For agriculture engineers

Understanding Soil

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The Content

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III. Soil Types

Soils are classified into different types based on their texture, composition, and properties.

The primary soil types are determined by the relative proportions of sand, silt, and clay, which are the three main mineral particles found in soil.

1- Sandy soil

Texture

Gritty and coarse to the touch.

Composed of large particles (0.05–2 mm in diameter).

Composition

Dominated by **sand** (over 70% sand content).

Low amounts of **silt** and **clay**.

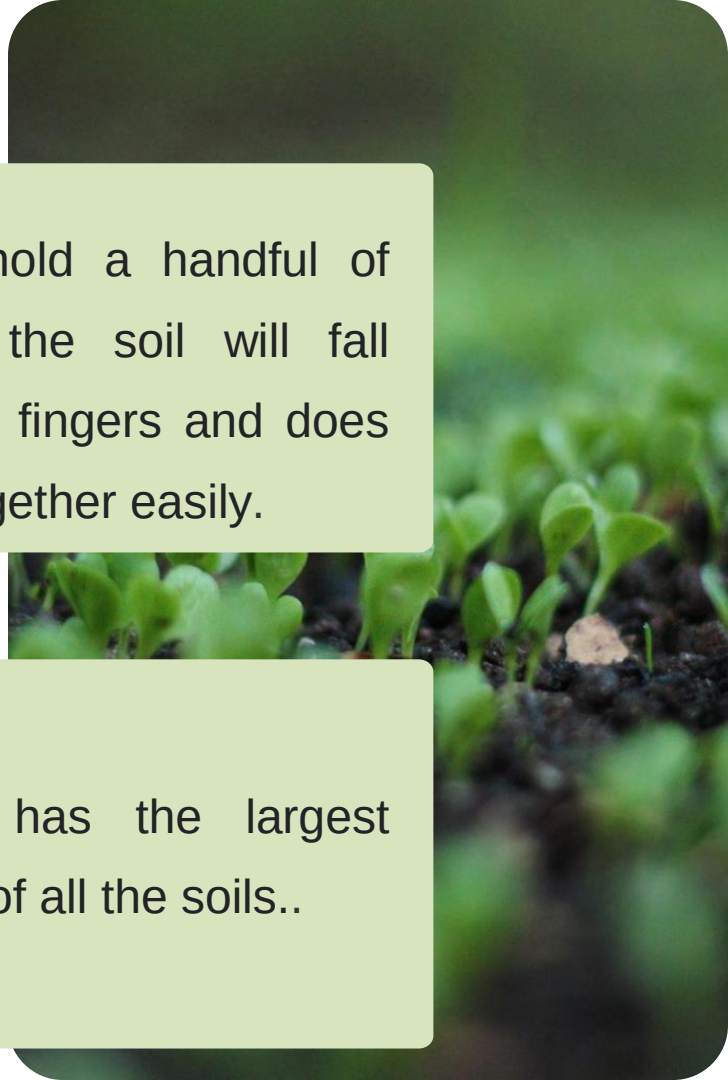
Color

Typically,light brown or tan due to low organic matter content

How to Identify sandy soil

Sandy soils have a gritty texture,

When you hold a handful of sandy soil, the soil will fall through your fingers and does not clump together easily.



Sandy soil will generally be a pale brown, beige, or gray color but the color can be darker.

Sandy soil has the largest particle size of all the soils..

Properties of Sandy soil

Drainage

Excellent drainage due to large pore spaces between particles.

Water flows through quickly, reducing the risk of waterlogging.

Water Retention

Poor water retention; dries out quickly.

Not ideal for drought-sensitive plants.

Nutrient Retention:

Low nutrient retention because nutrients leach out easily with water.

Requires frequent fertilization.

Properties of Sandy soil

Aeration

High aeration due to loose structure, which is beneficial for root growth.

