)

- **Area in India**: **Inceptisols > Entisols > Alfisols > Vertisols**.
- **Major Indian soil groups (ICAR: 8)**:

Soil	Area	Features
Alluvial	**~43%** (largest)	Indo-Gangetic plains; **Khadar** (new) / **Bhangar** (old); rich in K, poor in N
Red & yellow	~18%	TN, Karnataka, Odisha; **kaolinite**; red due to **iron oxides**; poor in N, P
Black (regur)	~15%	Deccan trap (Maharashtra, MP, Gujarat); **montmorillonite**; high water holding; self-ploughing; poor in N, P, OM; rich in Ca, Mg
Laterite	~4%	High rainfall – Kerala, Karnataka, Odisha, NE; acidic; **plantation crops, cashew**
Desert, saline-alkaline, peaty, forest/mountain	–	Rajasthan; Punjab/Haryana/UP; **Kerala (Kari soils)**; Himalaya

> **MEMORY TRICK**
> Jenny's factors "**CL-O-R-P-T**" = **Cl**imate, **O**rganisms, **R**elief, **P**arent material, **T**ime.

> **PREVIOUSLY ASKED / LIKELY QUESTIONS**
> - Black cotton soils belong to which order? → Vertisols.
> - Most extensive soil order in India? → Inceptisols.
> - Dominant clay mineral in black soils? → Montmorillonite; in red soils? → Kaolinite.
> - Solum consists of? → A + B horizons.

4.2 Soil Physics: Texture, Structure, Density, Water ★★☆

- **Composition (ideal loam by volume)**: **mineral 45%, OM 5%, water 25%, air 25%**.
- **Particle size (ISSS/International)**: **sand 2–0.02 mm** (coarse 2–0.2, fine 0.2–0.02), **silt 0.02–0.002 mm**, **clay < 0.002 mm (< 2 µm)**. USDA: sand 2–0.05 mm, silt 0.05–0.002 mm.
- **Texture** cannot be changed (permanent property). It is found from the **textural triangle (12 classes)** after mechanical analysis (**hydrometer – Bouyoucos; international pipette method**). **Loam** is ideal. "Heavy" (clay) and "light" (sand) refer to **ease of tillage**, not weight.
- **Structure** = arrangement of particles into aggregates (**peds**). **Crumb/granular** is best for crops; **platy** (puddled/compacted), **prismatic/columnar** (B horizon; columnar in sodic soils), **blocky**.
- **Particle density ≈ 2.65 g/cc**; **bulk density ≈ 1.33 g/cc** (sand 1.6 > clay 1.1). OM and tillage **lower** BD; compaction and puddling raise it.
- **Porosity (%) = (1 – BD/PD) × 100 ≈ 50%**. Clay has more **total** pore space; sand has more **macro** pores.
- **Soil colour**: **Munsell chart** – **Hue, Value, Chroma**. Black = humus/titanomagnetite; red = **haematite (Fe_2O_3)**; yellow = limonite (hydrated Fe oxide).
- **Specific heat**: water 1.0 > OM 0.5 > soil 0.2 cal/g; wet soils warm slowly.
- **Soil water (physical classes)**: gravitational (< 1/3 bar, drains away) → **capillary (1/3–31 bar; available water 1/3–15 bar)** → hygroscopic (> 31 bar, unavailable).
- **Atterberg limits** (plastic & liquid limits) – soil consistency; soils with **> 15% clay** are plastic.
- **Redox potential (Eh)**: well-drained **+400 to +700 mV**; waterlogged **–250 to –350 mV**.
- **Soil erosion**: water – **splash → sheet (most harmful, unnoticed) → rill → gully**; wind – **saltation (50–75%)**, creep, suspension. **Permissible soil loss ≈ 11.2–12.5 t/ha/yr**; India's average loss ≈ **16.4 t/ha/yr**. **USLE A = R K L S C P** (Wischmeier & Smith).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Particle density of mineral soil? → 2.65 g/cc.
- Diameter of clay particles? → < 0.002 mm.
- Soil colour is determined using? → Munsell colour chart.
- Most harmful (unnoticed) form of water erosion? → Sheet erosion.

4.3 Soil Chemistry: Colloids, CEC, pH & Nutrient Availability ★★★

- **Colloids** are < 1 µm in size, carry a **negative charge**, and hold cations. Each particle is a **micelle**.

Clay mineral	Type	Expansion	CEC (cmol/kg)
Kaolinite	**1:1**	Non-expanding	**3–15** (lowest)
Illite	2:1	Non-expanding (K fixes layers)	20–40
Montmorillonite (smectite)	**2:1**	**Expanding**	**80–120**
Vermiculite	2:1	Limited expanding	**100–150** (highest clay)
Chlorite	**2:1:1 (2:2)**	Non-expanding	10–40
Humus	Organic	–	**200–300** (highest of all)

- **CEC** = total exchangeable cations (cmol(p+)/kg = meq/100 g). **Base saturation %** = exchangeable bases ÷ CEC × 100.
- **Cation adsorption strength (lyotropic series)**: **$Al^{3+} > Ca^{2+} > Mg^{2+} > K^{+} = NH_4^{+} > Na^{+}$**. Na is held most weakly (it disperses clay).
- **Isomorphous substitution** (Al^{3+} for Si^{4+}; Mg^{2+} for Al^{3+}) creates the permanent negative charge.
- **pH** (Sørensen, 1909) = $-\log[H^+]$. **A 1-unit change = 10-fold change** in H^+ activity.
- **Most nutrients are available at pH 6.5–7.5**. Fe, Mn, Zn, Cu, Al are high in acid soils. **Mo** availability rises with pH (more available in alkaline soil). **P is most available at pH 6–7** (fixed by Fe/Al in acid soils, by Ca in alkaline soils).
- **Soil buffering** – resistance to pH change (highest in clay- and OM-rich soils).

- **Organic matter**: **OM = OC × 1.724** (**Van Bemmelen factor**); OC by the **Walkley & Black** method. Indian soils are low in OC (**< 0.5%** in most areas).
- **C:N ratio**: soil/humus **~10–12:1**; FYM 20–30:1; straw 80:1; sawdust 400:1. **> 30:1 → immobilisation**; **< 20:1 → mineralisation**.
- **N transformations**: **aminisation → ammonification → nitrification** ($NH_4^+ \rightarrow NO_2^-$ by ***Nitrosomonas***; $NO_2^- \rightarrow NO_3^-$ by ***Nitrobacter***) → **denitrification** (*Pseudomonas, Bacillus*; anaerobic). **S oxidation** by ***Thiobacillus***; sulphate reduction by ***Desulfovibrio*** (H_2S → akiochi in rice).
- **Micro-organisms (number)**: **bacteria > actinomycetes > fungi > algae**. Actinomycetes give soil its earthy smell (**geosmin**).

MEMORY TRICK

CEC ladder "**K-I-M-V-H**" = **K**aolinite < **I**llite < **M**ontmorillonite < **V**ermiculite < **H**umus.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Clay mineral with the highest CEC? → Vermiculite (humus overall).
- Conversion factor from organic carbon to OM? → 1.724.
- Nitrite to nitrate is converted by? → *Nitrobacter*.
- 1:1 type clay mineral? → Kaolinite.

4.4 Problem Soils & Reclamation ★★★

Parameter	Saline	Sodic (alkali)	Saline-sodic	Acid
pH	**< 8.5**	**> 8.5** (up to 10+)	< 8.5	**< 6.5** (strongly acid < 5.5)
EC (dS/m)	**> 4**	**< 4**	> 4	Low
ESP	**< 15**	**> 15**	> 15	–
SAR	< 13	> 13	> 13	–
Local name	**White alkali, solonchak**, reh	**Black alkali, solonetz, usar**	–	Laterite / red / hill soils
Reclamation	**Leaching** with good water + drainage	**Gypsum**, pyrites, press mud, S, green manure	Gypsum + leaching	**Lime** ($CaCO_3$) – liming; basic slag

- **Gypsum requirement (GR)** is calculated from ESP; **gypsum ~5–10 t/ha** depending on GR (applied **before** leaching). Gypsum is **not used for saline soils**.
- **Liming materials**: $CaCO_3$ (neutralising value **100**), CaO (**179**), $Ca(OH)_2$ (136), dolomite (109); basic slag; **press mud** (sugar factories).
- **Salt-tolerant crops**: **barley, sugar beet, cotton, dhaincha, date palm**, mustard, Karnal grass; sensitive – **beans, peas, gram, citrus**.
- **Salt-tolerant varieties**: rice **CSR-10, CSR-30, CSR-36**, Basmati CSR-30; wheat **KRL-210, KRL-283** (CSSRI, **Karnal**).
- **Acid sulphate soils (cat clays)**: pH < 4 after drainage (pyrite oxidation) – Kerala (Kuttanad), coastal deltas.
- **Irrigation water quality**: **SAR = $Na^+ / \sqrt{[(Ca^{2+} + Mg^{2+})/2]}$**; **RSC = $(CO_3^{2-} + HCO_3^-) – (Ca^{2+} + Mg^{2+})$**: safe < 1.25, unsafe > 2.5 meq/L.
- **Waterlogging & salinity** affect **~6.7 Mha** of India.

MEMORY TRICK

"**Saline = Salt = White = Wash (leach)**"; "**Sodic = Sodium = Black = Gypsum**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- ESP and pH of sodic soil? → ESP > 15, pH > 8.5.
- Amendment for alkali soil? → Gypsum.
- Neutralising value of CaO? → 179.
- CSSRI is located at? → Karnal.

4.5 Plant Nutrients: Forms, Functions & Deficiency ★★★

- **17 essential nutrients**: **C, H, O** (from air/water); **primary – N, P, K**; **secondary – Ca, Mg, S**; **micronutrients – Fe, Mn, Zn, Cu, B, Mo, Cl, Ni** (Ni = 17th, 1987). **Beneficial**: Na, Si, Co, V (Si for rice; Co for N-fixation).
- **Mobility in plant**:
  - **Mobile – N, P, K, Mg** → deficiency on **older leaves**;
  - **Immobile – Ca, B, Fe, S, Zn, Cu, Mn** → deficiency on **young leaves/growing tips**.
- **Uptake forms**: N – NH_4^+, NO_3^-; P – **$H_2PO_4^-$** (acid), HPO_4^{2-}; K – K^+; S – SO_4^{2-}; B – **H_3BO_3**; Mo – **MoO_4^{2-}**; Fe – Fe^{2+}; Zn – Zn^{2+}.

Nutrient	Key role	Deficiency disease / symptom
N	Protein, chlorophyll	Yellowing of older leaves (V-shaped in maize); **buttoning** of cauliflower
P	ATP, nucleic acids ("**key of life**")	Purple/red leaves (maize), poor roots; delayed maturity
K	Stomatal regulation, enzymes, quality	Marginal **scorching** of older leaves; lodging; **luxury consumption**
Ca	Cell wall (Ca pectate)	**Blossom-end rot** of tomato; **tip burn** of cabbage; **pops** in groundnut; bitter pit of apple
Mg	**Central atom of chlorophyll**	Interveinal chlorosis of old leaves; **sand drown** of tobacco
S	Amino acids (cysteine, methionine), oil	**Tea yellows**; low oil in oilseeds
Fe	Cytochromes, ferredoxin	**Interveinal chlorosis of young leaves**; lime-induced chlorosis
Zn	Auxin synthesis (tryptophan), carbonic anhydrase	**Khaira (rice)**; **white bud (maize)**; little leaf (brinjal, cotton); mottle leaf (citrus); rosette
Mn	Water splitting (photolysis)	**Grey speck (oats)**; **marsh spot (pea)**; **Pahala blight (sugarcane)**
Cu	Plastocyanin, polyphenol oxidase	**Reclamation disease / white tip** of cereals; **die-back** & **exanthema** of citrus
B	Pollen germination, sugar transport	**Browning / hollow stem (cauliflower)**; **heart rot (sugar beet)**; hen & chicken (grape); internal cork (apple); fruit cracking
Mo	**Nitrate reductase**, nitrogenase	**Whiptail of cauliflower**; yellowing of legumes
Cl	Osmoregulation, photosynthesis	Wilting, bronzing
Ni	**Urease**	"Mouse ear" in pecan

- **Indicator plants**: N – cauliflower, cabbage; P – mustard; K – potato; Ca & Mg – cauliflower; B – sunflower; Fe – sorghum; Zn – maize.
- **Most deficient nutrients in Indian soils**: **N > P > Zn > S > B** (Zn is the most deficient micronutrient, ~36–40% of soils).

MEMORY TRICK

Mobile "**N-P-K-Mg go Old**" – symptoms on old leaves; the rest show on young leaves.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Whiptail of cauliflower is due to deficiency of? → Molybdenum.
- Central atom of chlorophyll? → Mg.
- Reclamation disease is due to? → Cu deficiency.
- Ni is part of which enzyme? → Urease.
- Most deficient micronutrient in Indian soils? → Zinc.

4.6 Fertilisers: Nutrient Content (Most Asked Table) ★★★

Fertiliser	N %	P_2O_5 %	K_2O %	Other
Urea	**46**	–	–	Amide; biuret ≤ **1.5%** (≤ 0.25% for foliar)
Ammonium sulphate	**20.6**	–	–	**S 24%**; best for rice, tea
Calcium ammonium nitrate (CAN)	**25–26**	–	–	Neutral; "Kisan Khad"
Ammonium chloride	**25**	–	–	Acidic
Ammonium nitrate	**33–34**	–	–	Explosive, hygroscopic
Anhydrous ammonia	**82**	–	–	Highest N
Sodium nitrate (Chilean)	16	–	–	Basic residue
DAP	**18**	**46**	–	Complex
MAP	11	**52**	–	Complex
SSP	–	**16**	–	**S 12%, Ca 19–21%**; first fertiliser made in India
TSP	–	**46**	–	–
Rock phosphate	–	20–40	–	For acid soils
Bone meal (steamed)	1.5–2	22–30	–	Organic
Basic slag	–	14–18	–	Liming effect; Si source
MOP (KCl)	–	–	**60**	Cheapest K; avoid for tobacco, potato, sugar crops
SOP (K_2SO_4)	–	–	**50**	**S 18%**

Fertiliser	N %	P_2O_5 %	K_2O %	Other
Potassium nitrate	**13**	–	**44–46**	Fertigation
NPK 10:26:26	10	26	26	–
NPK 12:32:16	12	32	16	–
NP 20:20:0:13 (APS)	20	20	0	S 13%
NPK 19:19:19	19	19	19	Water soluble
Urea Gold	37	–	–	**S 17%** (sulphur-coated urea, 2023)
Nano Urea (IFFCO, 2021)	**4%**	–	–	500 ml bottle = foliar spray
Nano DAP (IFFCO, 2023)	8	16	–	Liquid, foliar/seed
Gypsum	–	–	–	**Ca 23%, S 18%** (agri grade ~13% S)
Zinc sulphate (heptahydrate / monohydrate)	–	–	–	**Zn 21% / 33%**
Borax / Solubor	–	–	–	**B 10.5–11% / 20%**
Copper sulphate	–	–	–	**Cu 24%**
Ferrous sulphate	–	–	–	**Fe 19%**
Manganese sulphate	–	–	–	Mn 30.5%
Ammonium molybdate	–	–	–	**Mo 52–54%**

- **Conversions**: **P_2O_5 × 0.436 = P** (P × 2.29 = P_2O_5); **K_2O × 0.83 = K** (K × 1.2 = K_2O).
- **Fertiliser calculation**: kg fertiliser = (nutrient needed ÷ % nutrient) × 100. Example: **100 kg N via urea = 217 kg urea**; 50 kg P_2O_5 via DAP = 109 kg DAP (supplies 19.6 kg N).
- **Acid-forming**: anhydrous ammonia (148) > ammonium chloride (128) > **ammonium sulphate (110)** > urea (~80) > DAP (~70) (equivalent acidity, kg $CaCO_3$/100 kg). **Basic**: sodium nitrate, calcium nitrate, calcium cyanamide.
- **Hygroscopicity**: ammonium nitrate > urea > CAN > AS.
- **N-use efficiency**: ~30–50% (rice ~30–40%).
  - **Nitrification inhibitors**: **N-Serve (nitrapyrin)**, DCD, **neem cake / neem oil**, thiourea.
  - **Urease inhibitor**: **NBPT**.
  - **Slow-release**: **urea-formaldehyde**, IBDU, CDU, sulphur-coated urea, **neem-coated urea** (mandatory for all urea since **May 2015**).
- **Urea bag**: **45 kg** (from Mar 2018; was 50 kg). **Urea MRP** is statutorily fixed (**₹242 per 45-kg bag**); P&K are under **NBS (since 1 Apr 2010)**.
- **Fertiliser Control Order (FCO) 1985** under the **Essential Commodities Act 1955** – covers chemical, bio and organic fertilisers. **Biostimulants** added as **Schedule VI (2021)**.
- **Fertiliser types**: **straight** (urea), **complex** (DAP – chemically combined), **mixed** (physical mix), **complete** (N+P+K). **High-analysis > 25%** total nutrients.
- **Application methods**: basal, **top-dressing**, **deep placement** (rice, urea super granules), **band placement** (P), **foliar spray** (micronutrients; urea 2%), **fertigation**.

UPDATED 2025-26

Fertiliser use trends: NPK use ratio **9.8 : 3.7 : 1 (Kharif 2024)** vs **ideal 4 : 2 : 1** – heavy N bias. Domestic fertiliser production **503.35 LMT (2023-24)**. **Biostimulants**: approval for **11 protein-hydrolysate biostimulants withdrawn (30 Sep 2025)**; interim sale allowed only till **16 Jun 2025** for applicants. NBS: Kharif 2026 subsidy **₹41,533.81 cr** (see Chapter 2).

MEMORY TRICK

Big four "**46-18/46-60-16**": **Urea 46 N**, **DAP 18-46**, **MOP 60 K_2O**, **SSP 16 P_2O_5 (+12 S)**.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- N content of CAN? → 25–26%. Of ammonium sulphate? → 20.6% (+24% S).
- P_2O_5 in SSP and TSP? → 16% and 46%.
- How much urea gives 100 kg N? → 217 kg.
- Maximum biuret allowed in urea? → 1.5%.
- Neem-coated urea was made mandatory in? → 2015.

4.7 Manures, Compost & Biofertilisers ★★★

Manure	N %	P_2O_5 %	K_2O %
FYM	**0.5**	0.2	0.5
Compost (rural)	0.5–1.0	0.4	0.8–1.2
Vermicompost	**1.5–2.0** (up to 3)	1.0	1.0–1.5
Poultry manure	**3.0**	2.6	1.4
Neem cake	5.2	1.0	1.4
Groundnut cake	7.3	1.5	1.3

Manure	N %	P_2O_5 %	K_2O %
Castor cake	4.3	1.8	1.3
Blood meal	**10–12**	1–1.5	0.6–0.8
Sheep/goat manure	3.0	1.0	2.0

- **Composting methods**: **Indore (Howard & Wad, 1924–26)**; **Bangalore (Acharya, 1939)** – anaerobic pit; Coimbatore; **NADEP** (N.D. Pandharipande, above-ground brick tank); **vermicompost** – ***Eisenia fetida*** (red wiggler), ***Eudrilus eugeniae***, ***Perionyx excavatus***.
- **Green manures**: **sunhemp (*Crotalaria juncea*) – best**, adds ~**80–130 kg N/ha**; **dhaincha (*Sesbania aculeata*)** – also for sodic soils; ***Sesbania rostrata*** – **stem nodules**. Incorporate at **flowering (45–60 days)**. **Green-leaf manures**: Gliricidia, Pongamia, neem.

Biofertiliser	Type	Crops / note
Rhizobium	Symbiotic N-fixer (root nodules)	Legumes – species-specific: ***R. leguminosarum*** (pea, lentil), ***R. phaseoli*** (beans), ***R. trifolii*** (berseem), ***R. meliloti*** (lucerne), ***Bradyrhizobium japonicum*** (soybean)
Azotobacter	Free-living, aerobic N-fixer	Wheat, vegetables, cotton
Azospirillum	Associative symbiotic	**Sorghum, bajra, maize** (cereals, grasses)
Acetobacter (Gluconacetobacter) diazotrophicus	Endophytic N-fixer	**Sugarcane**
BGA (*Anabaena, Nostoc*)	Free-living cyanobacteria	Rice; ~**20–30 kg N/ha**
Azolla–*Anabaena azollae*	Symbiotic (water fern)	Rice; ~40–60 kg N/ha
Frankia	Actinomycete (non-legume nodules)	***Casuarina***, alder
PSB – *Pseudomonas striata*, *Bacillus megaterium*; **PSF** – *Aspergillus awamori*	P-solubilisers	All crops
VAM / AM fungi (*Glomus*)	P mobilisers (mycorrhiza)	Absorb P, Zn; drought tolerance
KSB – *Frateuria aurantia*	K-solubiliser	–
Clostridium	Free-living, **anaerobic**	–

- **Leghaemoglobin** (pink, in nodules) protects **nitrogenase** from O_2; nitrogenase needs **Mo and Fe** (and Co for nodule bacteria).
- **Seed treatment**: ~**200 g culture per 10 kg seed** (in jaggery solution); soil application ~2 kg/ha mixed with FYM.
- **Order of seed treatment**: **F-I-R** → **F**ungicide → **I**nsecticide → **R**hizobium (biofertiliser last).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Stem-nodulating green manure? → *Sesbania rostrata*.
- Biofertiliser for sugarcane? → *Acetobacter diazotrophicus*.
- Nitrogen-fixer in *Casuarina*? → *Frankia*.
- Earthworm commonly used for vermicompost? → *Eisenia fetida*.
- N content of FYM? → ~0.5%.

