1. Alluvial Soils (covering most of Punjab)

Alluvial soils are formed by deposits from rivers like the Sutlej, Beas, and Ravi. These are deep, fertile, and rich in nutrients, especially potash, but may show nitrogen deficiency with continuous cropping. They have good water-holding capacity and are easy to till.

- **Crops that can be grown:** Wheat and rice are the most common because they need fertile soils and irrigation, both of which are available here. Maize, cotton, sugarcane, mustard, pulses, and vegetables like potato, tomato, and onion also perform very well.
- **Fertilizer guidance:** Balanced NPK application is important. For wheat, a typical recommendation is 120 kg urea, 50 kg DAP, and 50 kg MOP per acre. For rice, 135 kg urea, 50 kg DAP, and 30 kg MOP per acre. Green manuring with crops like dhaincha before rice helps maintain nitrogen levels and improves soil organic matter. Organic manures are also beneficial to avoid nutrient exhaustion in rice–wheat rotation.

2. Sandy Soils (found in South-West Punjab: Bathinda, Fazilka, Muktsar)

These soils have a coarse texture with large sand particles, which makes them well-drained but poor in holding water and nutrients. They are often low in organic matter and nitrogen.

- **Crops that can be grown:** Crops like pearl millet (bajra), maize, groundnut, cotton, guar, and pulses are suitable because they can tolerate drier conditions and sandy textures.
- **Fertilizer guidance:** Since sandy soils lose nitrogen quickly through leaching, nitrogen fertilizers (urea) should be applied in 2–3 splits. Gypsum or single super phosphate (SSP) can be used to supply sulphur, which is often deficient. Adding organic matter such as FYM, compost, or crop residues improves fertility and water-holding capacity. Zinc sulphate application is important if deficiency symptoms like stunted growth or yellowing leaves are seen.

3. Loamy Soils (balanced sand, silt, and clay – found in Ludhiana, Jalandhar, etc.)

Loamy soils are considered ideal agricultural soils. They are well-drained yet hold enough moisture, and they contain balanced nutrients.

- **Crops that can be grown:** Wheat, rice, maize, potato, sunflower, and fruits like citrus do very well. High-value crops such as vegetables and orchards can also be grown profitably.
- **Fertilizer guidance:** These soils respond efficiently to fertilizers. At sowing, DAP or SSP should be applied to supply phosphorus. Urea should be applied in 2–3 splits to maximize nitrogen use. Potassium deficiency is not always common but if soil test shows low K, MOP is added. Incorporating FYM or green manure improves soil organic carbon and keeps the soil structure healthy in the long term.

4. Clayey Soils (parts of Kapurthala, Amritsar)

These soils contain a higher percentage of clay, making them heavy and capable of holding water and nutrients. However, they drain poorly and are prone to waterlogging.

- **Crops that can be grown:** Paddy is the most suitable crop because it requires standing water. Wheat and sugarcane also grow well. Vegetables like okra and tomato are also grown in areas with proper drainage.
- **Fertilizer guidance:** Since clay soils retain nutrients, there is no need to overuse DAP. If the soil is sodic, gypsum should be added to reduce alkalinity. Nitrogen should be given in splits to reduce loss due to water stagnation. SSP is often preferred because it not only supplies phosphorus but also adds sulphur, which benefits oilseeds and pulses. Organic manures also help in improving aeration and reducing compaction.

5. Kallar / Saline-Sodic Soils (high pH > 8, found in pockets of Sangrur and Mansa)

These soils are problematic because of high salts (salinity) or excess sodium (sodicity). They have poor structure, low fertility, and high pH, which makes many nutrients unavailable.

- **Crops that can be grown:** Only salt-tolerant crops do well here, such as barley, mustard, guar, and certain varieties of rice. For forestry and wasteland use, ber and eucalyptus are planted.
- **Fertilizer guidance:** Gypsum should be applied at 10–15 quintals per acre to reclaim sodic soils. Organic matter such as FYM and green manures improve structure and microbial activity. Foliar sprays of zinc and iron are essential because these nutrients get locked in high pH conditions. Urea should be used carefully, as excess nitrogen aggravates sodicity and weakens soil health. Regular leaching with good-quality irrigation water also helps.

6. Calcareous Soils (lime-rich, alkaline in nature)

These soils contain free lime (calcium carbonate), which makes them alkaline and leads to deficiencies of micronutrients like zinc and iron.

- **Crops that can be grown:** Maize, wheat, bajra, pulses, and oilseeds adapt better to calcareous soils.
- **Fertilizer guidance:** Since zinc and iron are less available, zinc sulphate should be applied at about 25 kg per hectare, and iron sprays should be given if deficiency symptoms (like yellowing between leaf veins) appear. Adding organic matter like FYM and compost helps improve fertility. For phosphorus supply, SSP is more effective than DAP in these soils because it works better in the presence of lime and also provides sulphur.