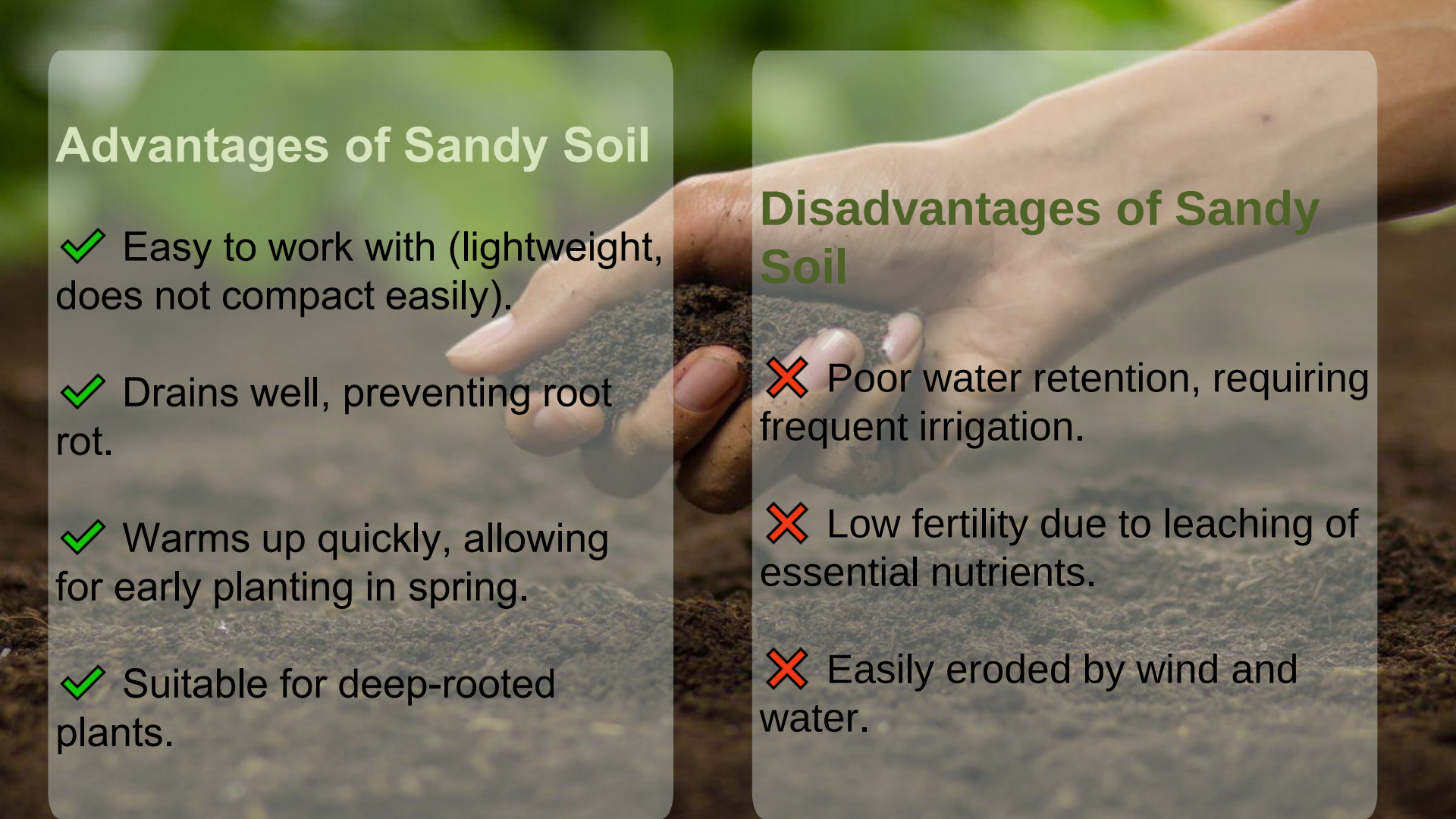
Temperature

Warms up quickly in spring, making it suitable for early planting

Workability

•Easy to work with, even when wet.