4.8 Soil Testing & Soil Health Card ★★★

Nutrient	Method	Low	Medium	High
Organic carbon (%)	**Walkley & Black**	< 0.5	0.5–0.75	> 0.75
Available N (kg/ha)	**Alkaline $KMnO_4$ (Subbiah & Asija, 1956)**	< 280	280–560	> 560
Available P (kg/ha)	**Olsen** (neutral/alkaline); **Bray-1** (acid)	< 10	10–25	> 25
Available K (kg/ha)	**Neutral NH_4OAc**, flame photometer	< 108	108–280	> 280
Zn, Fe, Cu, Mn (mg/kg)	**DTPA (Lindsay & Norvell, 1978)**	Zn < 0.6; Fe < 4.5	–	–
B (mg/kg)	**Hot water soluble**	< 0.5	0.5–1.0	> 1.0
S (mg/kg)	0.15% $CaCl_2$ / 0.01 M $Ca(H_2PO_4)_2$	< 10	10–20	> 20

- **Instruments**: pH meter, **EC meter (conductivity bridge)**; **flame photometer** (K, Na); **spectrophotometer/colorimeter** (P, B); **AAS – atomic absorption spectrophotometer** (Zn, Fe, Cu, Mn); **Kjeldahl** (total N).

- **Soil sampling**: **V-shaped cut, 0–15 cm** (0–30 cm for deep-rooted crops); composite of **10–15 spots per field**; **~500 g** per sample; avoid recently fertilised spots, bunds, trees.
- **Soil Health Card**: **12 parameters** (N, P, K, S, Zn, Fe, Cu, Mn, B, pH, EC, OC); every **2 years**; **> 25 crore cards** issued; under PM-RKVY. **Village-level soil testing labs**; **mini-labs ("Mridaparikshak")** – portable kits (ICAR-IISS Bhopal).
- **Integrated Nutrient Management (INM)**: fertiliser + organic manure + biofertiliser + crop residues + legumes.
- **STCR** (Soil Test Crop Response, **Ramamoorthy, 1967**) – fertiliser doses for a **targeted yield**. **IISS Bhopal** – Indian Institute of Soil Science.
- **World Soil Day – 5 Dec**; 2025 theme "**Healthy Soils for Healthy Cities**". **2015 – International Year of Soils**.

MEMORY TRICK

Soil test methods "**Walk-Sub-Olsen-Ammonium-DTPA**" → OC (Walkley-Black), N (Subbiah-Asija), P (Olsen), K (NH_4OAc), micronutrients (DTPA).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Available N is estimated by? → Alkaline $KMnO_4$ method (Subbiah & Asija).
- Available P in alkaline soil is estimated by? → Olsen's method.
- Micronutrient extractant? → DTPA.
- Low range of available N? → < 280 kg/ha.
- STCR concept was given by? → Ramamoorthy.

Nandyal Banking Coaching Center

5. Plant Pathology & Entomology

> **NOTE**
> Most questions are **disease–pathogen** and **pest–scientific name** matches. Learn the crop-wise tables, the vectors and the pesticide colour codes.

5.1 Plant Pathology: Basics & History ★★☆

- **Father of plant pathology**: **Anton de Bary** (proved *Phytophthora infestans* causes late blight). **Father of Indian plant pathology / mycology**: **E.J. Butler** (book "Fungi and Disease in Plants", 1918). **Father of Indian mycology**: K.C. Mehta (wheat rust epidemiology).
- **Disease triangle** = **host + pathogen + environment** (+ time = disease tetrahedron/pyramid).
- **Koch's postulates** – prove that a pathogen causes a disease.
- **Famous epidemics**:

Epidemic	Disease & pathogen
Irish famine (1845–46)	Late blight of potato – ***Phytophthora infestans***
Bengal famine (1942–43)	Brown spot of rice – ***Helminthosporium (Bipolaris) oryzae***
Coffee rust, Sri Lanka (1870s)	*Hemileia vastatrix* – Ceylon switched to tea
Southern corn leaf blight, USA (1970)	*Helminthosporium maydis* race T (Texas male-sterile cytoplasm)
Wheat rust epidemic	**Ug99** stem rust race (Uganda, 1999)

- **Pathogen groups**: **fungi** (most diseases, ~70%), **bacteria**, **viruses**, **viroids** (**PSTVd – potato spindle tuber**, first viroid, T.O. Diener 1971), **phytoplasma** (MLO; no cell wall; **tetracycline-sensitive**), **nematodes**, parasitic plants.
- **Fungal spores**: **oospore** (Oomycetes), **zygospore** (Zygomycetes), **ascospore** (Ascomycetes), **basidiospore** (Basidiomycetes), **conidia** (Deuteromycetes – "imperfect fungi").
- **Rust spore stages**: **0 – pycnia (spermogonia)**, **I – aecia**, **II – uredia** (repeating stage), **III – telia**, **IV – basidia**. Black stem rust of wheat (*Puccinia graminis tritici*) is **macrocyclic & heteroecious** – alternate host **barberry (*Berberis*)**.
- **Survival in India (K.C. Mehta)**: wheat rust inoculum survives in the **Nilgiri & Palni hills** (south) and the **Himalaya**, and spreads to the plains each year.
- **Damping-off** (*Pythium*) – nursery disease; **soil solarisation**.

> **PREVIOUSLY ASKED / LIKELY QUESTIONS**
> - Irish famine was caused by? → *Phytophthora infestans* (late blight of potato).
> - Bengal famine 1943 was due to? → Brown spot of rice.
> - Alternate host of black stem rust of wheat? → Barberry.
> - Father of Indian plant pathology? → E.J. Butler.

5.2 Major Crop Diseases & Pathogens (Crop-wise) ★★★

Crop	Disease	Pathogen (type)
Rice	**Blast**	***Pyricularia oryzae (Magnaporthe oryzae)*** (F) – neck/node blast
Rice	**Brown spot**	***Helminthosporium / Bipolaris oryzae*** (F)
Rice	**Bacterial leaf blight (BLB)**	***Xanthomonas oryzae* pv. *oryzae*** (B) – "kresek" phase
Rice	Sheath blight	***Rhizoctonia solani*** (F)
Rice	False smut	***Ustilaginoidea virens*** (F)
Rice	**Tungro**	RTBV + RTSV (V) – **green leafhopper (*Nephotettix*)**
Rice	Bakanae (foot rot)	***Fusarium fujikuroi*** (F) – excess **gibberellin**, tall seedlings
Wheat	**Black/stem rust**	***Puccinia graminis tritici*** (F)
Wheat	**Brown/leaf rust**	***Puccinia recondita / triticina*** (F)
Wheat	**Yellow/stripe rust**	***Puccinia striiformis*** (F) – cool north hills
Wheat	**Loose smut**	***Ustilago tritici*** (F) – internally seed-borne → **solar heat / hot water / carboxin**
Wheat	**Karnal bunt**	***Tilletia indica (Neovossia indica)*** (F) – first in Karnal 1931; quarantine
Wheat	Ear cockle / tundu	***Anguina tritici*** (nematode) + *Rathayibacter tritici* (tundu)
Wheat	**Wheat blast**	*Magnaporthe oryzae* pathotype *Triticum* – Bangladesh 2016 (threat)

Crop	Disease	Pathogen (type)
Maize	Turcicum leaf blight	*Exserohilum turcicum* (F)
Maize	Downy mildew	*Peronosclerospora* spp. (F)
Sorghum	Grain smut / ergot (sugary disease)	*Sphacelotheca sorghi* / *Sphacelia sorghi* (F)
Bajra	**Green ear (downy mildew)**	***Sclerospora graminicola*** (F)
Bajra	Ergot	*Claviceps fusiformis* (F) – toxic alkaloids
Gram	**Wilt**	***Fusarium oxysporum* f. sp. *ciceri*** (F)
Gram	Ascochyta blight	*Ascochyta rabiei* (F)
Pigeonpea	Wilt; **sterility mosaic**	*F. udum* (F); PPSMV – **eriophyid mite (*Aceria cajani*)**
Moong/Urd	**Yellow mosaic**	**MYMV** (V) – **whitefly (*Bemisia tabaci*)**
Groundnut	**Tikka (early/late leaf spot)**	***Cercospora arachidicola* / *Phaeoisariopsis personata*** (F)
Groundnut	Rosette; bud necrosis	GRV – **aphid**; **GBNV – thrips**
Mustard	White rust; Alternaria blight	***Albugo candida***; *Alternaria brassicae* (F)
Cotton	Root rot; bacterial blight (black arm / angular leaf spot)	*Rhizoctonia*; ***Xanthomonas citri* pv. *malvacearum*** (B)
Cotton	**Leaf curl**	CLCuV (V) – **whitefly**
Sugarcane	**Red rot** ("cancer of sugarcane")	***Colletotrichum falcatum*** (F) – sour alcoholic smell
Sugarcane	Whip smut	*Sporisorium (Ustilago) scitamineum* (F)
Sugarcane	Grassy shoot	**Phytoplasma**
Potato	**Late blight**	***Phytophthora infestans*** (F/Oomycete)
Potato	Early blight	***Alternaria solani*** (F) – concentric rings
Potato	**Wart**	***Synchytrium endobioticum*** (F) – Darjeeling (domestic quarantine)
Potato	Leaf roll; mosaic	PLRV – **aphid (*Myzus persicae*)**; PVY
Tomato	Leaf curl; spotted wilt	ToLCV – **whitefly**; TSWV – **thrips**
Tomato	Bacterial wilt	***Ralstonia solanacearum*** (B)
Brinjal	**Little leaf**	**Phytoplasma** – leafhopper (*Hishimonus phycitis*)
Bhindi	**Yellow vein mosaic**	YVMV – **whitefly**
Banana	**Panama wilt**; **bunchy top**; Sigatoka	***F. oxysporum* f. sp. *cubense*** (F); BBTV – **aphid (*Pentalonia nigronervosa*)**; *Mycosphaerella*
Mango	Powdery mildew; anthracnose; **malformation**	*Oidium mangiferae*; *Colletotrichum gloeosporioides*; *Fusarium mangiferae* (+ mite)
Citrus	**Canker**; greening; tristeza	***Xanthomonas citri*** (B); ***Candidatus Liberibacter*** – **psyllid**; CTV – **aphid (*Toxoptera citricida*)**
Grapes	Downy mildew; powdery mildew	***Plasmopara viticola*** (→ Bordeaux mixture); *Uncinula necator*
Apple	Scab	***Venturia inaequalis*** (F)
Coffee	Leaf rust	***Hemileia vastatrix*** (F)
Tea	Blister blight	***Exobasidium vexans*** (F)
Coconut	Bud rot; root (wilt); Thanjavur wilt	*Phytophthora palmivora*; phytoplasma; *Ganoderma*
Papaya	Ring spot	PRSV – **aphid**

MEMORY TRICK

Vectors – "**W-A-T-L-M**": **W**hitefly → YMV, leaf curl, YVMV; **A**phid → PLRV, bunchy top, CTV, PRSV, rosette; **T**hrips → TSWV, bud necrosis; **L**eafhopper → tungro, little leaf, grassy shoot; **M**ite → sterility mosaic.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Pathogen of rice blast? → *Pyricularia oryzae* (*Magnaporthe oryzae*).
- Karnal bunt of wheat is caused by? → *Tilletia indica*.
- Vector of yellow mosaic of moong? → Whitefly (*Bemisia tabaci*).
- "Cancer of sugarcane"? → Red rot (*Colletotrichum falcatum*).
- Sterility mosaic of pigeonpea is spread by? → Eriophyid mite.
- Bakanae disease of rice is due to? → *Fusarium fujikuroi* (excess gibberellin).

5.3 Bacteria, Viruses, Phytoplasma & Nematodes ★★★

- **Bacterial diseases** – mostly Gram-negative rods: ***Xanthomonas*** (BLB, citrus canker, black arm), ***Ralstonia*** (wilt), ***Erwinia / Pectobacterium*** (soft rot), ***Agrobacterium tumefaciens*** (**crown gall** – Ti plasmid, used in genetic engineering), ***Streptomyces scabies*** (common scab of potato – actinomycete). Control: **streptocycline**, copper oxychloride.
- **Viruses**: first discovered – **TMV** (Ivanowski 1892; Beijerinck "contagium vivum fluidum"; crystallised by **Stanley, 1935**). Most plant viruses are **ssRNA**; **gemini viruses (ssDNA)** – YMV, leaf curl (whitefly-borne); **caulimoviruses (dsDNA)**. Transmission: vectors, sap, grafting, seed, **dodder**.
- **Phytoplasma** diseases: **little leaf of brinjal**, **grassy shoot of sugarcane**, sesame phyllody, coconut root wilt, **sandal spike**; vectors – leafhoppers; controlled by **tetracycline**.
- **Nematodes** (round worms; father of nematology – **N.A. Cobb**):

Nematode	Disease / crop
***Meloidogyne* spp.**	**Root-knot** – vegetables (galls)
Heterodera avenae	**Molya** disease of wheat & barley (cereal cyst nematode – Rajasthan)
Anguina tritici	**Ear cockle** of wheat (seed galls)
Ditylenchus angustus	**Ufra** of rice (Bangladesh, Assam, WB)
Aphelenchoides besseyi	**White tip** of rice
Radopholus similis	Burrowing nematode – banana, **pepper "slow wilt"**
Globodera rostochiensis	Golden cyst nematode of potato (Nilgiris; quarantine)
Tylenchulus semipenetrans	Citrus decline (slow decline)
Rotylenchulus reniformis	Reniform nematode – cotton, vegetables

- **Nematode control**: summer ploughing, **marigold (*Tagetes*)** as trap/antagonist crop, crop rotation, carbofuran (now restricted), **Paecilomyces lilacinus / Purpureocillium**, *Pochonia*.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Crown gall is caused by? → *Agrobacterium tumefaciens*.
- First virus discovered? → TMV.
- Molya disease of wheat is caused by? → *Heterodera avenae*.
- Ufra disease of rice is caused by? → *Ditylenchus angustus*.
- Phytoplasma is sensitive to? → Tetracycline.

5.4 Fungicides & Disease Management ★★☆

- **Bordeaux mixture** – **Millardet (1882–85)**, France, for **downy mildew of grapes**: **$CuSO_4$ + lime + water = 1 : 1 : 100** (1%). Neutrality tested with an **iron knife/blade**. **Burgundy mixture** = $CuSO_4$ + sodium carbonate. **Chaubattia paste** (red lead + copper carbonate + lanolin) – wound dressing in apple.
- **Fungicide groups**:

Group	Examples	Use
Inorganic copper	Bordeaux, **copper oxychloride (Blitox)**	Downy mildews, blights
Inorganic sulphur	**Wettable sulphur**, lime sulphur	**Powdery mildews**, mites
Dithiocarbamates	**Mancozeb (Dithane M-45)**, zineb, thiram	Broad-spectrum protectant; thiram – seed
Benzimidazoles	**Carbendazim (Bavistin)**, benomyl	Systemic – seed/soil
Oxathiins	**Carboxin (Vitavax)**	**Loose smut** (systemic seed)
Phenylamides	**Metalaxyl (Ridomil)**	**Oomycetes** – late blight, downy mildew
Triazoles	**Propiconazole (Tilt)**, tebuconazole, hexaconazole	Rusts, sheath blight
Strobilurins	Azoxystrobin	Broad-spectrum systemic
Others	**Tricyclazole** (blast), validamycin (sheath blight), **streptocycline** (bacteria)	–

- **Biocontrol agents**: ***Trichoderma viride / harzianum*** (soil-borne fungi – wilt, root rot; seed treatment **4–10 g/kg**); ***Pseudomonas fluorescens*** (bacterial antagonist); *Bacillus subtilis*; *Ampelomyces quisqualis* (powdery mildew hyperparasite).
- **Cultural/physical**: **hot water treatment** (loose smut 52 °C, 10 min after pre-soak) and **solar heat treatment** (Luthra) for loose smut; **soil solarisation** (transparent polythene); crop rotation; resistant varieties; roguing.
- **Plant quarantine**: **Destructive Insects & Pests (DIP) Act 1914**; **Plant Quarantine Order 2003**. **Directorate of Plant Protection, Quarantine & Storage (PPQS)** – **Faridabad**. Domestic quarantine examples: potato wart (Darjeeling), banana bunchy top, San José scale, golden nematode.

MEMORY TRICK

Bordeaux "**1-1-100**" → 1 kg copper sulphate + 1 kg lime + 100 L water.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Bordeaux mixture was discovered by? → Millardet.
- Systemic fungicide for loose smut? → Carboxin (Vitavax).
- Fungicide specific for Oomycetes (late blight, downy mildew)? → Metalaxyl.
- Fungicide for rice blast? → Tricyclazole.
- Headquarters of PPQS? → Faridabad.

5.5 Entomology: Basics & Insect Orders ★★☆

- **Father of entomology**: **Aristotle**; modern – **William Kirby**; **India: T.V. Ramakrishna Ayyar**. Insects are the **largest class (Insecta)** in phylum **Arthropoda**: body = **head, thorax, abdomen**; **3 pairs of legs**; usually 2 pairs of wings.
- **Metamorphosis**: **ametabolous** (silverfish), **hemimetabolous/incomplete** (egg–nymph–adult: bugs, grasshoppers, termites), **holometabolous/complete** (egg–larva–pupa–adult: beetles, moths, flies, bees). Hormones: **ecdysone** (moulting – prothoracic gland), **juvenile hormone** (corpora allata).
- **Mouthparts**: **chewing** (grasshopper, beetles, caterpillars), **piercing–sucking** (bugs, aphids, mosquitoes), **siphoning** (adult moths & butterflies), **chewing–lapping** (honey bee), **sponging** (housefly), **rasping–sucking** (thrips).

Order	Examples	Key feature
Lepidoptera	Moths, butterflies (borers, bollworms)	Scaly wings; **larva = caterpillar** – most crop pests
Coleoptera	Beetles, weevils	**Largest order**; elytra (hard forewings)
Hemiptera	Bugs, aphids, jassids, whitefly, mealybugs, scale	Piercing–sucking; vectors of viruses
Orthoptera	Grasshoppers, **locusts**, crickets	Jumping hind legs
Thysanoptera	**Thrips**	Fringed wings; rasping–sucking
Diptera	Flies, fruit flies, midges	One pair of wings + **halteres**
Hymenoptera	Bees, wasps, ants, **parasitoids** (*Trichogramma*)	Most beneficial order
Isoptera (now in Blattodea)	**Termites**	Social; caste system

- **Mites** (Acari) and **spiders** are **arachnids** (4 pairs of legs) – controlled by **acaricides**.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Largest insect order? → Coleoptera.
- Hormone controlling moulting? → Ecdysone.
- Thrips have which type of mouthparts? → Rasping–sucking.
- Most crop pests belong to which order? → Lepidoptera.

5.6 Major Insect Pests (Crop-wise) ★★★

Crop	Pest	Scientific name
Rice	**Yellow stem borer**	***Scirpophaga incertulas*** – **dead heart** (vegetative), **white ear** (reproductive)
Rice	**Brown plant hopper (BPH)**	***Nilaparvata lugens*** – **hopper burn**
Rice	Gall midge	***Orseolia oryzae*** – **silver shoot / onion leaf**
Rice	Leaf folder; gundhi bug	*Cnaphalocrocis medinalis*; ***Leptocorisa acuta*** (milky grain stage)
Rice	Green leafhopper	*Nephotettix virescens* – tungro vector

Crop	Pest	Scientific name
Wheat	Termite; aphid; pink stem borer	*Odontotermes obesus*; *Rhopalosiphum maidis*; *Sesamia inferens*
Maize	**Fall armyworm** (invasive, **2018**, Karnataka)	***Spodoptera frugiperda***
Maize/sorghum	Stem borer; shoot fly	***Chilo partellus***; ***Atherigona soccata*** (sorghum)
Cotton	**Pink bollworm**	***Pectinophora gossypiella*** – rosette flowers; resistant to Bt
Cotton	American bollworm	***Helicoverpa armigera***
Cotton	Spotted bollworm	*Earias vittella*
Cotton	Whitefly; jassid; mealybug	***Bemisia tabaci***; *Amrasca biguttula*; *Phenacoccus solenopsis*
Pulses (gram, tur)	**Pod borer** (polyphagous)	***Helicoverpa armigera***
Pigeonpea	Pod fly; spotted pod borer	*Melanagromyza obtusa*; ***Maruca vitrata***
Stored pulses	**Pulse beetle**	***Callosobruchus chinensis / maculatus***
Mustard	**Mustard aphid**	***Lipaphis erysimi***; painted bug *Bagrada hilaris*; sawfly *Athalia lugens*
Groundnut	White grub; leaf miner; red hairy caterpillar	***Holotrichia consanguinea***; *Aproaerema modicella*; *Amsacta albistriga*
Sugarcane	Early shoot borer; top borer; pyrilla; woolly aphid	*Chilo infuscatellus*; ***Scirpophaga excerptalis*** (bunchy top); ***Pyrilla perpusilla***; *Ceratovacuna lanigera*
Brinjal	**Shoot & fruit borer**	***Leucinodes orbonalis***
Bhindi	Shoot & fruit borer	***Earias vittella*** / *E. insulana*
Cabbage/cauliflower	**Diamondback moth (DBM)**	***Plutella xylostella*** – first insect resistant to Bt sprays
Tomato	Fruit borer; **pinworm**	*Helicoverpa armigera*; ***Tuta absoluta*** (invasive, 2014)
Cucurbits	Fruit fly; red pumpkin beetle	***Bactrocera cucurbitae (Zeugodacus)***; *Raphidopalpa (Aulacophora) foveicollis*
Mango	**Mango hopper**; stone weevil; fruit fly	***Idioscopus* spp.**; ***Sternochetus mangiferae*** (quarantine); ***Bactrocera dorsalis***
Coconut	**Rhinoceros beetle**; red palm weevil; black-headed caterpillar	***Oryctes rhinoceros***; ***Rhynchophorus ferrugineus***; *Opisina arenosella*
Citrus	Lemon butterfly; leaf miner; psylla	*Papilio demoleus*; *Phyllocnistis citrella*; *Diaphorina citri* (greening vector)
Apple	**San José scale**; woolly apple aphid	***Quadraspidiotus perniciosus***; *Eriosoma lanigerum*
Coffee	**White stem borer**; berry borer	***Xylotrechus quadripes***; *Hypothenemus hampei*
Tea	**Tea mosquito bug**	***Helopeltis theivora***
Polyphagous	**Desert locust**; termites; armyworm	***Schistocerca gregaria*** (Locust Warning Organisation, **Jodhpur**); *Odontotermes*; *Spodoptera litura* (tobacco caterpillar)

MEMORY TRICK

Rice stem borer symptoms "**DEAD → WHITE**": **dead heart** at tillering, **white ear** at heading. Gall midge = "**silver shoot / onion leaf**". BPH = "**hopper burn**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Scientific name of brinjal shoot & fruit borer? → *Leucinodes orbonalis*.
- Fall armyworm was first reported in India in? → 2018 (Karnataka).
- Hopper burn in rice is caused by? → Brown plant hopper (*Nilaparvata lugens*).
- Pink bollworm scientific name? → *Pectinophora gossypiella*.
- Locust Warning Organisation is at? → Jodhpur.

5.7 Storage Pests & Grain Storage ★★☆

- **Primary (internal) feeders** – attack whole grain: **rice weevil (*Sitophilus oryzae*)**, **lesser grain borer (*Rhyzopertha dominica*)**, **Angoumois**

grain moth (*Sitotroga cerealella*), **pulse beetle (*Callosobruchus*)**.

- **Secondary feeders** – feed on broken grain/flour: **red flour beetle (*Tribolium castaneum*)**, saw-toothed grain beetle (*Oryzaephilus*), rice moth (*Corcyra cephalonica* – used to rear *Trichogramma*), **khapra beetle (*Trogoderma granarium*)** – **only the larva** damages; serious quarantine pest.
- **Safe storage moisture**: cereals **10–12%**; pulses ~9–10%; oilseeds 7–8%.
- **Fumigants**: **aluminium phosphide** (Celphos, 3 g tablet → phosphine gas, PH_3), EDB, methyl bromide (ozone-depleting – restricted to quarantine use).
- **Storage structures**: **Pusa bin**, Hapur kothi, silos, **CAP (Cover and Plinth)** storage of FCI; hermetic bags. **Rodent control**: **zinc phosphide (2%)** – acute; **bromadiolone** (anticoagulant).
- **Post-harvest losses**: cereals ~**4–6%**, pulses ~6–8%, fruits & vegetables **5–15%**.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Only the larva damages stored grain in? → Khapra beetle.
- Fumigant tablet used in godowns? → Aluminium phosphide (phosphine).
- Insect used to mass-rear *Trichogramma*? → Rice moth (*Corcyra cephalonica*).

5.8 Beneficial Insects: Apiculture, Sericulture, Lac ★★★

- **Apiculture (bee keeping)**:

Species	Name	Notes
Apis mellifera	**Italian/European bee**	Highest yield (**25–40 kg/hive/yr**); most used in India (Langstroth hive)
Apis cerana indica	Indian (Asiatic) hive bee	10–15 kg; Newton hive
Apis dorsata	**Rock bee**	Most aggressive; highest honey per colony (wild)
Apis florea	Little bee	Least honey
Tetragonula / Trigona	Stingless (dammer) bee	Medicinal honey

- **Castes**: **queen** (fertile female, lays up to **1,500–2,000 eggs/day**; fed **royal jelly**), **workers** (sterile females; ~**21 days** to develop), **drones** (males from **unfertilised eggs – parthenogenesis**). Bee dance – **Karl von Frisch** (round & waggle dance).
- **Langstroth** – father of modern beekeeping (movable frame hive; **bee space 6–9 mm**). Products: honey, **beeswax**, royal jelly, propolis, pollen, bee venom.
- **National Beekeeping & Honey Mission (NBHM) – 2020**, ₹500 cr; "**Sweet Revolution**". India exports honey mainly to the USA. **World Bee Day – 20 May**.
- **Sericulture (silk)**: **mulberry silkworm *Bombyx mori*** (~90% of output; monophagous on mulberry; **Karnataka** leads); **tasar** (*Antheraea mylitta* – Jharkhand), **muga** (***Antheraea assamensis*** – **golden silk, only in Assam**; GI), **eri** (*Samia ricini* – castor; non-violent "ahimsa" silk). **India is the 2nd largest silk producer** (after China) and the **only country producing all 4 types**. **Central Silk Board – Bengaluru (1948)**. Diseases: **pebrine** (*Nosema bombycis*), **flacherie**, **grasserie**, **muscardine**.
- **Lac culture**: **lac insect *Kerria lacca*** (*Laccifer lacca*) on **kusum, palas, ber**; strains **Rangeeni** (palas, ber) and **Kusmi** (kusum – better quality). **Jharkhand** leads; **IINRG, Ranchi** (Indian Institute of Natural Resins & Gums). India is the **largest lac producer**.

MEMORY TRICK

Silk types "**M-T-M-E**": **M**ulberry (*Bombyx*) – **T**asar (*A. mylitta*) – **M**uga (*A. assamensis*, Assam gold) – **E**ri (*Samia ricini*, castor).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Golden silk is produced by? → Muga silkworm (*Antheraea assamensis*).
- Bee species with the highest honey yield in hives? → *Apis mellifera*.
- Drones develop from? → Unfertilised eggs (parthenogenesis).
- Scientific name of lac insect? → *Kerria lacca*.
- Pebrine disease of silkworm is caused by? → *Nosema bombycis* (protozoan).

5.9 IPM, Biological Control & Pesticides ★★★

- **IPM** – combines cultural, mechanical, biological and chemical methods to keep pests **below the Economic Threshold Level (ETL)**. **EIL** (Economic Injury Level) – Stern et al. (1959). **ETL < EIL**. India adopted IPM in **1985**; **Central IPM Centres (CIPMCs)**.
- **Mechanical/physical tools**: light traps, **pheromone traps** (sex pheromones – *Helicoverpa*, PBW "gossyplure", fruit fly **methyl eugenol** trap), **yellow sticky traps** (whitefly, aphids), **blue sticky traps** (thrips), bird perches (T-shaped), trap crops (**marigold** in tomato; mustard in cabbage).
- **Biological control**:

Bio-agent	Type	Target
Trichogramma chilonis / japonicum	Egg parasitoid (wasp)	Borers, bollworms (**Tricho-cards, 50,000–1.5 lakh/ha**)
Chrysoperla zastrowi (carnea)	Predator (green lacewing)	Aphids, whitefly, mealybug
Cryptolaemus montrouzieri	Predator (ladybird – "mealybug destroyer")	Mealybugs
Bacillus thuringiensis (Bt)	Bacterium – Cry toxins	Lepidopteran caterpillars
NPV (HaNPV, SlNPV)	Virus (baculovirus)	*Helicoverpa*, *Spodoptera* (**250 LE/ha**)
Beauveria bassiana	Fungus – **white muscardine**	Borers, beetles
Metarhizium anisopliae	Fungus – **green muscardine**	White grub, rhinoceros beetle
Verticillium (Lecanicillium) lecanii	Fungus	Sucking pests
Neochetina weevils; ***Zygogramma***	Weed bio-agents	Water hyacinth; Parthenium

- **Botanicals**: **neem (azadirachtin)**, pyrethrum (*Chrysanthemum cinerariaefolium* – pyrethrins), **nicotine sulphate**, rotenone (*Derris*).
- **Insecticide classes**:

Class	Examples	Note
Organochlorines	DDT, BHC/HCH, endosulfan	Persistent – **mostly banned** (endosulfan banned 2011 – SC)
Organophosphates	Chlorpyrifos, malathion, monocrotophos, profenofos, **phorate**	AChE inhibitors; antidote **atropine + PAM**
Carbamates	Carbaryl, carbofuran, **carbosulfan**	AChE inhibitors (reversible)
Synthetic pyrethroids	Cypermethrin, deltamethrin, lambda-cyhalothrin	Low dose; toxic to fish
Neonicotinoids	**Imidacloprid**, thiamethoxam, acetamiprid	Systemic – sucking pests; harm bees
Diamides	**Chlorantraniliprole (Coragen)**, flubendiamide	Lepidopteran borers
Others	Spinosad (bacterial), emamectin benzoate, fipronil, **buprofezin** (IGR – BPH)	–

- **Formulations**: **EC** (emulsifiable concentrate), **WP** (wettable powder), **SC/FS**, **G** (granules), **D** (dust), **WG/WDG**, **SL**, ULV.
- **Toxicity label colours (Insecticides Rules 1971)**:

Colour triangle	Category	Oral LD_{50} (mg/kg)
Red	**Extremely toxic**	**1–50**
Yellow	Highly toxic	51–500
Blue	Moderately toxic	501–5000
Green	Slightly toxic	> 5000

- **LD_{50}** – dose killing 50% of test animals (lower = more toxic). **MRL** – maximum residue limit; **PHI** – pre-harvest interval; **waiting period**.
- **Insecticides Act 1968** & Rules 1971; **CIB&RC** (Central Insecticides Board & Registration Committee) – **Faridabad**.

UPDATED 2025-26

Pesticide regulation 2025-26:

- **Draft Pesticides Management Bill, 2025** (released for comments, Jan 2026) – would **replace the Insecticides Act 1968 & Rules 1971**; Central Pesticides Board + Registration Committee; decision on applications within **12 months** (extendable to 18); digital licensing; **mandatory**

accreditation of testing labs; a cancelled molecule = **banned nationwide**; support for **biopesticides and IPM**.

- **Paraquat dichloride** – **draft ban order (13 Jul 2026)** on import, manufacture, sale and use; all registrations to be cancelled.
- **Carbosulfan** (carbamate) – **draft complete ban (Aug 2026)**: "intrinsically highly hazardous", breaks down to **carbofuran**, toxic to birds, pollinators and fish; no antidote.
- **Glyphosate** – use only by **Pest Control Operators** (2022).
- **National Pest Surveillance System (NPSS)** – AI-based pest identification app for farmers (2024).

MEMORY TRICK

Label colours "**R-Y-B-G**" (most → least toxic): **R**ed, **Y**ellow, **B**lue, **G**reen – like a traffic light running down to green = safe-ish.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Red triangle on a pesticide label means? → Extremely toxic (LD_{50} 1–50 mg/kg).
- Egg parasitoid used as Tricho-cards? → *Trichogramma*.
- Green muscardine fungus? → *Metarhizium anisopliae*.
- Antidote for organophosphate poisoning? → Atropine (+ PAM).
- Act proposed to replace the Insecticides Act 1968? → Pesticides Management Bill, 2025.

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6. Horticulture

> **NOTE**
> Horticulture output is now **more than foodgrains**. Questions focus on **varieties & hybrids, propagation, physiological disorders, plant growth regulators, institutes/boards** and the **latest production figures**.

6.1 Horticulture at a Glance (Current Data) ★★★

- **Horticulture** = Latin *hortus* (garden) + *cultura*. Branches: **pomology** (fruits), **olericulture** (vegetables), **floriculture**, landscape gardening, **post-harvest technology**, plantation crops, spices, medicinal & aromatic plants.
- **Golden Revolution** (horticulture, ~1991–2003) – **Dr K.L. Chadha** (father of Indian horticulture growth push). Horticulture ≈ **33% of agri GVA** from ~18% of the area.
- India is the **2nd largest producer of fruits & vegetables** (after China); **1st** in **banana, mango, papaya, lime/lemon, okra (bhindi)**; largest producer of **dry onion (~25% of world)** and of **coconut**.

> **UPDATED 2025-26**
> **Horticulture production – 2nd Advance Estimates 2025-26** (released 17 Jun 2026)

Item	2024-25 (Final)	2025-26 (2nd AE)
Total horticulture	370.74 Mt	**377.78 Mt (record)**
Area	30.14 Mha	30.15 Mha
Fruits	117.65 Mt	**121.48 Mt** (+3.25%)
Vegetables	217.80 Mt	**221.00 Mt**
Onion	30.77 Mt	30.74 Mt
Potato	–	**59.89 Mt**
Tomato	–	**21.46 Mt** (+4.2%)
Spices	–	12.66 Mt
Plantation crops	–	16.93 Mt
Flowers	–	4.58 Mt (+7.5%)

- Horticulture output in **2013-14 was 280.70 Mt** – a ~35% rise in 12 years.
- **Leading states**: **mango – UP**; **grapes – Maharashtra (Nashik)**; **apple – J&K**; **litchi – Bihar**; **onion – Maharashtra**; **potato – UP**; **tea – Assam**; **coffee – Karnataka (~70%)**; **rubber – Kerala**; **saffron – J&K (Pampore)**; **cardamom – Kerala**; **chilli – Andhra Pradesh/Telangana**.

> **PREVIOUSLY ASKED / LIKELY QUESTIONS**
> - Horticulture production 2025-26 (2nd AE)? → 377.78 Mt.
> - India ranks first in the production of? → Banana, mango, papaya, okra (and coconut).
> - Father of the Golden Revolution? → Dr K.L. Chadha.

6.2 Propagation, Nursery & Orchard Management ★★★

- **Sexual (seed)**: papaya, coconut, arecanut, mangosteen (apomictic), most vegetables. **Polyembryony** (nucellar seedlings = true to type): **mango (west-coast types like Olour, Bappakai), citrus, jamun**.

Method	Main fruit crops
Veneer / softwood / epicotyl (stone) grafting	**Mango** (softwood & epicotyl – commercial)
Air layering (gootee / marcottage)	**Litchi**, pomegranate, guava
Stooling / mound layering	**Guava**, apple rootstocks (M & MM series)
Patch budding	**Ber, jamun**
T- (shield) budding	**Rose, citrus**, ber, peach
Cuttings (hardwood)	**Grapes, pomegranate, fig**, rose
Suckers / sword suckers	**Banana** (sword suckers best); pineapple (slips, crown)
Runners	**Strawberry**
Tissue culture (micro-propagation)	**Banana (G-9)**, date palm, orchids, potato

- **Rootstocks**: **apple – Malling (M-9 dwarfing, M-7) & Malling-Merton (MM-106, MM-111)**; **citrus – Rangpur lime, rough lemon, Troyer citrange**; **mango – Olour, Vellaikolamban (dwarfing)**; **grape – Dogridge (salinity/drought)**.
- **Planting systems**: **square** (most common), rectangular, **hexagonal** (~15% more plants), **quincunx (filler plants)**, contour (hills). **HDP (high-density planting)**: mango **Amrapali 2.5 × 2.5 m (1,600 plants/ha)**; banana paired rows; apple on M-9.
- **Training systems**: **open centre (vase)** – peach, plum; **central leader** – apple (HDP); **modified leader**; grapes – **bower/pandal** (S. India),

kniffin, telephone/T-trellis, head system; **espalier**.

- **Pruning**: grapes – **back pruning (Apr) + forward pruning (Oct)** in peninsular India; guava – crop regulation (**bahar treatment**: ambe, mrig, hasta) by withholding water/flower thinning.
- **Fruit-crop terms**: **alternate/biennial bearing** – **mango** (cultivars like Dashehari, Langra), apple; **parthenocarpy** – banana, pineapple, seedless grapes (induced by **GA_3**); **unfruitfulness**; **June drop** (citrus); **apomixis**.

MEMORY TRICK

Propagation "**Mango-Graft, Litchi-Air, Guava-Stool, Ber-Patch, Grape-Cut, Banana-Sucker, Strawberry-Runner**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Commercial propagation of mango? → Softwood/veneer/epicotyl grafting.
- Litchi is propagated by? → Air layering (gootee).
- Dwarfing rootstock of apple? → M-9.
- Bahar treatment is given in? → Guava (also pomegranate).
- Polyembryony is found in? → Mango (west-coast types), citrus.

6.3 Fruit Crops: Varieties & Facts ★★★

Crop	Botanical name / family	Key facts & varieties
Mango ("king of fruits")	*Mangifera indica* – Anacardiaceae	Origin Indo-Burma; **Alphonso** (Maharashtra, GI), Dashehari, Langra, Chausa, **Banganapalli** (AP), Totapuri, Kesar; hybrids **Mallika** (Neelum × Dashehari) & **Amrapali** (Dashehari × Neelum – dwarf, regular bearer) from **IARI**; **Arka Puneet, Arka Anmol** (IIHR); **Pusa Arunima, Pusa Surya**; flowering induced by **paclobutrazol**; **spongy tissue** in Alphonso
Banana	*Musa paradisiaca* – Musaceae	**Grand Naine (G-9)** – tissue culture, most popular; Dwarf Cavendish, **Robusta**, Nendran (Kerala), Poovan, Rasthali; **parthenocarpic, triploid (AAA)**; **NRC Banana – Tiruchirappalli**; Panama wilt, bunchy top
Citrus	*Citrus* spp. – Rutaceae	**Nagpur mandarin (santra)**, Coorg & Khasi mandarin; Kinnow (King × Willow leaf – Punjab); sweet orange **Mosambi**; acid lime **Kagzi lime**; fruit = **hesperidium**; **CCRI – Nagpur**
Guava ("apple of the tropics"; "poor man's apple")	*Psidium guajava* – Myrtaceae	**Allahabad Safeda**, Sardar (L-49), **Lalit**, **Arka Kiran**, Shweta; rich in **vitamin C & pectin**; **wilt** (*Fusarium*)
Grapes	*Vitis vinifera* – Vitaceae	**Thompson Seedless** (most common), Anab-e-Shahi, Bangalore Blue, **Pusa Navrang** (juice, IARI); **NRC Grapes – Pune**; berry size ↑ by **GA_3**; fruit = berry
Papaya	*Carica papaya* – Caricaceae	**Pusa Delicious, Pusa Nanha (dwarf, mutant)**, Pusa Majesty, **Red Lady (Taiwan hybrid)**, Co-2 (papain), **Surya, Arka Prabhat**; **papain** from latex; dioecious/gynodioecious; PRSV
Apple	*Malus domestica* – Rosaceae	**Red Delicious, Royal Delicious**, Golden Delicious, Ambri (Kashmir), Gala, Fuji; low chill **Anna, Dorsett Golden**; needs **1,000–1,500 chilling hours**; **CITH – Srinagar**
Pomegranate	*Punica granatum* – Lythraceae	**Bhagwa** (most popular), Ganesh, **Solapur Lal** (biofortified); **NRC Pomegranate – Solapur**; **bacterial blight** (*Xanthomonas axonopodis* pv. *punicae*); fruit = **balausta**
Litchi	*Litchi chinensis* – Sapindaceae	Shahi (Muzaffarpur GI), China; edible part = **aril**; **NRC Litchi – Muzaffarpur**; fruit cracking (B)

Crop	Botanical name / family	Key facts & varieties
Pineapple	*Ananas comosus* – Bromeliaceae	**Kew, Queen, Mauritius**; CAM plant; flowering induced by **ethrel/NAA/calcium carbide**; fruit = **sorosis**
Ber	*Ziziphus mauritiana* – Rhamnaceae	**Gola, Umran, Seb**; arid zone fruit; **CIAH – Bikaner**
Aonla	*Phyllanthus emblica* – Phyllanthaceae	Richest in **vitamin C** (after Barbados cherry); **NA-7, Krishna, Chakaiya**
Sapota	*Manilkara zapota* – Sapotaceae	**Kalipatti, Cricket Ball**; chicle (chewing gum)
Jackfruit	*Artocarpus heterophyllus* – Moraceae	Largest edible fruit; fruit = **sorosis**
Date palm	*Phoenix dactylifera*	Dioecious; tissue-culture (Barhee); Kutch (Gujarat)
Strawberry	*Fragaria × ananassa*	Runners; edible part = **thalamus** (fruit = etaerio of achenes)

- **Edible parts**: apple, pear – **thalamus (false fruit/pome)**; mango – **mesocarp**; coconut – **endosperm**; litchi – **aril**; banana – **mesocarp + endocarp**; citrus – **juicy hairs (placental)**; guava – whole fruit (berry); pomegranate – **juicy testa**.