•Does not become compacted easily.



Advantages of Sandy Soil

✔ Easy to work with (lightweight, does not compact easily).

✔ Drains well, preventing root rot.

✔ Warms up quickly, allowing for early planting in spring.

✔ Suitable for deep-rooted plants.

Disadvantages of Sandy Soil

✘ Poor water retention, requiring frequent irrigation.

✘ Low fertility due to leaching of essential nutrients.

✘ Easily eroded by wind and water.


Best Plants for Sandy Soil

Vegetables: Carrots, radishes, potatoes, onions, asparagus.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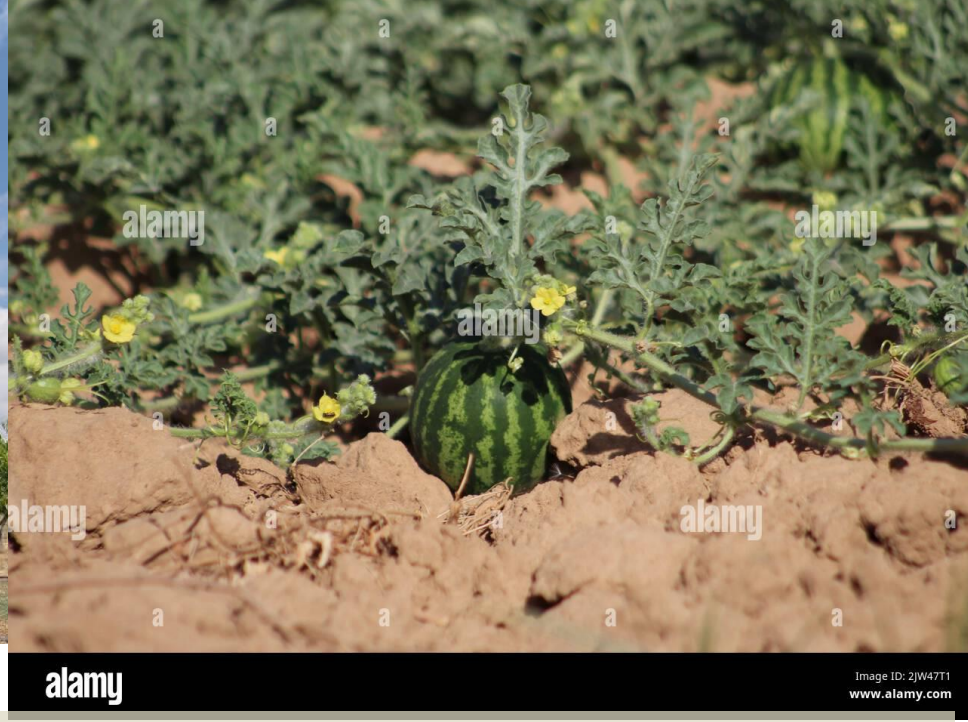
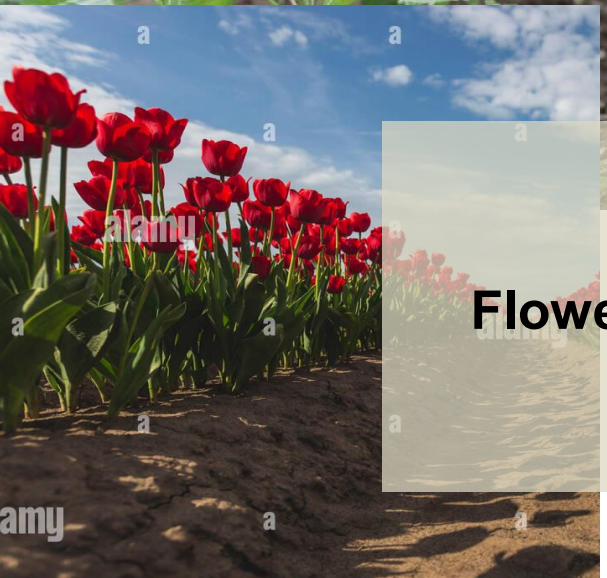
Herbs: Lavender, rosemary, thyme.