MEMORY TRICK

Mango hybrids "**M-N-D, A-D-N**": **M**allika = **N**eelum × **D**ashehari; **A**mrapali = **D**ashehari × **N**eelum.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Amrapali mango is a cross of? → Dashehari × Neelum (dwarf, regular bearing).
- Most popular tissue-culture banana? → Grand Naine (G-9).
- Edible part of litchi? → Aril. Of apple? → Thalamus.
- Kinnow is a cross of? → King × Willow-leaf mandarin.
- Papain is obtained from? → Latex of raw papaya fruit.

6.4 Physiological Disorders & Plant Growth Regulators ★★★

Disorder	Crop	Cause / cure
Black tip	Mango	**Brick-kiln smoke (SO_2, CO, ethylene)**; spray **borax 0.6%**
Spongy tissue	Mango (Alphonso)	Heat/convection near ripening; harvest at 3/4 maturity
Mango malformation	Mango	*Fusarium mangiferae* + mite; **NAA 200 ppm** in Oct
Alternate bearing	Mango, apple	Variety/hormonal; **paclobutrazol (Cultar)** in soil
Fruit cracking	Pomegranate, litchi	Moisture fluctuation, **boron** deficiency
Granulation	Citrus	Juice vesicles dry; late harvest
Bitter pit	Apple	**Ca deficiency**
Internal browning / cork	Apple	**Boron** deficiency
Choke throat	Banana	Low temperature (winter)
Blossom-end rot	Tomato	**Ca deficiency** (irregular watering)
Puffiness	Tomato	Poor pollination, low light, excess N
Buttoning	Cauliflower	**N deficiency**, overaged seedlings
Whiptail	Cauliflower	**Mo deficiency**
Browning / hollow stem	Cauliflower	**B deficiency**
Riceyness	Cauliflower	Hot weather – flower buds visible
Bolting	Onion, cabbage, radish	Premature flowering (cold or long days)
Hollow heart / black heart	Potato	Fast growth / O_2 shortage in storage
Hen & chicken	Grapes	**Zn/B deficiency** – uneven berries

- **Plant growth regulators (PGRs)**:

PGR	Major horticultural use
Auxins – IBA, NAA, IAA, 2,4-D	**IBA – rooting of cuttings**; NAA – prevents pre-harvest drop, **pineapple flowering**, thinning; 2,4-D – fruit drop in citrus
Gibberellins – GA_3	**Seedless grapes – berry size/elongation**; parthenocarpy; breaks dormancy (potato); bolting; malting
Cytokinins – kinetin, BAP	Cell division; tissue culture (shoot); delay senescence

PGR	Major horticultural use
Ethylene – Ethrel/ethephon	**Fruit ripening** (banana, mango), pineapple flowering, female flowers in cucurbits
ABA	Stress/stomatal closure; dormancy – "stress hormone"
Paclobutrazol	GA inhibitor – **regular bearing in mango**, dwarfing
CCC (cycocel)	Growth retardant; dwarfing
Maleic hydrazide	**Sprout suppression in onion & potato** stores
Calcium carbide	Banned for ripening (releases acetylene; FSSAI)

- **Tissue-culture ratio (Skoog & Miller): high auxin : cytokinin → roots; high cytokinin : auxin → shoots.**

MEMORY TRICK

"Black tip = Brick kiln, Bitter pit = Bad calcium, Buttoning = Bad nitrogen, Whiptail = Weak molybdenum".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Black tip of mango is caused by? → Brick-kiln fumes; corrected with borax.
- Chemical used for regular bearing in mango? → Paclobutrazol.
- Rooting hormone for cuttings? → IBA.
- Sprout inhibitor for stored onion/potato? → Maleic hydrazide.
- Bitter pit of apple is due to? → Calcium deficiency.

6.5 Vegetable Crops ★★★

Crop	Family	Key facts & varieties
Tomato	Solanaceae	*Solanum lycopersicum*; **lycopene** (red); **Pusa Ruby, Arka Vikas, Arka Rakshak (triple disease-resistant F_1)**, Pusa Hybrid-1; leaf curl (whitefly); **Tuta absoluta**
Brinjal	Solanaceae	*S. melongena*; origin **India**; **Pusa Purple Long, Arka Kusumakar**; **Bt brinjal** – moratorium in India (**2010**), grown in **Bangladesh**; little leaf
Chilli	Solanaceae	*Capsicum annuum*; pungency – **capsaicin**; colour – **capsanthin**; **Pusa Jwala, G-4 (Guntur)**; AP/Telangana lead; leaf curl (thrips, mites)
Potato	Solanaceae	Tuber = stem; **Kufri** series (CPRI Shimla): **Kufri Bahar, Kufri Jyoti, Kufri Chipsona-1/3 (chips), Kufri Khyati, Kufri Pukhraj**
Onion	Amaryllidaceae (Alliaceae)	*Allium cepa*; pungency – **allyl propyl disulphide**; colour – **quercetin**; **Agrifound Dark Red, Pusa Red, N-53 (kharif), Bhima series** (DOGR – **Rajgurunagar, Pune**); Maharashtra leads (**Lasalgaon** – largest onion market)
Garlic	Alliaceae	Smell – **allicin / diallyl disulphide**; G-41, Agrifound Parvati
Okra (bhindi)	Malvaceae	**Arka Anamika, Parbhani Kranti** (YVMV-resistant); India – largest producer
Cabbage / cauliflower	Brassicaceae	"Cole crops"; **cauliflower – Pusa Snowball (late), Pusa Katki (early)**; cabbage – Golden Acre, Pride of India; cabbage head = **terminal bud**; cauliflower curd = **pre-floral fleshy apical meristem**
Cucurbits	Cucurbitaceae	Monoecious; **ethrel ↑ female flowers**, GA ↑ male; bitter gourd – **momordicin**; cucumber bitterness – **cucurbitacin**; watermelon – **Sugar Baby, Arka Manik**; muskmelon – **Pusa Madhuras, Hara Madhu**
Root crops	–	**Carrot** (Pusa Kesar, Nantes – β-carotene), **radish** (Pusa Chetki, Japanese White), beetroot (**betanin**)
Peas / beans	Fabaceae	**Arkel** (early pea, wrinkled seeded), Bonneville; French bean – Contender
Sweet potato / tapioca	Convolvulaceae / Euphorbiaceae	**CTCRI – Thiruvananthapuram**; tapioca – **HCN (linamarin)**; Sree Visakham

- **Seedless (triploid) watermelon: Pusa Bedana** (IARI). **Parthenocarpic cucumber** for polyhouses: **Pusa Seedless Cucumber-6.**

- **Vegetable seed rate (approx.)**: onion **8–10 kg/ha**; tomato/brinjal/chilli **400–500 g/ha** (hybrid 150–200 g); cauliflower/cabbage **500 g/ha**; okra **8–10 kg/ha**; peas **80–100 kg/ha**.
- **IIVR – Varanasi** (vegetables); **IIHR – Bengaluru** ("Arka" varieties); **IARI** ("Pusa" varieties).

MEMORY TRICK

Pigments & compounds: "**Tomato-Lycopene, Chilli-Capsaicin (hot)/Capsanthin (red), Onion-Allyl propyl disulphide, Garlic-Allicin, Carrot-Carotene, Beet-Betanin, Bitter gourd-Momordicin, Cucumber-Cucurbitacin**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Pungency in chilli is due to? → Capsaicin.
- Red colour of tomato? → Lycopene.
- Seedless watermelon variety from IARI? → Pusa Bedana.
- Directorate of Onion & Garlic Research is at? → Rajgurunagar, Pune.
- Edible part of cauliflower? → Curd (pre-floral apical meristem).

6.6 Plantation Crops, Spices & Floriculture ★★☆

Crop	Facts
Coconut	*Cocos nucifera* (Arecaceae); India **largest producer**; **Kerala, Karnataka, TN, AP**; varieties **West Coast Tall, Chowghat Orange Dwarf**; hybrids **Chandra Sankara, Kera Ganga**; root wilt (Kerala); **CPCRI – Kasaragod**; **Coconut Development Board – Kochi**; World Coconut Day **2 Sep**
Arecanut	*Areca catechu*; Karnataka; **yellow leaf disease**, Koleroga (*Phytophthora*)
Cashew	*Anacardium occidentale*; nut = **true fruit**, apple = **false fruit (swollen peduncle)**; **Vengurla, Ullal** varieties; **DCR – Puttur**; tea mosquito bug
Tea	*Camellia sinensis*; **Assam** largest; "**two leaves and a bud**"; **Tea Board – Kolkata**; caffeine/theine
Coffee	*Coffea arabica* & *C. robusta*; **Karnataka ~70%**; India grows coffee under **shade**; **Coffee Board – Bengaluru**; white stem borer, leaf rust
Rubber	*Hevea brasiliensis*; **Kerala** largest; latex tapping; **Rubber Board – Kottayam**
Cocoa	*Theobroma cacao*; intercrop in coconut/areca; Kerala, Karnataka, AP

- **Spices**: India = "**Land of Spices**"; largest producer, consumer & exporter. **Spices Board – Kochi**; **IISR – Kozhikode**.

Spice	Facts
Black pepper ("king of spices")	*Piper nigrum*; Kerala, Karnataka; **Panniyur-1** (first hybrid); **quick wilt** (*Phytophthora*), slow wilt (nematodes); pungency **piperine**
Cardamom ("queen of spices")	*Elettaria cardamomum*; Kerala (Idukki); **katte** virus; **ICRI – Myladumpara**
Turmeric	*Curcuma longa*; colour **curcumin**; **Telangana, Maharashtra**; **National Turmeric Board – Nizamabad**; Lakadong (Meghalaya – high curcumin)
Ginger	*Zingiber officinale*; pungency **gingerol**; rhizome
Saffron	*Crocus sativus*; **stigma** is used; **J&K (Pampore)**; **National Saffron Mission (2010)**
Chilli	India's largest spice export (by value, along with spice oils)
Clove / nutmeg	Clove – **unopened flower bud**; nutmeg & mace (aril) – same fruit
Seed spices	Cumin, coriander, fennel, fenugreek – **Rajasthan & Gujarat** (NRCSS – **Ajmer**)

- **Floriculture**: rose ("queen of flowers"; **budding**; varieties **Pusa Sonia, Arjun, Raktagandha**), **marigold** (*Tagetes*; lutein; Pusa Narangi Gainda), **tuberose** (Rajanigandha; **Suvasini, Prajwal**), **gerbera, carnation** (protected cultivation), **orchids** – "queen of cut flowers" (Sikkim, NE), **gladiolus** (corms), **chrysanthemum** (short-day; "queen of the East"). Floriculture exports via APEDA; **DFR – Pune** (Directorate of Floricultural Research).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- King of spices? → Black pepper. Queen of spices? → Cardamom.
- Colour of turmeric is due to? → Curcumin.
- In saffron the economic part is? → Stigma.
- Coffee Board is located at? → Bengaluru. Rubber Board? → Kottayam.
- Cashew apple is? → A false fruit (swollen peduncle).

6.7 Protected Cultivation, Post-Harvest & Processing ★★☆

- **Protected cultivation**: polyhouse/greenhouse, **shade-net house** (35–75% shade), **low tunnels**,

plastic mulch, insect-proof net house. **Naturally ventilated polyhouse** is the most common; UV-stabilised **200 micron** polythene. Crops: capsicum, cucumber (parthenocarpic), tomato, gerbera, carnation, rose.

- **Plasticulture**: **black mulch** – weed control & moisture; **silver/reflective mulch** – repels aphids/thrips; **transparent** – soil solarisation.
- **Hydroponics** (soilless, nutrient solution), **aeroponics**, **vertical farming**.
- **Fruit types by ripening**:
  - **Climacteric** (ripen after harvest, ethylene peak): **mango, banana, apple, papaya, guava, sapota, tomato, avocado**;
  - **Non-climacteric**: **citrus, grapes, pineapple, litchi, pomegranate, strawberry, cherry, watermelon**.
- **Post-harvest losses** of fruits & vegetables ≈ **5–15%**.
- **Storage**: **cold storage** (most fruits 0–13 °C; banana **13 °C** – chilling injury below); **CA (controlled atmosphere)** – low O_2, high CO_2 (apple); **zero-energy cool chamber** (Pusa – evaporative cooling, brick double wall); **ripening chambers** with **ethylene 100 ppm**; **1-MCP** delays ripening.
- **Processing**: India processes only ~**2–4%** of fruits & vegetables. **Jam** (fruit pulp, TSS **68.5%**); **jelly** (pectin + acid + sugar, TSS **65%**; **pectin** best from guava, apple, citrus peel); **marmalade** (jelly with peel – citrus); **squash** (25% juice, 40–45% TSS); **RTS** beverage (10% juice); **preservatives** – **KMS (potassium metabisulphite)** for light-coloured products, **sodium benzoate** for coloured products; **FPO (1955) → FSSA 2006/FSSAI**.
- **Irradiation**: low dose (**< 1 kGy**) – sprout inhibition (onion, potato), disinfestation (mango export). Symbol – **Radura**.

MEMORY TRICK

Climacteric "**MAP-BAT-GS**" = **M**ango, **A**pple, **P**apaya, **B**anana, **A**vocado, **T**omato, **G**uava, **S**apota.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Which of these is non-climacteric – banana or grapes? → Grapes.
- Preservative for coloured fruit products? → Sodium benzoate.
- TSS of jam? → 68.5%.
- Zero-energy cool chamber works on? → Evaporative cooling.

6.8 Horticulture Schemes, Boards & Institutes ★★★

- **MIDH (2014-15)** – umbrella for NHM, HMNEH, NHB, **CDB (Coconut Development Board)**, CIH (Nagaland); under **Krishonnati Yojana**; **58 Centres of Excellence** (mostly Indo-Israel).
- **Cluster Development Programme (CDP)** – NHB, **2021**: 55 clusters (12 pilot) – e.g. **mango – Lucknow, Kutch, Mahbubnagar**; **banana – Anantapur, Theni**; **apple – Shopian, Kinnaur**; **grapes – Nashik**; **pomegranate – Solapur**.
- **Clean Plant Programme (Aug 2024)** – ₹1,765.67 cr; **9 Clean Plant Centres** for virus-free planting material.
- **Operation Greens (2018)** – **TOP (tomato, onion, potato)**; extended to all fruits & vegetables ("**TOTAL**", 2020); MoFPI.
- **High-value agriculture (Budget 2026-27)** – coconut promotion scheme, cashew & cocoa programme, sandalwood, nuts in hills.

Board / Institute	Location
National Horticulture Board (NHB, 1984)	**Gurugram**
Coconut Development Board	**Kochi**
Spices Board	**Kochi**
Tea Board	**Kolkata**
Coffee Board	**Bengaluru**
Rubber Board	**Kottayam**
National Turmeric Board (2025)	**Nizamabad**
National Makhana Board (2025)	Bihar
IIHR	**Bengaluru**
CISH (subtropical hort.)	**Lucknow**
CITH (temperate hort.)	**Srinagar**
CIAH (arid hort.)	**Bikaner**
IIVR (vegetables)	**Varanasi**
CPRI (potato)	**Shimla**
CPCRI (plantation crops)	**Kasaragod**
IISR (spices)	**Kozhikode**
CTCRI (tuber crops)	**Thiruvananthapuram**
NRC Banana	**Tiruchirappalli**
NRC Grapes	**Pune**
NRC Litchi	**Muzaffarpur**
NRC Pomegranate	**Solapur**

Board / Institute	Location
CCRI (citrus)	**Nagpur**
DCR (cashew)	**Puttur**
DOGR (onion & garlic)	**Rajgurunagar (Pune)**
DFR (floriculture)	**Pune**
DMAPR (medicinal & aromatic plants)	**Anand (Gujarat)**

PREVIOUSLY ASKED / LIKELY QUESTIONS

- NHB headquarters? → Gurugram.
- CISH is located at? → Lucknow.
- Operation Greens originally covered? → Tomato, onion, potato (TOP).
- NRC Banana is at? → Tiruchirappalli.

Nandyal Banking Coaching Center

7. Animal Husbandry & Dairy

NOTE

High-yield areas: **breeds & their home tracts**, **milk composition**, **diseases (cause, vaccine)**, **livestock statistics** and **DAHD schemes** (Rashtriya Gokul Mission, NPDD, NLM, AHIDF, NADCP).

7.1 Livestock Statistics (Latest) ★★★

UPDATED 2025-26

Basic Animal Husbandry Statistics (2024-25)

Item	2024-25	Notes
Milk	**247.87 Mt** (~248 Mt)	**World's largest** (~25% of world); +3.58%; was 146.3 Mt in 2014-15
Per-capita milk availability	**485 g/day**	World average ~394 g/day
Eggs	**149.11 billion**	**2nd in world**; 106 eggs/person/yr; top state **Andhra Pradesh**
Meat	**10.50 Mt**	**4th in world**
Wool	34.57 million kg	**Rajasthan ~48%**
Bovine productivity	**2,251 kg/animal /yr**	Indigenous cattle 1,343 kg; buffalo 2,365 kg

- **Top milk states**: **UP > Rajasthan > MP > Gujarat > Maharashtra**. Highest per-capita availability: **Punjab**, then Rajasthan, Haryana.
- **Milk share by species**: **buffalo and crossbred cattle ~31–32% each**, indigenous/non-descript cattle ~20%, goat ~3%.
- Livestock sector **CAGR ~12.8% (current prices) since 2014-15**; livestock ≈ **16% of farm income**; **~5.5% of total GVA** and **~31% of agri GVA**.
- **20th Livestock Census (2019)**:
  - total livestock **535.78 million (+4.6% over 2012)**; **bovines ~303 million**;
  - cattle **192.5 M**, buffalo **109.9 M**, goats **148.9 M**, sheep **74.3 M**, pigs 9.1 M; **poultry 851.8 M (+16.8%)**.
  - State-wise: **UP** has the most livestock; **West Bengal** the most cattle; **UP** buffalo; **Rajasthan** goats; **Telangana** sheep; **Assam** pigs; **Tamil Nadu** poultry.
- **21st Livestock Census** – conducted **Oct 2024 – Feb 2025**: **first fully digital** census (mobile app), covers **16 species and 219 indigenous breeds** (ICAR-NBAGR) plus poultry; also counts pastoralists. Done every **5 years** (first in **1919-20**).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Milk production of India in 2024-25? → 247.87 Mt (~248 Mt).
- Per-capita milk availability? → 485 g/day.
- India's rank in egg production? → 2nd.
- Which bovine gives the highest milk fat (buffalo or cow)? → Buffalo (~6.5–7%).
- State with the most goats (20th census)? → Rajasthan.

7.2 Cattle & Buffalo Breeds ★★★

- **India has 219+ registered indigenous breeds** across species (ICAR-**NBAGR, Karnal**): cattle **53**, buffalo **20**, goat **39**, sheep **46**, chicken **20+** (numbers grow every year as new breeds are registered).

Type	Cattle breeds	Home tract / feature
Milch	**Sahiwal**	Punjab (Montgomery, Pak.) – best indigenous dairy breed
Milch	**Gir**	Gujarat (Gir forest) – **domed forehead, pendulous ears**
Milch	**Red Sindhi**	Sindh (Pakistan) – red colour, tick resistant
Milch	**Tharparkar** (dual)	Rajasthan (Thar) – white/grey; drought hardy
Draught	**Nagori, Hallikar, Amritmahal, Khillar, Kangayam, Siri, Ponwar, Bargur**	Rajasthan; Karnataka; Karnataka; Maharashtra; TN; Sikkim/Darjeeling; UP; TN
Dual purpose	**Hariana, Ongole, Kankrej, Tharparkar, Deoni, Rathi**	Haryana; **AP (Nellore)**; **Gujarat** (fastest draught breed, "sawai chal"); Rajasthan; Maharashtra; Rajasthan (Bikaner)
Miniature	**Vechur** (Kerala – smallest cattle, GI), **Punganur** (AP – dwarf)	–

- **Exotic dairy breeds**: **Holstein-Friesian** (Netherlands – **highest milk yield**, lowest fat ~3.5%), **Jersey** (Jersey Island, UK – **highest fat ~5%**, smallest exotic, heat tolerant), Brown Swiss, Guernsey, Ayrshire.
- **Crossbreds**: **Karan Swiss** (Brown Swiss × Sahiwal), **Karan Fries** (HF × Tharparkar) – **NDRI Karnal**; **Sunandini** (Kerala), **Frieswal** (HF × Sahiwal – Military Dairy Farms & ICAR).

Buffalo breed	Home tract / feature
Murrah	**Haryana (Rohtak)** – best dairy buffalo; tightly **curled horns**; "black gold"
Nili-Ravi	Punjab – **wall eyes** (white in eyes)
Jaffarabadi	Gujarat (Saurashtra) – **heaviest**, drooping horns
Surti	Gujarat – **sickle-shaped horns**, highest fat %
Mehsana	Gujarat – Murrah × Surti
Bhadawari	UP/MP – **highest milk fat (up to 13%)**
Toda	Nilgiris (TN) – tribal buffalo
Chilika	Odisha – brackish water

- **India has the largest buffalo population** in the world (~57%).
- **Cattle facts**: gestation **~280–285 days** (buffalo **~310 days**); oestrous cycle **21 days**; heat lasts **18–24 hours**; best time for **AI – mid to end of heat (a.m.–p.m. rule)**; age at first calving ~30–36 months (exotic/crossbred earlier).

MEMORY TRICK

"**Sahiwal-Gir-Sindhi-Thar**" = top 4 milch breeds (**S-G-S-T**). Murrah = "**M**ost **M**ilk buffalo"; Bhadawari = "**B**utterfat **B**uffalo".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Best indigenous dairy breed of cattle? → Sahiwal.
- Home tract of Ongole cattle? → Andhra Pradesh (Nellore/Prakasam).
- Smallest cattle breed? → Vechur (Kerala).
- Buffalo breed with the highest milk fat? → Bhadawari.
- Karan Fries is a cross of? → Holstein-Friesian × Tharparkar.

7.3 Small Ruminants, Pigs, Poultry & Others ★★☆

Species	Important breeds	Key facts
Goat ("poor man's cow")	**Jamunapari** (UP – tallest, Roman nose, milch), **Beetal** (Punjab), **Barbari** (UP – stall-fed), **Black Bengal** (WB – meat, prolific, **best skin**), **Sirohi**, Osmanabadi, **Changthangi** (Ladakh – **pashmina**)	Gestation **~150 days**; CIRG – **Makhdoom (Mathura)**
Sheep	**Nellore** (AP – tallest, meat), **Marwari** (carpet wool), **Chokla** (finest carpet wool – "merino of India"), **Deccani**, **Garole** (WB – **FecB gene, prolific**), **Avikalin, Bharat Merino** (CSWRI)	Gestation **~150 days**; CSWRI – **Avikanagar (Rajasthan)**
Pig	**Large White Yorkshire** (exotic), Landrace, **Ghungroo** (WB), Niang Megha	Gestation **114 days (3-3-3)**; NRC Pig – **Guwahati**
Poultry	Indigenous: **Aseel** (fighter, best meat), **Kadaknath** (MP – **black meat**, GI), Chittagong, Naked Neck; improved: **Vanaraja, Gramapriya, Giriraja, Kalinga Brown**; exotic layer **White Leghorn**, broiler **Cornish, Plymouth Rock**	Incubation **21 days (chicken)**; duck/turkey 28 days; quail 17–18 days; **CARI – Izatnagar**
Camel	**Bikaneri, Jaisalmeri, Kachchhi, Kharai (swimming camel, Gujarat)**	NRC Camel – **Bikaner**; Rajasthan state animal
Mithun	*Bos frontalis* – NE (Arunachal, Nagaland)	NRC Mithun – **Medziphema (Nagaland)**
Yak	Ladakh, Arunachal, Sikkim	NRC Yak – **Dirang (Arunachal)**
Horse/donkey	**Marwari, Kathiawari** (inward-curving ears), Zanskari; Halari donkey	NRC Equines – **Hisar**

- **Gestation periods**: cow 280; buffalo 310; **mare 340**; sheep/goat 150; **sow 114**; **camel ~390 days (longest)**; rabbit **31 days**; elephant ~640 days.
- **Poultry**: layer starts ~**18–20 weeks**; broiler ready in **5–6 weeks** (~2 kg); FCR (broiler) ≈ **1.6–**

1.8; egg weight ~55–60 g; **egg = 11–13% shell, 58% albumen, 31% yolk**.

MEMORY TRICK

Gestation "**114 (pig) – 150 (goat/sheep) – 280 (cow) – 310 (buffalo) – 340 (mare)**" → "**Pigs Get Cows Busy Mating**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Black-meat chicken breed? → Kadaknath.
- Prolific sheep breed with the FecB gene? → Garole.
- Gestation period of a sow? → 114 days.
- Pashmina comes from which goat? → Changthangi.
- CIRG (goats) is located at? → Makhdoom, Mathura.

7.4 Milk, Dairy Technology & Products ★★★

- **Milk composition (cow)**: water **~87%**, **fat ~4%**, protein ~3.3% (**casein ~80%** of protein), **lactose ~4.8%** (milk sugar), ash ~0.7%; **SNF ~8.5–9%**. **Buffalo milk fat ~6.5–7%** (higher fat & SNF, no carotene → white colour).
- **Colour**: cow milk **yellowish – β-carotene**; whey – **greenish yellow – riboflavin**.
- **Milk pH ~6.6–6.8**; specific gravity **1.028–1.032** (lactometer); freezing point **–0.525 to –0.55 °C** (detects added water).
- **Colostrum** – first milk after calving; rich in **immunoglobulins**, vitamin A; feed within **1 hour** of birth, ~10% of body weight/day.
- **FSSAI milk standards (min.)**: **cow milk fat 3.0–4.0%, SNF 8.5%**; **buffalo fat 5.0–6.0%, SNF 9.0%**; **toned milk 3.0% fat, 8.5% SNF**; **double toned 1.5% fat, 9.0% SNF**; **standardised 4.5% fat, 8.5% SNF**; **full cream 6.0% fat, 9.0% SNF**; **skimmed < 0.5% fat**.
- **Pasteurisation**:
  - **LTLT (holder) – 63 °C for 30 min**;
  - **HTST (flash) – 72 °C for 15 s**;
  - **UHT – 135–150 °C for 2–4 s** (aseptic packing, long shelf life);
  - index organism: ***Coxiella burnetii***; test: **alkaline phosphatase test**.
- **Milk tests**: **MBRT (methylene blue reduction)** – bacterial quality; **COB (clot-on-boiling)**; Gerber test – fat; lactometer – density.
- **Dairy products**:

Product	Fat %	Note
Ghee	**99.5%+**	Moisture < 0.5%; adulteration test – **Baudouin test** (vanaspati, sesame oil)
Butter	**80%**	Table butter
Khoa	~20–25%	Heat-desiccated milk; **pindi, dhap, danedar**
Paneer	> 50% (dry matter)	Acid–heat coagulation (citric acid)
Cheese	–	**Rennet (chymosin)** coagulation; cheddar, mozzarella
Dahi / yoghurt	–	*Lactobacillus bulgaricus* + ***Streptococcus thermophilus***
Ice cream	10%+	Overrun 80–100%

- **Bulk milk cooler (BMC)** cools milk to **4 °C**; milk should be chilled within ~2 hours.
- **A1 vs A2 milk** – β-casein variant; indigenous cows/buffalo give **A2**.

MEMORY TRICK

Pasteurisation "**63-30, 72-15**" → LTLT 63 °C/30 min; HTST 72 °C/15 sec.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- HTST pasteurisation temperature and time? → 72 °C for 15 seconds.
- Main protein of milk? → Casein.
- Yellow colour of cow milk is due to? → β-carotene.
- Fat content of toned milk (FSSAI)? → 3.0% (SNF 8.5%).
- Test for pasteurisation efficiency? → Alkaline phosphatase test.

7.5 Animal Nutrition, Breeding & Health ★★★

- **Feeding**: maintenance + production ration; **dry matter intake ~2.5–3% of body weight**; **~1 kg concentrate per 2.5 kg milk** (cow) / per 2 kg (buffalo). **Green fodder – berseem ("king of fodders")**, **lucerne ("queen of fodders")**, maize, sorghum, **napier/hybrid napier (CO-4, CO-5)**, cowpea. **Silage** (anaerobic fermentation; pH ~4;

lactic acid), **hay** (dried to ~15% moisture). **Urea-molasses mineral block (UMMB)**; **urea treatment of straw (4%)**. Fodder deficit: green ~11–12%, dry ~23% (IGFRI).

- **Ruminant stomach**: **rumen (largest, ~80%) – reticulum – omasum – abomasum ("true stomach")**. Calves: oesophageal groove.
- **Breeding**: **artificial insemination (AI)** – frozen semen in **liquid nitrogen (–196 °C)**; **sex-sorted semen** (≈ 90% female calves); **ET (embryo transfer)**, **IVF**; **progeny testing**; **cross-breeding**, **grading up**; **in-breeding**. **Ovsynch** – timed AI.
- **Housing**: **loose housing** (common in India); floor space **~3.5 m² (covered)** per cow; head-to-head / tail-to-tail stalls.

Disease	Cause	Key facts / vaccine
FMD (foot-and-mouth)	**Virus (Aphthovirus)**	Vesicles on mouth/feet; drop in milk; **NADCP** – vaccination every 6 months
HS (haemorrhagic septicaemia)	Bacteria – ***Pasteurella multocida***	Monsoon; buffaloes; "galghotu"
Black quarter (BQ)	***Clostridium chauvoei***	Young cattle; crepitating swelling
Anthrax	***Bacillus anthracis***	Sudden death; tarry blood from orifices; **zoonotic**; don't open carcass
Brucellosis	***Brucella abortus***	**Abortion in 3rd trimester**; zoonotic; **S-19 vaccine** for female calves **4–8 months**
Mastitis	Bacteria (*Staph., Strep.*)	Udder inflammation; **CMT (California Mastitis Test)**; most costly dairy disease
Lumpy skin disease (LSD)	**Capripox virus**	Vectors – flies, mosquitoes, ticks; outbreak 2022; **Lumpi-ProVacInd** (ICAR-NRCE Hisar) & goat-pox vaccine
Theileriosis / babesiosis	**Protozoa** (tick-borne)	Fever; red urine (babesiosis)
Milk fever	**Hypocalcaemia**	After calving; **calcium borogluconate** IV
Ketosis	Low blood glucose	High yielders; sweet breath
Bloat / tympany	Gas in rumen	Legume overfeeding (lucerne, berseem)
PPR ("goat plague")	Morbillivirus	Sheep & goats; eradication target **2030**
Ranikhet (Newcastle)	Virus	Poultry; **F1/Lasota & R2B vaccines**
Bird flu (HPAI H5N1)	Influenza A	Poultry culling within 1 km
ASF (African swine fever)	Asfivirus	Pigs; up to **100% mortality**; first in India **2020** (NE)
Rinderpest	Virus	**Eradicated** (India free 2006; world 2011)

- **India is free of**: rinderpest, **CBPP**, **AHS**; targets FMD-free by **2030** (vaccination) and brucellosis control.

UPDATED 2025-26

India's first indigenous African Swine Fever vaccine – **live attenuated** (Genotype II, gene-deleted) by **ICAR-NIHSAD, Bhopal** (Aug 2026). Lumpy skin vaccine **Lumpi-ProVacInd** (ICAR-NRCE Hisar & IVRI). **Budget 2026-27**: loan-linked capital subsidy to add **20,000+ veterinary professionals**; credit-linked subsidy and Livestock FPOs.

MEMORY TRICK

Bacterial diseases "**HS-BQ-Anthrax-Bru**" = **H**aemorrhagic septicaemia (*Pasteurella*), **B**lack **Q**uarter (*Clostridium*), **A**nthrax (*Bacillus*), **Bru**cellosis (*Brucella*). FMD, LSD, PPR, Ranikhet = viral.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- King of fodders? → Berseem.
- Milk fever is due to? → Hypocalcaemia.
- Brucellosis vaccine and age? → S-19, female calves 4–8 months.
- Causal agent of HS? → *Pasteurella multocida*.
- Indigenous vaccine for lumpy skin disease? → Lumpi-ProVacInd.
- True stomach of ruminants? → Abomasum.

7.6 Dairy Development, Cooperatives & DAHD Schemes ★★★

- **Operation Flood (1970–96)** – **NDDB** (est. **1965, Anand**); **Dr Verghese Kurien** – "Father of the White Revolution"; **National Milk Day – 26 Nov** (his birthday). **AMUL** (1946, Anand – Tribhuvandas Patel) – **ranked No. 1 cooperative in the world (ICA)**; ~36 lakh farmer members.

- **Anand pattern** – 3-tier: **village DCS → district union → state federation**. Network: **22 milk federations, 241 district unions**; **~1.72 crore** farmers; women ≈ **70%** of dairy workforce.

Scheme	Year	Key features
Rashtriya Gokul Mission (RGM)	**2014** (revised **Mar 2025**)	Conserve & develop **indigenous breeds**; **outlay ₹3,400 cr (2021-26)** after +₹1,000 cr; **National AI Programme** (free doorstep AI – **14 crore+ inseminations**); **sex-sorted semen** (> 1 crore doses); **22 IVF labs**; **MAITRIs**; **Gokul Grams**; **Gopal Ratna Awards**; one-time **35% assistance for heifer-rearing centres**; **3% interest subvention for IVF heifers**
NPDD (National Programme for Dairy Development)	2014-15 (restructured 2021)	**Component A** – chilling & milk-testing infrastructure; **Component B – "Dairying through Cooperatives"** (JICA-assisted)
White Revolution 2.0	**25 Dec 2024** (2024-25 to 2028-29)	Ministry of Cooperation + DAHD; **75,000 new dairy cooperatives** + strengthen 46,422; procurement **1,007 lakh kg/day** by 2028-29; 3 multi-state societies (cattle feed, organic manure/biogas, hides)
NLM (National Livestock Mission)	**2014-15** (revised 2021)	**Entrepreneurship** – **50% capital subsidy** for poultry (up to ₹25 lakh), sheep & goat (₹50 lakh), pig (₹30 lakh), fodder/silage (₹50 lakh); breed improvement; **livestock insurance**
AHIDF	**2020**	₹15,000 cr fund (DIDF merged → **₹29,110 cr** to 2025-26); **3% interest subvention**; dairy, meat, feed, vaccine plants
LHDCP (Livestock Health & Disease Control Programme)	Revised **Mar 2025** (₹3,880 cr, 2024-26)	**NADCP** (FMD & brucellosis vaccination, 100% central), **Mobile Veterinary Units (1962 helpline)**, **Pashu Aushadhi** (generic vet medicines)
NADCP	**Sep 2019** (Mathura)	**FMD & brucellosis** control; FMD by 2025 → eradicate by **2030**
KCC for AH & fisheries	**2018-19**	Up to **₹2 lakh** within KCC; interest subvention
Bharat Pashudhan / INAPH	2023-24	Digital livestock database; **12-digit ear tag (Pashu Aadhaar)**

- **Pashu Kisan Credit Card** – Haryana state scheme (2020). **Gaushala/fodder**: **IGFRI – Jhansi**.
- **Institutes**: **NDRI – Karnal** (deemed university), **IVRI – Izatnagar (Bareilly)**, **NBAGR – Karnal**, **CIRB (buffalo) – Hisar**, **CIRC (cattle) – Meerut**, **NRCE (equines) – Hisar**, **CARI – Izatnagar**, **CSWRI – Avikanagar**, **CIRG – Makhdoom**, **NIHSAD – Bhopal** (high-security animal diseases), **NIANP – Bengaluru**, **NDDB – Anand**.

MEMORY TRICK

DAHD schemes "**G-N-N-A-L**": **G**okul (breeds), **N**PDD (dairy infra), **N**LM (entrepreneurship 50%), **A**HIDF (infra fund 3%), **L**HDCP (health/NADCP).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Revised outlay of Rashtriya Gokul Mission (2021-26)? → ₹3,400 crore.
- Target of White Revolution 2.0? → 75,000 new dairy cooperatives.
- Capital subsidy under NLM entrepreneurship? → 50%.
- Helpline number for Mobile Veterinary Units? → 1962.
- NDDB was set up in? → 1965, Anand.

8. Agricultural Economics & Extension

> **NOTE**
> Economics: **cost concepts, laws of returns, marketing terms, Acts & institutions, WTO boxes, land holdings**. Extension: **history of programmes (year + person), adoption & communication models, KVK/ATMA**.

8.1 Indian Agriculture: Key Economic Facts ★★★

- Agriculture & allied ≈ **one-fifth of national income** (current prices); growth averaged **~4.4%** over the last 5 years. Provisional estimates (new base year **2022-23**) put agri GVA growth at **3.0% in 2025-26**.
- Agriculture employs about **46% of the workforce** (PLFS) – disguised unemployment is high.
- **Land holdings – Agriculture Census 2015-16 (10th; latest published)**:
  - **146.45 million** operational holdings; **average size 1.08 ha** (2.28 ha in 1970-71);
  - **marginal (< 1 ha) 68.5%**, **small (1–2 ha) 17.6%** → **small + marginal ≈ 86%** of holdings but only ~47% of the area;
  - **women-operated holdings 13.9%**;
  - **largest number of holdings – UP**; largest average size – **Nagaland**, then Punjab.
- **11th Agriculture Census (2021-22)**: field work for all **3 phases completed** (first done digitally, with tablets/smartphones); results awaited. The census is held every **5 years** (first in **1970-71**).

Size class	Area	Share of holdings (2015-16)
Marginal	< 1 ha	68.5%
Small	1–2 ha	17.6%
Semi-medium	2–4 ha	9.5%
Medium	4–10 ha	3.8%
Large	> 10 ha	0.6%

- **Farm income**: **SAS 2019 (NSS 77th round)** – average monthly income of agricultural households **₹10,218**; **NAFIS 2021-22** – **₹13,661**.
- **Land use**: geographical area **328.7 Mha**; reporting area ~305 Mha; **net sown area ~141 Mha (~46%)**; gross cropped area **~219 Mha**; cropping intensity **~155%**; net irrigated ~**55%** of net sown area.

> **PREVIOUSLY ASKED / LIKELY QUESTIONS**
> - Average size of operational holdings (2015-16)? → 1.08 ha.
> - Share of small & marginal holdings? → ~86%.
> - Agriculture Census is conducted every? → 5 years (first 1970-71).
> - Net sown area of India? → ~141 Mha.

8.2 Farm Management & Production Economics ★★★

- **Farm management** – how farmers organise land, labour and capital for maximum profit. Tools: farm records, **budgeting** (complete & **partial budgeting**), **linear programming** (Dantzig, 1947), farm planning.
- **Laws of returns**:
  - **Increasing returns** (MP rising);
  - **Constant returns**;
  - **Diminishing returns** – most common in agriculture (**Law of Diminishing Marginal Returns** / variable proportions).
- **Three stages of production**:
  - **Stage I** – irrational (MP > AP);
  - **Stage II – rational zone** (from **AP max** to **MP = 0**);
  - **Stage III** – irrational (MP negative).
- **Three relationships**:

Relationship	Question answered	Optimum condition	Tools
Factor–product	How much input to use?	**MVP = price of input** (MPP = Px/Py)	Production function
Factor–factor	How to produce? (least-cost input mix)	**MRTS = price ratio of inputs**	**Isoquant, isocost, isocline, expansion path**
Product–product	What to produce?	**MRPS = price ratio of products**	**Production possibility curve, iso-revenue line**

- **Product relationships**: **competitive** (wheat–mustard on the same land), **complementary** (legume + cereal), **supplementary** (poultry with

crops), **joint** (wheat grain & straw, cotton lint & seed).

- **Principles**: **opportunity cost**; **equi-marginal returns** (allocate limited capital where marginal returns are equal); **comparative advantage**; **substitution**; **time comparison** (discounting – NPV, compounding).
- **Cost concepts (CACP)**:

Cost	Includes
A1	All **paid-out** costs: hired labour, bullock/machine, seed, fertiliser, manure, pesticides, irrigation, land revenue, interest on working capital, depreciation
A2	**A1 + rent paid for leased-in land**
A2 + FL	A2 + **imputed value of family labour → MSP benchmark (≥ 1.5 × A2+FL since 2018-19)**
B1	A1 + interest on owned fixed capital (excluding land)
B2	B1 + rental value of owned land + rent paid for leased land
C1	B1 + imputed family labour
C2	**B2 + imputed family labour** (comprehensive cost – **Swaminathan Commission: MSP = C2 + 50%**)
C2	C2 with labour valued at statutory/market wage
C3	C2 + ***10% for managerial input*** *of the farmer*

- **Farm efficiency measures**: **cost of cultivation (per ha)** vs **cost of production (per quintal)**; **gross income**, **farm business income**, **family labour income**, **net income**; **BCR (B:C ratio)**; **input-output ratio**.
- **Returns to scale**: increasing / constant / decreasing (all inputs changed together). **Cobb–Douglas** production function (Y = aX^b; b = elasticity).