Fruits: Watermelon, peanuts, peaches.



Flowers: Tulips, hibiscus, sunflowers.

How to Improve Sandy Soil

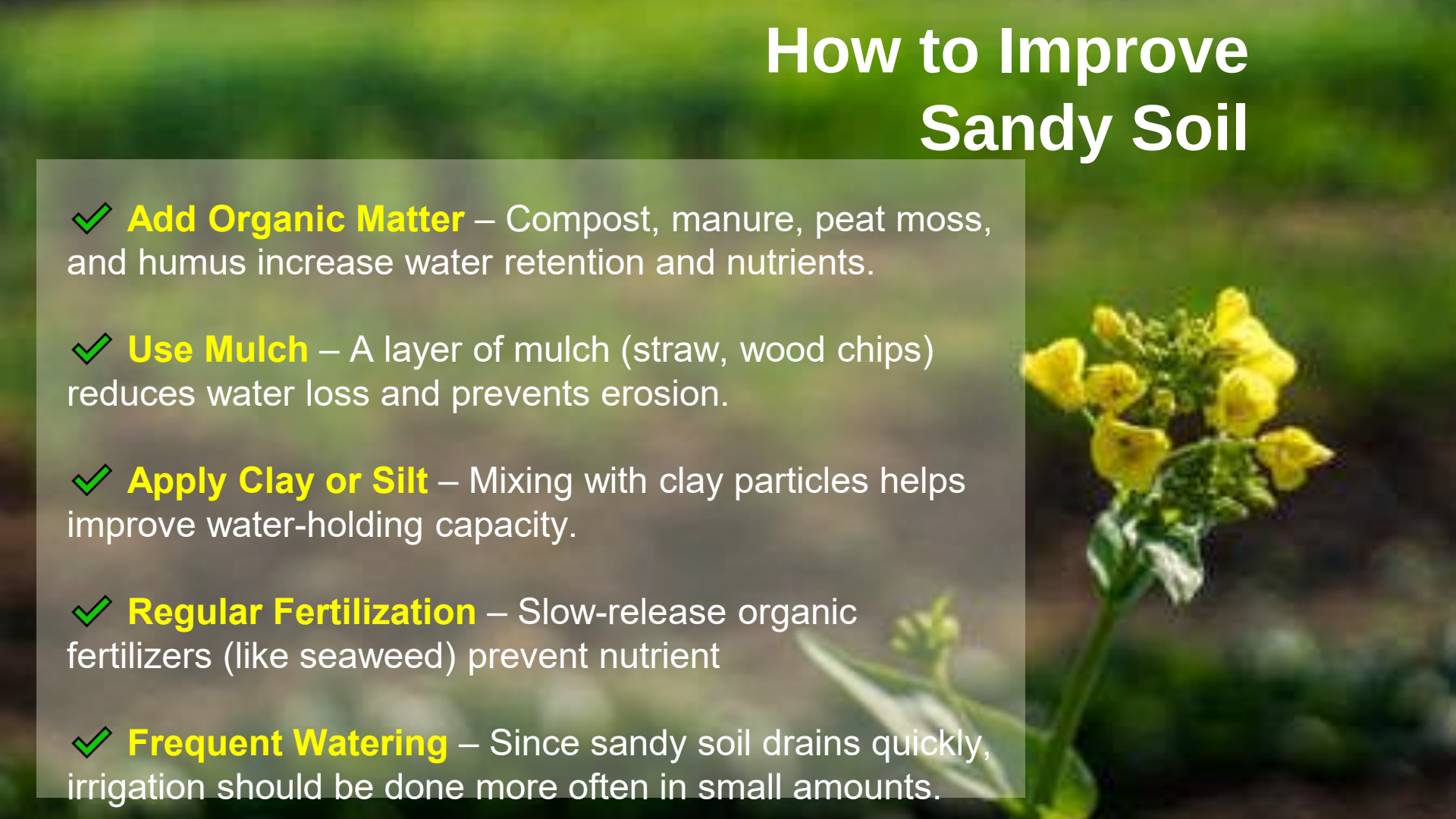
✔ **Add Organic Matter** – Compost, manure, peat moss, and humus increase water retention and nutrients.