MEMORY TRICK

Cost ladder: "**A1 → A2 (+rent) → A2+FL (+family labour, MSP) → B (+own capital & land) → C2 (Swaminathan) → C3 (+10% management)**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Rational stage of production? → Stage II (AP max to MP = 0).
- Cost concept used for fixing MSP? → A2 + FL (MSP ≥ 1.5 times).
- Swaminathan Commission recommended MSP at? → C2 + 50%.
- Tool for least-cost combination of inputs? → Isoquant & isocost (MRTS = price ratio).
- Wheat grain and straw are? → Joint products.

8.3 Agricultural Marketing & Price Policy ★★★

- **Marketed surplus** = quantity **actually sold**; **marketable surplus** = total production – farm family needs (seed, feed, consumption, wages in kind). Small farmers often show **distress sale** (marketed > marketable).
- **Price spread** = consumer price – farmer price; **producer's share in consumer rupee**. Marketing efficiency – **Shepherd's formula**: ME = V/I – 1 (V = value of goods sold, I = marketing cost).
- **Marketing functions**: **exchange** (buying, selling), **physical** (storage, transport, processing), **facilitating** (grading, financing, risk-bearing, market information).
- **Markets**: **primary/rural (haats)**, **secondary/wholesale (mandis)**, **terminal** (export/large city), **regulated markets** (APMC), **cooperative markets**, **futures/forward**, **contract farming**.
- **Grading & standardisation**: **AGMARK** – **Agricultural Produce (Grading & Marking) Act 1937**; **DMI (Directorate of Marketing & Inspection) – Faridabad**.

Act / institution	Year	Fact
Royal Commission on Agriculture	**1928**	Led to regulated markets and ICAR (1929)
First regulated market	**1886**	**Karanja (Hyderabad Residency)** – cotton
AGMARK Act	**1937**	Grading & marking
NAFED	**1958**	Procurement of pulses/oilseeds (PSS)
NCDC	**1963**	Cooperative development finance
FCI	**1965** (Food Corporations Act 1964)	Procurement, storage, PDS; **L.K. Jha Committee**
CACP	**1965** (as Agricultural Prices Commission)	Recommends MSP for **22 crops** + FRP for sugarcane
CWC (Central Warehousing Corporation)	**1957**	Warehousing
Model APMC Act	**2003**	Private markets, direct marketing, contract farming

Act / institution	Year	Fact
Model APLM Act	**2017**	Agricultural Produce & Livestock Marketing; whole state as one market
Model Contract Farming Act	**2018**	Contract farming & services
3 Farm Laws	2020 → **repealed Nov 2021**	–
e-NAM	**14 Apr 2016**	1,656 mandis; 247 commodities
Operation Greens	2018	TOP → TOTAL

- **MSP**: announced for **22 mandated crops** (14 kharif, 6 rabi, 2 commercial) + toria & de-husked coconut; **FRP for sugarcane** (₹365/q for 2026-27); CACP considers cost (A2+FL, C2), demand–supply, inter-crop parity, terms of trade, world prices.
- **Buffer stock norms (FCI)**: rice + wheat; operational & strategic reserve; **OMSS** (open market sale scheme) to cool prices.
- **Food security**:
  - **NFSA 2013** – **75% rural and 50% urban** population;
  - **5 kg grain/person/month**; **AAY – 35 kg/household**;
  - **PMGKAY** – **free foodgrains** to ~81 crore people, extended for **5 years from 1 Jan 2024**;
  - eldest woman is head of household for ration cards;
  - **One Nation One Ration Card** (2019).
- **WTO – Agreement on Agriculture (1995)**:
  - **Amber box** – trade-distorting support (MSP, input subsidies); **de minimis 10%** of value of production for developing countries (5% developed);
  - **Blue box** – production-limiting payments;
  - **Green box** – minimal distortion (research, extension, PM-KISAN-type income support, PDS stocks);
  - **Peace clause** (Bali, 2013) protects India's public stockholding.
- **Terms of trade** (agri vs non-agri prices); **cobweb theorem** – price/output cycles (e.g. onion, potato); **Engel's law** – share of income spent on food falls as income rises; **Gini coefficient / Lorenz curve** – inequality.

MEMORY TRICK

WTO boxes "**Amber = Alarm (distorting, capped), Blue = Bounded (production-limiting), Green = Go (allowed)**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Difference between marketed and marketable surplus? → Marketed = actually sold; marketable = surplus left after family needs.
- AGMARK is under which Act? → Agricultural Produce (Grading & Marking) Act, 1937.
- NFSA coverage? → 75% rural, 50% urban.
- MSP falls in which WTO box? → Amber box.
- Year CACP was set up? → 1965.

8.4 Agricultural Statistics (Basics) ★☆☆

- **Central tendency**: mean, **median** (middle value), **mode** (most frequent). For moderately skewed data: **Mode = 3 Median – 2 Mean**.
- **Dispersion**: range, **standard deviation**, variance (SD^2), **coefficient of variation (CV) = SD/mean × 100** (compares variability; CV < 20% acceptable in field trials).
- **Skewness**: positive – mean > median > mode; negative – mean < median < mode. **Kurtosis** – peakedness (leptokurtic, mesokurtic, platykurtic).
- **Correlation (r)** ranges **–1 to +1**; **regression** – predicts Y from X; **r^2 = coefficient of determination**.
- **Experimental designs (R.A. Fisher – principles: replication, randomisation, local control)**: **CRD** (homogeneous conditions – labs/pots), **RBD** (one-way heterogeneity – most common in field trials), **LSD** (two-way heterogeneity; rows = columns = treatments), **split-plot**. **ANOVA**, **F-test** (variances), **t-test** (two means), **chi-square** (goodness of fit/independence).
- **Sampling**: simple random, stratified, systematic, cluster, multi-stage. **Crop cutting experiments (CCE)** – used for yield estimation (≈ 5 m × 5 m plots; basis of PMFBY claims, along with YES-TECH).

PREVIOUSLY ASKED / LIKELY QUESTIONS

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- Design used when the field has heterogeneity in one direction? → RBD.
- Coefficient of variation formula? → SD/mean × 100.
- Father of modern statistics/experimental design? → R.A. Fisher.

8.5 Extension Education: Concepts, Methods & Adoption ★★★

- **Extension** – "education for rural people outside the classroom"; Latin *ex* (out) + *tensio* (stretching). **Father of extension – Seaman A. Knapp (USA)**; **Smith–Lever Act 1914** (USA cooperative extension).
- **Principles**: interest & needs, grass-roots, **learning by doing**, participation, adaptability, satisfaction, cultural difference, leadership, trained specialists, whole family, evaluation.
- **Extension teaching methods**:

Method type	Examples	Reach / cost
Individual	Farm & home visits, office calls, personal letters, **result demonstration**	Most effective, high cost
Group	**Method demonstration**, group meetings, **field days**, tours, **kisan goshthi**, training, **Farmer Field School (FFS)**	Medium
Mass	Radio, TV, **Kisan Call Centre (1800-180-1551)**, newspapers, exhibitions, **kisan melas**, mobile apps, social media	Widest reach, low cost per person

- **Method demonstration** – shows **how to do** (skill: e.g. seed treatment, grafting). **Result demonstration** – shows **what can be done** (proves the worth of a practice; long duration). Result demonstration was introduced by **Seaman Knapp**.
- **Dale's Cone of Experience** – most concrete (**direct purposeful experience**) at the base → most abstract (**verbal symbols**) at the top. "**Learning by doing**" is best.
- **Communication models**: **Aristotle** (speaker–speech–audience); **Shannon & Weaver (1949)** – mathematical model with **noise**; **Berlo (1960) – SMCR (Source–Message–Channel–Receiver)**; **Leagans (1961)** – communicator, message, channel, treatment, audience, response; **Schramm** – field of experience.
- **Adoption process (Rogers & Beal, 1955)**: **Awareness → Interest → Evaluation → Trial → Adoption** (A-I-E-T-A). **Innovation–decision process (Rogers, 1983)**: **Knowledge → Persuasion → Decision → Implementation → Confirmation**.

Adopter category (Rogers)	% of people	Trait
Innovators	**2.5%**	Venturesome
Early adopters	**13.5%**	Respected, **opinion leaders**
Early majority	**34%**	Deliberate
Late majority	**34%**	Sceptical
Laggards	**16%**	Traditional

- **Diffusion** of an innovation follows an **S-shaped curve**; attributes that speed adoption: relative advantage, compatibility, low complexity, trialability, observability.
- **Leadership**: **opinion leaders** (informal, local); **sociometry** (J.L. Moreno) to identify leaders.
- **PRA (Participatory Rural Appraisal)** – Robert Chambers; tools: **social & resource maps, seasonal calendar, transect walk, Venn diagram, matrix ranking**. **RRA** came before PRA.

MEMORY TRICK

Adoption "**AIETA**" = "**A**ll **I**ndian **E**xtension **T**eams **A**dopt"; adopter % "**2.5-13.5-34-34-16**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Which demonstration shows "how to do"? → Method demonstration.
- SMCR model of communication was given by? → Berlo.
- Percentage of innovators? → 2.5%.
- Stages of adoption? → Awareness, interest, evaluation, trial, adoption.
- Father of extension? → Seaman A. Knapp.

8.6 Extension Programmes in India (Timeline) ★★★

Year	Programme	Person / place / feature
1903	Rural reconstruction	**Christian Missionaries**
1920	**Gurgaon Experiment**	**F.L. Brayne** (Deputy Commissioner)

Year	Programme	Person / place / feature
1921	**Sriniketan**	**Rabindranath Tagore** (Visva-Bharati)
1921	**Marthandam (Kerala)**	**Spencer Hatch** (YMCA) – "beehive" motto
1932	**Baroda Rural Reconstruction**	**V.T. Krishnamachari**
1943	**Grow More Food Campaign**	After Bengal famine
1946	**Firka Development** (Madras)	T. Prakasam – Gandhian approach
1948	**Etawah Pilot Project (UP)**	**Albert Mayer** – forerunner of CDP
1948	**Nilokheri (Haryana)**	**S.K. Dey** – "Mazdoor Manzil"; refugees
1952 (2 Oct)	**Community Development Programme (CDP)**	Block as unit; **Ford Foundation**
1953 (2 Oct)	**National Extension Service (NES)**	–
1957	**Balwant Rai Mehta Committee**	**3-tier Panchayati Raj**; first at **Nagaur (Rajasthan), 2 Oct 1959**
1960	**IADP (Package Programme)**	**7 districts** (first **West Godavari**, Shahabad, Raipur, Aligarh, Tanjore, Ludhiana, Pali)
1964	**IAAP**	Intensive Agricultural Area Programme
1966	**HYVP**	High-Yielding Varieties Programme – Green Revolution
1969	**Krishi Vigyan Kendra concept**	**Education Commission**; **Mohan Singh Mehta Committee (1973)**
1974	**First KVK – Puducherry** (TNAU)	"**Learning by doing**"; **Lab to Land**
1974 –77	**T&V (Training & Visit) system**	**Daniel Benor** – World Bank; fortnightly visits
1973	**DPAP** (drought-prone areas), **SFDA** (1971)	–
1978 -80	**IRDP**	Integrated Rural Development Programme
1979	**Lab to Land Programme**	ICAR golden jubilee
1998	**NATP**	National Agricultural Technology Project (World Bank)
2005	**ATMA**	Agricultural Technology Management Agency – **district level**, bottom-up planning; **SREP**
2006	NAIP	National Agricultural Innovation Project
2015	**ARYA**; **Mera Gaon Mera Gaurav**	Attracting & Retaining Youth in Agriculture; scientists adopt villages
2016	**Farmer FIRST**; **Student READY**	Farm, Innovations, Resources, Science & Technology; Rural Entrepreneurship Awareness Development Yojana
2023 –25	**Kisan e-Mitra, NPSS, Krishi Sakhi, Viksit Krishi Sankalp Abhiyan, Bharat-VISTAAR**	Digital & campaign-mode extension

- **KVKs**: **731 KVKs** in 638 rural districts (2026); managed by ICAR through **11 ATARIs** (Agricultural Technology Application Research Institutes). Mandate: **on-farm testing (OFT), front-line demonstrations (FLD), training**, seed/planting material. **300 priority KVKs** to be upgraded by **Mar 2027**; entrepreneurship & skill centres at all KVKs by Dec 2028.
- **ATMA** (2005; under **SMAE – Sub-Mission on Agricultural Extension**, NMAET): district-level society; **Farmer Friend (1 per 2 villages)**, **Farmer Interest Groups**, **SREP** (Strategic Research & Extension Plan).
- **Other**: **DD Kisan** (TV channel, **26 May 2015**); **mKisan** portal (SMS advisories); **Kisan Suvidha app**; **Agri-Clinics & Agri-Business Centres (ACABC, 2002)** – NABARD/MANAGE; **MANAGE – Hyderabad** (National Institute of Agricultural Extension Management); **EEIs** (Extension Education Institutes).

MEMORY TRICK

Pre-independence "**G-S-M-B**" = **G**urgaon (Brayne 1920) – **S**riniketan (Tagore 1921) – **M**arthandam (Hatch 1921) – **B**aroda (Krishnamachari 1932). Post: **Etawah (Mayer) & Nilokheri (Dey) 1948 → CDP 1952 → NES 1953**.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Etawah Pilot Project was started by? → Albert Mayer (1948).
- First KVK was established at? → Puducherry (1974).
- T&V system was introduced by? → Daniel Benor.

- IADP was first started in? → West Godavari (1960; 7 districts).
- First Panchayati Raj was inaugurated at? → Nagaur, Rajasthan (2 Oct 1959).

8.7 Rural Development Programmes

★★☆

- **VB-G RAM G (Viksit Bharat – Guarantee for Rozgar and Ajeevika Mission (Gramin)) Act, 2025** – **replaced MGNREGA (2005)**; in force from **1 Jul 2026**:
  - **125 days** of guaranteed wage employment per rural household (was 100);
  - cost sharing **Centre 60 : State 40** (**90:10** NE & Himalayan states);
  - **60-day pause** during peak sowing/harvest seasons (to keep farm labour available);
  - **floor wage ₹300/day**; **₹95,692.31 cr** allocated for 2026-27;
  - new **Gramin Rozgar Guarantee Cards** (valid 3 years).
- **MGNREGA (old facts)**: Act **2005**, launched **2 Feb 2006** at **Bandlapalli (Anantapur, AP)** in 200 districts; 100 days; one-third of workers women.
- **DAY-NRLM (Aajeevika, 2011)** – women SHGs; **Lakhpati Didi** (3 crore target); **DAY-NULM** for urban areas.
- **PMAY-G** (2016; earlier Indira Awaas Yojana 1985) – rural housing; **PMGSY (25 Dec 2000)** – all-weather rural roads.
- **DDU-GKY (2014)** – rural youth skilling; **RSETIs** – bank-led self-employment training institutes (1 per district; lead bank sponsors).
- **SVAMITVA (24 Apr 2020)** – drone mapping of rural inhabited land; property cards.
- **Swachh Bharat Mission-Gramin** (2014), **Jal Jeevan Mission** (2019 – tap water to all rural homes).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Which Act replaced MGNREGA? → VB-G RAM G Act, 2025 (from 1 July 2026).
- Days of employment guaranteed under VB-G RAM G? → 125 days.
- MGNREGA was launched at? → Bandlapalli, Anantapur (2 Feb 2006).
- SVAMITVA uses which technology? → Drones (property cards).

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9. Agricultural Engineering

> **NOTE**
> Asked mostly as one-liners: **implements & their use**, **tractor/engine facts**, **pump & irrigation engineering terms**, **conservation structures**, **post-harvest machines**, **renewable energy (biogas, solar)** and **mechanisation schemes (SMAM, CHC, drones)**.

9.1 Farm Power & Tractors ★★☆

- **Sources of farm power**: human (~0.05–0.1 hp), **animal** (a pair of bullocks ~**0.8–1.0 hp**; a bullock ~0.5 hp), mechanical (tractors, power tillers, engines), electrical, renewable (solar, wind, biogas). **1 hp = 746 W ≈ 0.746 kW**.
- **Farm power availability** in India ≈ **2.5–3 kW/ha**; **farm mechanisation level ≈ 47%** (China ~60%, USA ~95%).
- **India is the world's largest tractor manufacturer/market**. Most tractors are **30–50 hp**, **2-wheel drive**.
- **Engines**:
  - **Tractors use diesel (CI – compression ignition) engines**, **4-stroke**; compression ratio **14:1 to 22:1**; no spark plug (fuel ignites by heat of compression).
  - **Petrol (SI – spark ignition)**: compression ratio 6–10:1; carburettor + spark plug.
  - **4 strokes**: **suction → compression → power (expansion) → exhaust**; one power stroke per **2 crankshaft revolutions**. 2-stroke engines: one power stroke per revolution.
- **Tractor systems**: **clutch** (connects/disconnects engine and gearbox), **differential** (lets rear wheels turn at different speeds on turns; **differential lock** for slippery fields), **PTO (power take-off)** – standard speed **540 rpm** (also 1000 rpm), **3-point hitch linkage** with **hydraulic** control (**draft & position control**); **ballasting** (water/calcium chloride in tyres, iron weights) improves traction.
- **Wheel slip** for best tractive efficiency ≈ **10–15%** (fields).
- **Tractor types**: **wheel** (2WD, 4WD), **crawler/track** (heavy soils, swampy land – least slip), **walking/power tiller** (**8–15 hp, 2-wheel; paddy puddling, hill farming**).
- **Power tiller** – best suited to **wetland paddy**, small holdings and hill farming.

> **MEMORY TRICK**
> 4-stroke cycle "**S-C-P-E**" = "**S**uck, **S**queeze, **B**ang, **B**low" → Suction, Compression, Power, Exhaust.

> **PREVIOUSLY ASKED / LIKELY QUESTIONS**
> - Tractors usually use which type of engine? → Diesel (CI), 4-stroke.
> - Standard PTO speed? → 540 rpm.
> - Function of the differential? → Allows rear wheels to rotate at different speeds while turning.
> - Implement best suited for paddy puddling in small holdings? → Power tiller.
> - 1 hp equals? → 746 watts.

9.2 Tillage & Sowing Implements ★★★

- **Tillage**: **primary** (opening/breaking soil – ploughs) and **secondary** (seedbed preparation – harrows, cultivators, planker/leveller). **Conservation tillage** keeps **≥ 30% residue cover**; **zero tillage** – no primary tillage (**Happy Seeder / zero-till drill**).

Implement	Type	Key facts
Indigenous (desi) plough	Primary	**V-shaped furrow**, leaves unploughed strips; does not invert soil; wooden
Mould board (MB) plough	Primary	**Cuts, lifts, inverts** the furrow slice; parts – **share, mould board, landside, frog**; good for burying weeds & green manure
Disc plough	Primary	For **hard, dry, sticky, stony, trashy** soils; disc dia. 60–90 cm
Chisel plough / subsoiler	Primary	Breaks **hardpan** (subsoiler 45–75 cm deep)
Rotavator (rotary tiller)	Primary + secondary	One-pass seedbed; L-shaped blades; puddling
Disc harrow	Secondary	Clod breaking; **tandem/offset**; after ploughing
Spike-tooth harrow	Secondary	Light soils; levelling, crust breaking
Cultivator (tiller)	Secondary	**Spring-tine / rigid-tine**; shallow tillage & interculture
Planker / leveller	Secondary	Levels, compacts; **laser land leveller** saves **20–30% water**
Puddler	Wetland	Puddling rice fields

Implement	Type	Key facts
Ridger	Secondary	Makes ridges & furrows (potato, sugarcane)
Bund former	–	Field bunds

- **Plough size** = width of furrow; draft of MB plough ≈ 0.4–0.7 kg/cm² of furrow cross-section.
- **Sowing equipment**:
  - **seed drill** – drops seed in rows at uniform depth;
  - **seed-cum-fertiliser drill** – places fertiliser below/beside seed;
  - **planter** – single seeds at fixed spacing (maize, cotton);
  - metering by **fluted roller** (most common for cereals), cup-feed, inclined/vertical plate (planters);
  - **pneumatic planter** – precision.
- **Rice transplanting**: **self-propelled transplanter (mat-type nursery, 4–8 rows)**, **drum seeder** (8-row, sprouted seed – DSR).
- **Zero-till drill (inverted-T tines)** – wheat after rice. **Happy Seeder** (PAU) – cuts & lifts rice straw and sows wheat. **Super Seeder**, **Super SMS** (straw management system on combines), **mulcher**, **baler** – **CRM scheme** for paddy residue (Punjab, Haryana, UP, Delhi).
- **Interculture**: **wheel hoe**, **cono weeder** (SRI rice), **rotary weeder**, **power weeder**.

MEMORY TRICK

Plough choice: "**MB = Invert, Disc = Hard & Trashy, Chisel = Hardpan, Desi = V-cut**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Plough suitable for hard, trashy and stony soils? → Disc plough.
- Which plough inverts the furrow slice? → Mould board plough.
- Seed metering mechanism most common in seed drills? → Fluted roller.
- Water saving by laser land levelling? → ~20–30%.
- Implement to break hardpan? → Subsoiler / chisel plough.

9.3 Plant Protection, Harvesting & Threshing Equipment ★★☆

- **Sprayers**:
  - **hand compression**;
  - **knapsack** (manual, ~15–16 L);
  - **power sprayer** (high pressure);
  - **boom sprayer** (tractor);
  - **mist blower** (air-assisted, low volume);
  - **ULV / CDA** sprayers;
  - **electrostatic**;
  - **agricultural drones** (UAVs).
- **Nozzles**: **hollow cone** – insecticides/fungicides (fine spray, good coverage); **flat fan** – **herbicides** (uniform band); **flood jet** – herbicides (low pressure); **solid cone**.
- **Spray volume**: **high volume > 400 L/ha**; **low volume 5–400 L/ha**; **ULV < 5 L/ha**. Herbicides: ~500 L/ha (knapsack).
- **Dusters**: rotary/hand; power duster.
- **Harvesting**: sickle (serrated), reaper (vertical conveyor reaper), **reaper-binder**, **combine harvester** (cutting + threshing + cleaning in one pass; **cutter bar → reel → threshing cylinder & concave → straw walkers → cleaning sieves & fan → grain tank**); grain loss target < 2–3%.
- **Threshers**: **axial-flow** (multi-crop), **spike-tooth**, **rasp-bar**, **hammer mill type** (wheat – makes *bhusa*), **paddy thresher (wire-loop)**. Thresher drum/cylinder peripheral speed ~**20–30 m/s** (cereals). **Dangerous Machines (Regulation) Act 1983** – thresher safety (chute length ≥ 90 cm).
- **Winnowing**: winnowing fan/winnower (separates chaff by air).
- **Shellers**: **maize sheller**, groundnut decorticator.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Nozzle preferred for herbicide spraying? → Flat fan.
- Spray volume of ULV application? → < 5 L/ha.
- Machine that harvests, threshes and cleans in one operation? → Combine harvester.
- Act regulating threshers for safety? → Dangerous Machines (Regulation) Act, 1983.

9.4 Agricultural Drones & Mechanisation Schemes ★★★

- **Drone (UAV) rules**: **Drone Rules 2021**; drone pilot needs a **Remote Pilot Certificate** (DGCA-authorised school); **"Drone Shakti"** (Budget 2022-23); **SOPs for pesticide spraying by drones** (MoA&FW–CIB&RC, **2022**) – interim approval for spraying.
- **Kisan Drones** – spraying pesticides & nutrients (nano urea/DAP), crop assessment, land records (**SVAMITVA**).
- **Drone subsidy (SMAM)**:
  - **100% of cost (up to ₹10 lakh)** to **ICAR institutes, KVKs, SAUs** for demonstrations;
  - **75%** to FPOs for demos;
  - **CHCs by cooperatives/FPOs/rural entrepreneurs – 40% (up to ₹4 lakh)**; agri graduates – 50% (up to ₹5 lakh);
  - individual small/marginal, SC/ST, women, NE farmers – **50% (up to ₹5 lakh)**; others **40% (₹4 lakh)**.
- **Namo Drone Didi (2023)** – **15,000 drones** to women SHGs; **80% of cost up to ₹8 lakh**; ₹1,261 cr (2024-25 to 2025-26).
- **SMAM (Sub-Mission on Agricultural Mechanisation, 2014-15)** – now under **PM-RKVY**: subsidy on machines (**40–50%**); **Custom Hiring Centres (CHCs)** & **Farm Machinery Banks** (subsidy ~40%; **80% for village-level farm machinery banks** in some components); "**FARMS-Farm Machinery Solutions**" app (CHC Farm Machinery app).
- **Crop Residue Management (CRM) scheme** (2018) – Punjab, Haryana, UP, Delhi; **50% subsidy to individuals, 80% to CHCs/cooperatives** for in-situ & ex-situ straw machinery.
- **Testing**: **Farm Machinery Training & Testing Institutes (FMTTIs)** – **Budni (MP)**, **Hisar (Haryana)**, **Anantapur (AP)**, **Biswanath Chariali (Assam)**. **CIAE – Bhopal** (Central Institute of Agricultural Engineering); **CIPHET – Ludhiana** (post-harvest); **CIRCOT – Mumbai** (cotton technology); **CIFT – Kochi** (fisheries technology).
- **GST on tractors cut to 5%** (from 12%) and on drip/sprinklers, harvesters to 5% – from **22 Sep 2025**.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Drone subsidy for ICAR/KVKs under SMAM? → 100%, up to ₹10 lakh.
- Farm machinery testing institute in Madhya Pradesh? → Budni.
- CIAE is located at? → Bhopal.
- GST on tractors after Sept 2025? → 5%.

9.5 Irrigation & Water Lifting Engineering ★★☆

- **Pumps**:
  - **centrifugal** (most common; surface water, low head – suction lift max ~**6–7 m** practically, theoretical 10.3 m);
  - **submersible** (deep tubewells; motor + pump under water);
  - **jet**, **turbine/vertical turbine**, **propeller (axial flow – high discharge, low head)**;
  - reciprocating/piston (high head, low discharge).
  - **Priming** needed for centrifugal pumps (fill casing with water).
- **Traditional water lifts**: **Persian wheel (rahat)** – most efficient animal-operated lift; **dhekli/picottah** (lever), **swing basket**, **don**, **mhote/charsa** (leather bag, bullock).
- **Wells & tubewells**: **open/dug well**; **cavity well**; **tubewell** – **shallow (< 35 m)**, **deep (> 70 m)**; **gravel packing**; **strainer**; **development of tubewell** (removes fines). **Aquifer** – water-bearing formation; **confined (artesian)** vs **unconfined**.
- **Pump power**: **Water hp (WHP) = Q × H / 75** (Q in L/s, H in m); **BHP = WHP / pump efficiency**.
- **Measurement of flow**: **V-notch weir** (small flows), **rectangular/Cipolletti weir**, **Parshall flume** (low head loss, silt-laden water), **orifice**, **current meter** (canals), **float method**.
- **Drip system components**: **pump → filters (sand/media for organic matter, screen/disc for fine particles; hydrocyclone for sand) → fertiliser tank / venturi injector → mainline (PVC) → sub-main → laterals (LLDPE, 12–16 mm) → drippers/emitters (2–8 L/h)**. **Fertigation** via venturi. Clogging control – **acid treatment (HCl)**, **chlorination**.

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- **Sprinkler**: **impact (rotating) sprinkler**; pressure **~2–4 kg/cm²**; **rain-gun** (sugarcane, large areas); **micro-sprinkler**; **centre pivot** (large farms).
- **Surface irrigation efficiency** ~30–50%; **sprinkler ~70–80%**; **drip ~90–95%**.
- **Drainage**: surface (open ditches), sub-surface – **tile drains**, **mole drains** (clay soils, mole plough), **vertical drainage** (pumping wells); **bio-drainage** (eucalyptus).

MEMORY TRICK

Efficiency ladder "**Flood 40 – Sprinkler 75 – Drip 90+**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Most efficient animal-operated water lift? → Persian wheel.
- Pump used in deep borewells? → Submersible pump.
- Device for measuring flow in silt-laden channels with low head loss? → Parshall flume.
- Water use efficiency of drip irrigation? → ~90–95%.
- Filter used to remove sand in drip systems? → Hydrocyclone / sand separator.

9.6 Soil & Water Conservation Engineering ★★☆

- **Erosion control structures**:
  - **contour bunds** (slope < 6%, low rainfall);
  - **graded bunds** (> 800 mm rain);
  - **bench terraces** (16–33% slope; **level, outward-sloping, inward-sloping** types);
  - **Zingg terraces**; **broad-base terraces**;
  - **grassed waterways** (safe disposal of runoff);
  - **check dams** (gully control);
  - **gabions** (stone in wire mesh);
  - **drop spillway, chute spillway, drop-inlet spillway** (gully heads).
- **Gully classes**: G1 small → G5/G6 very large (depth & width).
- **Water harvesting**:
  - **farm ponds** (dugout/embankment; lining with LDPE/silpaulin);
  - **percolation tanks**;
  - **nala bunds**;
  - **check dams**;
  - **khadin** (Rajasthan, runoff farming);
  - **tanka/kund** (Rajasthan, underground cistern);
  - **johad** (Rajasthan/Haryana);
  - **zabo** (Nagaland – forest + paddy + animal pond);
  - **bamboo drip** (Meghalaya);
  - **ahar-pyne** (Bihar);
  - **kuhl** (Himachal);
  - **eri** (Tamil Nadu tanks);
  - **kere** (Karnataka);
  - **phad** (Maharashtra).
- **Watershed** – area draining to a common outlet; **ridge-to-valley** approach; **Watershed Development Component of PMKSY (WDC-PMKSY 2.0)** – DoLR; size: **micro-watershed ~500–1000 ha**; **mini ~1,000–10,000 ha**.
- **Runoff estimation**: **Rational method Q = CIA/360** (Q m^3/s, C runoff coefficient, I mm/h, A ha); **SCS curve number method**.
- **Erosion estimation**: **USLE A = R·K·L·S·C·P** (Wischmeier & Smith, 1965/1978).

MEMORY TRICK

Traditional water harvesting "**Khadin-Tanka-Johad (Rajasthan), Zabo (Nagaland), Bamboo drip (Meghalaya), Ahar-Pyne (Bihar), Kuhl (Himachal), Eri (TN), Phad (Maharashtra)**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Zabo system of water conservation belongs to? → Nagaland.
- Bamboo drip irrigation is practised in? → Meghalaya.
- Rational formula for peak runoff? → Q = CIA/360.
- Structure for safe disposal of runoff from terraces? → Grassed waterway.

9.7 Post-Harvest Engineering & Processing ★★☆

- **Unit operations**: cleaning, **grading**, drying, **dehusking/hulling**, polishing, milling, size reduction, packaging, storage.
- **Grain drying**: harvest moisture (paddy ~20–25%) → safe storage **12–14%**. **Sun drying**; **mechanical dryers** – **LSU (Louisiana State University) dryer** (continuous mixing type,

paddy), **recirculating batch dryer**, flat-bed, **solar dryer**. **Equilibrium moisture content (EMC)**.

- **Rice milling**: paddy → **cleaner → husker (rubber roll sheller – least breakage)** → paddy separator → **polisher/whitener** → grader. **Huller (Engelberg)** – old, more breakage. **Head rice recovery** ideal > 60%. Rice bran → **rice bran oil** (stabilise to prevent rancidity – lipase). **Parboiling**: **CFTRI method**, **Jadavpur method**, **pressure parboiling**.
- **Pulse milling (dal)**: dry & wet methods; **CFTRI method**; **mini dal mill (CIAE/PKV)**; pre-milling treatment with oil/water.
- **Oil extraction**: **ghani** (traditional), **expeller** (mechanical screw press; ~5–8% oil left in cake), **solvent extraction** (**hexane**; < 1% oil left).
- **Size reduction**: hammer mill (feed), burr mill, roller mill (flour). Laws – **Rittinger, Kick, Bond**.
- **Cold chain**: **pre-cooling** (forced air, hydro-cooling), **cold storage**, **reefer vans**; **CA/MA storage**; **zero-energy cool chamber** (IARI).
- **Food processing schemes (MoFPI)**:
  - **PMKSY (Pradhan Mantri Kisan SAMPADA Yojana, 2017)** – mega food parks, cold chain, agro-processing clusters;
  - **PMFME (2020)** – **35% credit-linked subsidy up to ₹10 lakh** for micro units; **ODOP – One District One Product**;
  - **PLISFPI** (PLI for food processing, 2021).
- **Storage structures**: **Pusa bin** (mud + polythene), **Pusa kothar**, **Hapur tekka**, **metal bins**, **steel silos** (FCI – PPP), **CAP storage**; underground **khatti** (avoid – moisture).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Husker that causes least grain breakage? → Rubber roll sheller.
- Solvent used for oil extraction? → Hexane.
- Safe moisture for storing paddy? → ~12–14%.
- MoFPI scheme giving 35% subsidy to micro food units? → PMFME.
- LSU dryer is used for? → Paddy (continuous drying).

9.8 Renewable Energy in Agriculture ★★☆

- **Biogas**: anaerobic digestion of **cattle dung** (+ crop residues) → **methane ~55–65%** + **CO_2 ~35–45%** (+ traces of H_2S). Optimum temperature **~35 °C (mesophilic)**, pH ~7, **C:N ~25–30:1**, slurry **dung:water = 1:1**; **HRT 40–60 days**. **1 m³ biogas ≈ 0.6 L kerosene ≈ 4.7 kWh** heat; **~25 kg dung → 1 m³ biogas/day** (roughly 1 m³ per 2–3 cattle).
  - **Plant designs**: **KVIC floating-drum (gobar gas)** – **gas holder floats**, constant pressure; **Janata fixed-dome** (PRAD, Lucknow); **Deenbandhu** (AFPRO, **cheapest fixed-dome**).
  - **Slurry** = good manure (~1.5–2% N).
- **GOBARdhan** (2018) → **national compressed biogas (CBG) scheme approved Aug 2026: ₹23,731 cr (2026-27 to 2035-36)** (Ministry of Petroleum).
- **Solar energy**:
  - **solar pumps (PM-KUSUM Component B)**, **solar dryers**, **solar cookers**, **solar PV**;
  - **agrivoltaics** (crops under solar panels) – **10 GW** proposed in **PM-KUSUM 2.0**;
  - **PM Surya Sarovar Yojana (Jul 2026)** – floating solar on reservoirs & canals.
- **Biomass**: gasifiers (**producer gas – CO + H_2**), briquetting of crop residue, **biochar** (pyrolysis), **2G ethanol** from rice straw (Panipat refinery, 2022); **E20 petrol** achieved in 2025.
- **Wind mills** – water pumping in coastal/arid areas.

MEMORY TRICK

Biogas plants "**KVIC = Floating drum; Janata & Deenbandhu = Fixed dome (Deenbandhu cheapest)**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Main gas in biogas? → Methane (~55–65%).
- Cheapest fixed-dome biogas plant model? → Deenbandhu.
- In the KVIC biogas plant, the gas holder is? → A floating drum.
- Producer gas consists mainly of? → CO and H_2.

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10. Fisheries

> **NOTE**
> Short chapter, sure marks: **production data**, **fish species (scientific names)**, **culture systems**, **PMMSY/FIDF** and **institutes**.

10.1 Fisheries at a Glance (Current Data) ★★★

> **UPDATED 2025-26**
> **Fish production 2024-25: 197.75 lakh tonnes – 2nd largest producer in the world (~8% of global output)**; up **106%** from 95.79 lakh t (2013-14) and 141.64 lakh t (2019-20).

- **Inland fisheries ≈ 75%** of production (**aquaculture-led**); marine ≈ 25%. India is **2nd in aquaculture** and a top producer of **farmed shrimp**.
- Fisheries ≈ **7.4% of agri GVA**; **fastest-growing agri sub-sector (~8.8% a year, FY16–FY25)**; livelihood for ~**3 crore** fishers & fish farmers.
- **Top states**: **Andhra Pradesh** (largest – **inland & shrimp/aquaculture**), **West Bengal** (2nd; largest **fish seed** producer), **Karnataka/Gujarat** (marine), **Odisha**, **Kerala**. Highest per-capita consumption – **Lakshadweep, Kerala, Goa, NE states**.
- **Seafood exports**: **~US$ 8.46 bn (2025-26)**; 2024-25 **₹62,408 cr**; **frozen shrimp** is the top item (by value); markets – **USA, China**, EU, SE Asia. **MPEDA** (1972, **Kochi**) promotes exports.
- **Coastline ~11,099 km** (revised); **EEZ ~2.02 million km²**; inland resources – rivers & canals, **reservoirs (~3.15 Mha)**, ponds & tanks, **floodplain wetlands (beels)**, brackish water.
- **Department of Fisheries** – separate ministry (Ministry of **Fisheries, Animal Husbandry & Dairying**) since **2019**. **National Fish Farmers Day – 10 July** (Dr Hiralal Chaudhuri & Dr K.H. Alikunhi achieved **induced breeding** of carps on 10 Jul 1957). **World Fisheries Day – 21 Nov**.
- **Blue Revolution** ("Neel Kranti") – **Dr Hiralal Chaudhuri** is called the father of induced breeding / Blue Revolution in India.

> **PREVIOUSLY ASKED / LIKELY QUESTIONS**

- Fish production of India in 2024-25? → 197.75 lakh tonnes.
- India's rank in world fish production? → 2nd (~8%).
- Largest fish-producing state? → Andhra Pradesh.
- National Fish Farmers Day? → 10 July.
- Headquarters of MPEDA? → Kochi.

10.2 Important Fish Species & Culture Systems ★★★

Group	Species (scientific name)	Notes
Indian Major Carps (IMC)	**Catla (*Catla catla*)** – surface feeder; **Rohu (*Labeo rohita*)** – column feeder; **Mrigal (*Cirrhinus mrigala*)** – bottom feeder	Backbone of freshwater aquaculture; rohu most popular
Exotic carps	**Silver carp (*Hypophthalmichthys molitrix*)** – surface (phytoplankton); **Grass carp (*Ctenopharyngodon idella*)** – macro-vegetation (weed control); **Common carp (*Cyprinus carpio*)** – bottom	With IMC → **composite fish culture (6 species)**
Catfish	*Clarias batrachus* (magur), ***Pangasianodon hypophthalmus* (pangasius)**, *Heteropneustes fossilis* (singhi), *Wallago attu*	Air-breathing (magur, singhi); pangasius – AP
Exotic/other	**Tilapia (*Oreochromis niloticus*)** – GIFT tilapia; *Clarias gariepinus* (**African catfish – banned** in India); **Pacu**, **Amur carp**	–
Coldwater	**Rainbow trout (*Oncorhynchus mykiss*)**, **mahseer (*Tor* spp. – "tiger of water")**, snow trout	Himalayan states, Kashmir
Shrimp / prawn	**Pacific white shrimp (*Litopenaeus vannamei*)** – **most farmed** (introduced **2009**); **tiger shrimp (*Penaeus monodon*)**; **giant freshwater prawn (*Macrobrachium rosenbergii*, "scampi")**	AP leads
Brackish water	**Milkfish (*Chanos chanos*)**, **mullet (*Mugil cephalus*)**, **Asian seabass/bhetki (*Lates calcarifer*)**, pearl spot (*Etroplus suratensis* – Kerala state fish, karimeen)	–

Group	Species (scientific name)	Notes
Marine (capture)	**Oil sardine (*Sardinella longiceps*)** – top marine catch (Kerala); **Indian mackerel (*Rastrelliger kanagurta*)**; **Bombay duck (*Harpadon nehereus*)**; **pomfret**, **tuna**, **seer fish**, **hilsa (*Tenualosa ilisha*)** – anadromous, WB/Bangladesh	–
Ornamental	Goldfish, guppy, molly, angel fish	Export & domestic hobby

- **Composite fish culture** (stocking ratio example – catla 30 : rohu 20/30 : mrigal 20 : silver carp 10 : grass carp 10 : common carp 10); stocking **~5,000–8,000 fingerlings/ha**; yield **4–6 t/ha/yr** (up to 10+ t with intensive feeding).
- **Induced breeding (hypophysation)** – **pituitary extract** injection; now synthetic hormones **Ovaprim / Ovatide** (GnRH analogue + domperidone). **Chinese hatchery** (circular, eco-hatchery) for carp breeding.
- **Seed stages**: **egg → spawn (hatchling, 3–4 days) → fry (~1 inch, ~15–20 days) → fingerling (~3–4 inches, 2–3 months) → yearling** (table fish).
- **Pond preparation**: drying/ploughing, **liming ($CaCO_3$ 200–500 kg/ha)**, **eradicate predatory fish – mahua oil cake (250 ppm; saponin)**, bleaching powder, **tea seed cake**; manuring (cow dung), fertilising; pH **7.5–8.5**, DO **> 5 mg/L**, transparency ~30–40 cm.
- **Integrated fish farming**: **fish-cum-paddy**, **fish-cum-duck**, **fish-cum-poultry**, **fish-cum-pig**, **fish-cum-cattle**; **sewage-fed fisheries – East Kolkata Wetlands (bheries)** (Ramsar site).
- **Modern systems**: **RAS (Recirculatory Aquaculture System)**, **Biofloc** (C:N > 15:1 – microbes convert waste to protein), **cage culture in reservoirs**, **pen culture**, **aquaponics**, **seaweed cultivation** (Tamil Nadu – *Kappaphycus*), **pearl culture**, **mussel/oyster** farming.
- **Fish diseases**: **EUS (epizootic ulcerative syndrome – *Aphanomyces invadans*)**, **white spot (WSSV – shrimp)**, **EHP** (shrimp, microsporidian), **argulosis** (fish louse), **dropsy**, fin rot. Shrimp – **SPF (specific pathogen free) broodstock**; Vannamei import via **Aquatic Quarantine Facility – Chennai**.

MEMORY TRICK

IMC feeding zones "**C-R-M = Top-Middle-Bottom**" → **C**atla (surface), **R**ohu (column), **M**rigal (bottom). Exotic: **S**ilver (surface plankton), **G**rass (weeds), **C**ommon (bottom).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Surface feeder among Indian major carps? → Catla.
- Most cultured shrimp in India? → *Litopenaeus vannamei*.
- Chemical used to kill predatory fish in ponds? → Mahua oil cake (saponin).
- Hormone preparation for induced breeding? → Ovaprim (or pituitary extract).
- Scientific name of hilsa? → *Tenualosa ilisha*.
- Sewage-fed fisheries are famous at? → East Kolkata Wetlands.

10.3 Fish Processing, Marine Fisheries & Regulation ★★☆

- **Fish composition**: water ~70–80%, **protein 15–20%** (high biological value), fat 0.2–20%; rich in **omega-3 fatty acids** (EPA, DHA), iodine, vitamin D.
- **Preservation**: icing (fish:ice 1:1), **chilling**, **freezing (–18 to –40 °C; IQF)**, **canning**, **salting**, **drying (sun/solar)**, **smoking**, **fermentation**; **surimi** (minced fish paste – threadfin bream), **fish meal**, **fish oil**, **chitosan** (from shrimp shell), **isinglass** (swim bladder).
- **Spoilage indicator**: **TVB-N** (total volatile base nitrogen), **TMA** (trimethylamine – fishy odour), **histamine** (scombroid poisoning – tuna, mackerel).
- **Marine fishing**: **trawling** (bottom), **purse seine** (shoaling fish – sardine, mackerel), **gill net**, **hook & line, long lining** (tuna), **dol net** (Bombay duck). **Uniform fishing ban (monsoon) – 61 days**: **east coast 15 Apr – 14 Jun**, **west coast 1 Jun – 31 Jul**.
- **Potential Fishing Zone (PFZ) advisories** – **INCOIS, Hyderabad** (satellite SST & chlorophyll). **Sagar Parikrama** (2022–23) – outreach to coastal fishers.

- **Laws**: **Indian Fisheries Act 1897**; **Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act 1981**; State **Marine Fishing Regulation Acts (MFRA)**; **Coastal Aquaculture Authority Act 2005** (CAA, Chennai). **Sustainable Fisheries Rules for EEZ & High Seas (2025)**.
- **Marine Fisheries Census 2025** – launched **31 Oct 2025** (digital, geo-referenced).

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Fishing ban period on the west coast? → 1 June – 31 July (61 days).
- PFZ advisories are issued by? → INCOIS, Hyderabad.
- Compound responsible for fishy odour? → Trimethylamine (TMA).
- Coastal Aquaculture Authority is set up under? → CAA Act, 2005.

10.4 Fisheries Schemes, Institutes & Current Affairs ★★★

Scheme	Year / outlay	Key features
PMMSY (Pradhan Mantri Matsya Sampada Yojana)	**2020**; **₹20,050 cr** (2020-21 to 2024-25, extended to **2025-26**)	"**Blue Revolution**" flagship; production, infrastructure, post-harvest; **60% assistance for women/SC/ST**, 40% others; **RAS, biofloc, cage culture**; fishers' insurance; livelihood support during **fishing ban**. Budget 2026-27: **₹2,500 cr**
PM-MKSSY (PM Matsya Kisan Samridhi Sah-Yojana)	**Feb 2024**; **₹6,000 cr** (2023-24 to 2026-27)	Central sector sub-scheme of PMMSY – **formalisation** via **National Fisheries Digital Platform (NFDP)**, **aquaculture insurance**, micro-enterprise performance grants, traceability
FIDF (Fisheries & Aquaculture Infrastructure Development Fund)	**2018-19**; **₹7,522 cr**; extended to **Mar 2026**	**3% interest subvention**; loans at **≥ 5%** via **NABARD, NCDC, scheduled banks**; fishing harbours, landing centres; **225 projects (₹6,685.78 cr)**
KCC for fisheries	**2018-19**	Up to **₹2 lakh** within KCC limit (Budget 2025-26 announced raising KCC limits to ₹5 lakh); **4.39 lakh** fishers covered
Blue Revolution scheme	2015-16 to 2019-20	Merged into PMMSY

- **Budget 2026-27 (fisheries)**: **record ₹2,761.80 cr**; integrated development of **500 reservoirs & Amrit Sarovars**; **fish caught by Indian vessels in EEZ/high seas – duty-free** (landing abroad = export); duty-free inputs for seafood processing raised to **3%** of export value.
- **Fisheries FPOs**: **2,195** formed. **NFDP**: **30.6 lakh** stakeholders registered. **Fishing-ban livelihood support**: ~4.33 lakh families.
- **Fisheries institutes (ICAR)**:

Institute	Location
CIFA (freshwater aquaculture)	**Bhubaneswar**
CIFRI (inland fisheries)	**Barrackpore (Kolkata)**
CMFRI (marine fisheries)	**Kochi**
CIFT (fisheries technology)	**Kochi**
CIBA (brackishwater aquaculture)	**Chennai**
CIFE (fisheries education – deemed university)	**Mumbai**
NBFGR (fish genetic resources)	**Lucknow**
DCFR (coldwater fisheries)	**Bhimtal (Uttarakhand)**
NFDB (National Fisheries Development Board, 2006)	**Hyderabad**
MPEDA (1972)	**Kochi**
Fishery Survey of India	**Mumbai**

MEMORY TRICK

Fisheries institutes "**CIFA-Bhubaneswar, CIFRI-Barrackpore, CMFRI & CIFT-Kochi, CIBA-Chennai, CIFE-Mumbai, NFDB-Hyderabad**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Outlay of PMMSY? → ₹20,050 crore.
- Interest subvention under FIDF? → 3% (loans at not less than 5%).
- CIFA is located at? → Bhubaneswar.
- NFDB headquarters? → Hyderabad.

- Assistance under PMMSY for women/SC/ST beneficiaries? → 60%.

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11. Forestry

NOTE

Lowest weightage – read the **ISFR 2023 numbers**, **agroforestry systems**, **important trees (botanical names & uses)**, **forest laws & policies** and **institutes**.

11.1 Forest Cover: India State of Forest Report (ISFR 2023) ★★★

UPDATED 2025-26

ISFR 2023 – released **21 Dec 2024** at **FRI, Dehradun** by **Forest Survey of India (FSI)** (biennial; **18th** report; first ISFR **1987**).

Item	ISFR 2023
Total forest + tree cover	**8,27,357 sq km = 25.17%** of geographical area
Forest cover	**7,15,343 sq km (21.76%)**
Tree cover	**1,12,014 sq km (3.41%)**
Increase since 2021	**+1,445 sq km** (forest +156; tree +1,289)
Mangrove cover	**~4,992 sq km** (West Bengal – Sundarbans largest, then Gujarat, A&N)
Carbon stock	**~7,285 million tonnes**
Bamboo-bearing area	~1.55 lakh sq km

- **Forest cover classes**: **very dense forest (VDF) ≥ 70% canopy**, **moderately dense 40–70%**, **open forest 10–40%**, **scrub < 10%**.
- **Largest forest + tree cover (area)**: **Madhya Pradesh > Arunachal Pradesh > Maharashtra**; **largest forest cover**: **MP > Arunachal > Chhattisgarh**.
- **Highest forest cover %**: **Lakshadweep (UT)**; among states **Mizoram** (~84%), Arunachal, Meghalaya.
- **Max increase (forest + tree cover)**: **Chhattisgarh**, then UP, Odisha, Rajasthan.
- **Targets**: **National Forest Policy 1988 – 33%** of area under forest/tree cover (**60% in hills**). **NDC**: additional carbon sink of **2.5–3 billion t CO_2e by 2030** (ISFR 2023 shows ~2.29 bn t achieved vs 2005).
- **India's global position (FAO FRA)**: among the **top 10 countries by forest area**; **3rd in net forest-area gain**.

MEMORY TRICK

ISFR 2023 numbers "**25 – 21.8 – 3.4**" → total 25.17% = forest 21.76% + tree 3.41%.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Total forest & tree cover as per ISFR 2023? → 25.17% (8.27 lakh sq km).
- State with the largest forest cover (area)? → Madhya Pradesh.
- ISFR is published by? → Forest Survey of India, Dehradun (every 2 years).
- Forest cover target under National Forest Policy 1988? → 33% (60% in hills).

11.2 Agroforestry & Social Forestry ★★★

- **Agroforestry** – trees + crops and/or livestock on the same land; term coined by **Bene et al. (1977)**; **ICRAF (World Agroforestry Centre) – Nairobi** (1978); **CAFRI (Central Agroforestry Research Institute) – Jhansi**.

System	Components	Example
Agri-silviculture	Crops + trees	Wheat under **poplar** (Punjab/Haryana); crops with **Eucalyptus**, **Melia dubia**
Silvi-pasture	Trees + pasture/grass	Subabul, *Hardwickia* with grasses (Cenchrus)
Agro-silvo-pasture	Crops + trees + pasture/animals	Home gardens
Agri-horticulture	Crops + fruit trees	Ber/aonla with pulses
Horti-silvi-pasture	Fruit trees + trees + grass	–
Aqua-silviculture / silvi-fishery	Trees + fish	Mangroves with fish/shrimp
Alley cropping (hedgerow intercropping)	Crops between rows of N-fixing shrubs	**Leucaena, Gliricidia**
Taungya system	Forest planting + temporary crops by villagers	**Burma (1850s)**; teak with crops
Home gardens	Multi-storey trees, crops, animals	**Kerala**
Boundary/shelterbelt planting	Trees on field borders	**Windbreaks** – Rajasthan

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- **Agroforestry policy**: **National Agroforestry Policy 2014** – **India was the first country** to adopt one. **Sub-Mission on Agroforestry (SMAF)** (2016-17) – now under **PM-RKVY**; "**Har Medh Par Ped**" (a tree on every bund).
- **Social forestry** (term – **J.C. Westoby, 1968**; recommended by **National Commission on Agriculture, 1976**) – **farm forestry**, **community forestry**, **extension forestry** (roadside, canal-side), **urban forestry**. **Joint Forest Management (JFM)** – **1990** (began at **Arabari, West Bengal, 1970s**).
- **Shifting cultivation** – **jhum** (NE), **podu** (Andhra/Odisha), **bewar** (MP), **kumari** (Western Ghats), **penda** (Odisha). Swiddens; fallow cycle shortened → degradation.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- First country to adopt a National Agroforestry Policy? → India (2014).
- Taungya system originated in? → Burma (Myanmar).
- CAFRI is located at? → Jhansi.
- Agri-silviculture example in Punjab? → Wheat under poplar.
- JFM started in? → 1990 (Arabari model, West Bengal).

11.3 Important Trees & Forest Products ★★☆

Tree	Botanical name	Use / fact
Teak	***Tectona grandis***	"**King of timbers**"; Verbenaceae (Lamiaceae); MP largest; Nilambur (Kerala) – oldest teak plantation (**1840s**)
Sal	***Shorea robusta***	Hard timber, sal seeds (oil); Central & east India
Sandalwood	***Santalum album***	**Root hemi-parasite**; heartwood oil; Karnataka & TN; **spike disease (phytoplasma)**; Budget 2026-27 – sandalwood focus
Red sanders	***Pterocarpus santalinus***	**Endemic to Andhra Pradesh (Seshachalam)**; dye & musical instruments
Rosewood (shisham)	***Dalbergia sissoo / latifolia***	Furniture
Deodar	***Cedrus deodara***	Himalayan conifer; durable timber
Chir pine	***Pinus roxburghii***	**Resin (oleoresin → turpentine & rosin)**
Eucalyptus	***Eucalyptus* spp.**	Fast-growing; pulp; "ecological terrorist" (high water use); bio-drainage
Poplar	***Populus deltoides***	Agroforestry (Punjab, Haryana, UP); plywood, matchwood
Casuarina	***Casuarina equisetifolia***	**Frankia** N-fixer; coastal shelterbelts, poles
Subabul	***Leucaena leucocephala***	"**Miracle tree**"; fodder, fuel; **mimosine** toxin
Neem	***Azadirachta indica***	**Azadirachtin**; neem-coated urea; "village pharmacy"
Khejri	***Prosopis cineraria***	**State tree of Rajasthan**; desert agroforestry; Bishnoi conservation
Babul	***Acacia nilotica***	Tannin, gum; fuel
Khair	***Senegalia (Acacia) catechu***	**Katha** (catechu) & kutch
Mahua	***Madhuca longifolia***	Flowers (liquor), seed oil; **mahua oil cake – fish poison**
Tendu	***Diospyros melanoxylon***	**Leaves – bidi wrappers** (major NTFP)
Bamboo	*Dendrocalamus strictus*, *Bambusa* spp.	"**Green gold**", "**poor man's timber**"; a **grass** (Poaceae); **removed from the "tree" definition** (Indian Forest Act amendment **2017**); **National Bamboo Mission** (2006; restructured 2018)
Rubber	***Hevea brasiliensis***	Latex – Kerala
Silver oak	***Grevillea robusta***	Shade tree in coffee/tea
Melia dubia	***Melia dubia***	Fast-growing agroforestry tree (plywood) – TN, Karnataka

- **NTFPs / MFP (minor forest produce)**: tendu leaves, **lac**, gums (karaya, ghatti), resins, honey, **mahua**, sal seed, bamboo, **tamarind**, medicinal plants. **MSP for MFP** scheme (TRIFED, 2013-14); **Van Dhan Vikas Kendras** (2018).
- **Wood**: **heartwood** (dead, durable, dark) vs **sapwood** (living, light); **seasoning** (drying to ~12% moisture) – air & kiln; **preservation** – **ASCU** (arsenic–copper–chrome), creosote.

MEMORY TRICK

"**Teak = King, Bamboo = Green gold, Subabul = Miracle tree, Neem = Village pharmacy, Khejri = Rajasthan's tree**".

PREVIOUSLY ASKED / LIKELY QUESTIONS

- King of timbers? → Teak (*Tectona grandis*).
- Sandalwood is a? → Root hemi-parasite.
- Leaves of which tree are used for bidis? → Tendu (*Diospyros melanoxylon*).
- Bamboo was removed from the definition of "tree" in? → 2017 (Indian Forest Act amendment).
- Turpentine is obtained from? → Chir pine resin.

11.4 Forest Laws, Policies, Programmes & Institutes ★★☆

Law / policy / programme	Year	Key point
First Forest Policy	**1894**	British
Indian Forest Act	**1927**	Reserved, protected & village forests
National Forest Policy	**1952**, **1988**	1988 – **33%** cover; people-centric; JFM
Wildlife (Protection) Act	**1972** (amended **2022**)	Schedules, protected areas
Forest (Conservation) Act	**1980** → amended as **Van (Sanrakshan Evam Samvardhan) Adhiniyam, 2023**	Centre's approval for diverting forest land
42nd Amendment	**1976**	Forests & wildlife moved from **State to Concurrent List**; **Art. 48A** (DPSP) & **51A(g)** (duty)
Environment (Protection) Act	**1986**	Umbrella Act (after Bhopal)
Biological Diversity Act	**2002** (amended 2023)	NBA – **Chennai**
Forest Rights Act (FRA)	**2006**	Rights of forest dwellers & STs; Gram Sabha
CAMPA Act	**2016**	Compensatory afforestation funds
National Afforestation Programme (NAP)	2000-02	Through **JFMCs / FDAs**
Green India Mission (GIM)	**2014** (NAPCC, 2008)	Increase forest cover on **5 Mha** + improve quality on 5 Mha; revised plan 2025 includes **Aravalli** restoration
Nagar Van Yojana	2020	Urban forests
"Ek Ped Maa Ke Naam"	**5 Jun 2024**	Tree-planting campaign (World Environment Day)
Green Credit Programme	**2023**	Credits for tree plantation on degraded land

- **Chipko movement** – **1973**, **Mandal (Chamoli)**, Uttarakhand – **Sunderlal Bahuguna, Chandi Prasad Bhatt, Gaura Devi**. **Appiko** – Karnataka (1983). **Bishnoi** (Khejarli, 1730 – **Amrita Devi**).
- **Institutes**: **ICFRE – Dehradun** (Indian Council of Forestry Research & Education); **FRI – Dehradun** (1906); **FSI – Dehradun** (1981); **IGNFA – Dehradun** (IFS training); **IFGTB – Coimbatore** (forest genetics & tree breeding); **IWST – Bengaluru** (wood science); **AFRI – Jodhpur** (arid forests); **TFRI – Jabalpur** (tropical forests); **IFP – Ranchi** (forest productivity); **HFRI – Shimla**; **RFRI – Jorhat**; **IIFM – Bhopal** (forest management); **CAFRI – Jhansi**; **Wildlife Institute of India – Dehradun**; **IPIRTI – Bengaluru** (plywood).
- **Days**: **World Forestry Day / International Day of Forests – 21 March**; **Van Mahotsav – first week of July** (started **1950** by **K.M. Munshi**); **World Environment Day – 5 June**.

MEMORY TRICK

Forest law years "**27-72-80-86-06**" → Indian Forest Act 1927, Wildlife Act 1972, Forest Conservation Act 1980, EPA 1986, Forest Rights Act 2006.

PREVIOUSLY ASKED / LIKELY QUESTIONS

- Chipko movement started in? → 1973, Chamoli (Uttarakhand).
- Van Mahotsav was started by? → K.M. Munshi (1950).
- 42nd Amendment moved forests to which list? → Concurrent List.

- New name of the Forest (Conservation) Act after the 2023 amendment? → Van (Sanrakshan Evam Samvardhan) Adhiniyam.
- IFGTB is located at? → Coimbatore.

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12. Last-Day Revision (One Page)

Topic	Must-remember facts (Oct 2026)
Production 2025-26	Foodgrains **376.56 Mt**; rice 154.02; wheat 120.66; maize 55.09; pulses 27.41; oilseeds 43.06; sugarcane 500.06 Mt; horticulture **377.78 Mt**
Livestock & fish (2024-25)	Milk **247.87 Mt**, **485 g/day**; eggs 149.11 bn; meat 10.50 Mt; fish **197.75 lakh t** (2nd in world)
MSP	Paddy **₹2,441** (KMS 2026-27); wheat **₹2,610** (RMS 2027-28); safflower highest hike +₹675; moong margin 61%
PM-KISAN	₹6,000 = 3 × ₹2,000; to **2030-31** (₹3.15 lakh cr); 23rd instalment – Tarakeswar, 20 Jun 2026
PMFBY	Premium **2% / 1.5% / 5%**; NE 90:10; wild-animal add-on from Kharif 2026
New missions	PMDDKY – **100 districts, ₹24,000 cr/yr × 6 yrs**; Pulses – ₹11,440 cr, 350 lakh t by 2030-31; Cotton – ₹5,659 cr; NMEO-OS ₹10,103 cr; NMNF ₹2,481 cr
Digital	AgriStack Farmer IDs **10.31 crore**; **Bharat-VISTAAR** (Budget 2026-27); Kisan e-Mitra (PM-KISAN chatbot)
PSL	**40%** total; agri **18%**; NCF 14%; **SMF 10%**; micro 7.5%; weaker 12%; RRB 75%; FPO limit ₹4 cr (₹10 cr)
KCC	7% → **4%** effective (1.5% IS + 3% PRI); ≤ ₹3 lakh; collateral-free **₹2 lakh**; new RBI Directions – **6-yr card from 1 Jan 2027**
NABARD & RRB	NABARD **12 Jul 1982** (CRAFICARD); RIDF 1995-96; RRBs **28** (1 May 2025), share 50:35:15
RBI & credit	Repo **5.50%** (7 Oct 2026); agri credit target 2025-26 **₹32.5 lakh cr**; PMJDY **59 crore** a/cs
Agronomy	Wheat CRI 21 DAS; rice Khaira = Zn; *Phalaris* → clodinafop/sulfosulfuron; C4 – maize, sugarcane, sorghum, bajra
Soil	Urea 46 N; DAP 18-46; SSP 16 P_2O_5 + 12 S; MOP 60 K_2O; AS 20.6 N + 24 S; 100 kg N = 217 kg urea; sodic: pH > 8.5, ESP > 15 → gypsum
Protection	Blast – *Pyricularia*; Karnal bunt – *Tilletia indica*; red rot – *Colletotrichum*; YMV – whitefly; tungro – GLH; label red = LD_{50} 1–50
Horticulture	Amrapali = Dashehari × Neelum; G-9 banana; black tip = brick kiln; whiptail = Mo; paclobutrazol – mango regular bearing
Animal husbandry	Sahiwal best milch; Murrah best buffalo; HTST 72 °C/15 s; RGM ₹3,400 cr; White Revolution 2.0 – 75,000 cooperatives
Economics & extension	MSP = 1.5 × A2+FL; C2+50% (Swaminathan); first KVK Puducherry 1974; adopters 2.5-13.5-34-34-16; VB-G RAM G – **125 days** (from 1 Jul 2026)
Engineering	PTO 540 rpm; disc plough – hard soils; flat fan nozzle – herbicides; drip 90%+; biogas CH_4 55–65%
Fisheries	Catla surface, rohu column, mrigal bottom; vannamei most farmed; PMMSY ₹20,050 cr; FIDF 3%
Forestry (ISFR 2023)	Total **25.17%** (forest 21.76 + tree 3.41); largest – MP; target 33%; teak = king of timbers

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