✔ **Use Mulch** – A layer of mulch (straw, wood chips) reduces water loss and prevents erosion.

✔ **Apply Clay or Silt** – Mixing with clay particles helps improve water-holding capacity.

✔ **Regular Fertilization** – Slow-release organic fertilizers (like seaweed) prevent nutrient

✔ **Frequent Watering** – Since sandy soil drains quickly, irrigation should be done more often in small amounts.



Silty Soil is a fertile soil type known for its smooth texture and high nutrient content.

2- Silty Soil

It is composed primarily of **silt particles**, which are finer than sand but coarser than clay.

2- silty soil

Texture

- Smooth and silky when dry.
- Slippery and soft when wet.

Composition

- Dominated by **silt particles** (0.002–0.05 mm in diameter).
- Contains smaller amounts of sand and clay.

Color

Usually, dark brown or black due to high organic matter content.


SILT

How to Identify silty soil

Silt soils have a slippery, more smooth texture similar to clay but they do not stick together like clay does.

Silt soils have a medium sized particle size between sandy and clay sized.

Properties of silty soil

Drainage

- Moderate drainage; better than clay but not as fast as sandy soil.
- Retains moisture well without becoming waterlogged.

Water Retention

Excellent water retention, making it drought-resistant.

Nutrient Retention

- High nutrient retention due to its fine particles and organic matter content.
- Fertile and ideal for plant growth.

Properties of silty soil

Aeration

Moderate aeration; better than clay but less than sandy soil.

Workability

- Easy to work with and cultivate.
- Can become compacted if overworked or walked on when wet.

Erosion

Prone to erosion by wind and water due to its fine texture.

Advantages of Silty Soil

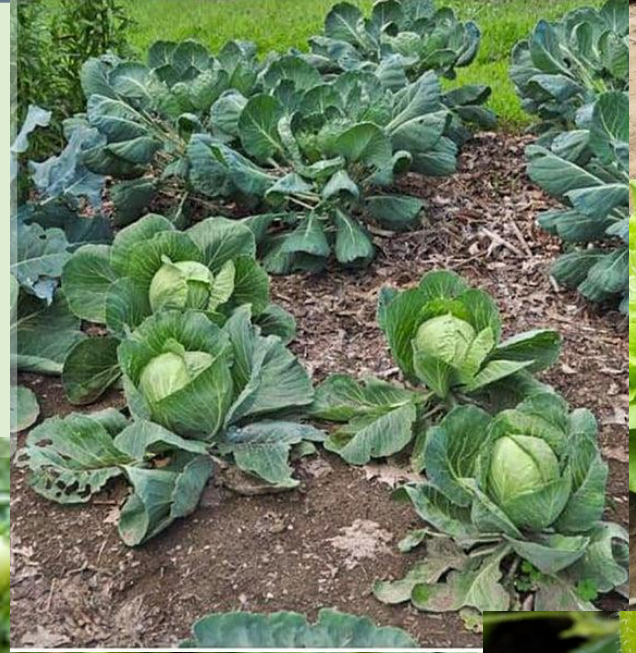
- Highly fertile and rich in nutrients.
- Retains moisture well, reducing the need for frequent irrigation.
- Easy to till and cultivate.
- Warms up quickly in spring, allowing for early planting.

Disadvantages of Silty Soil

- Prone to compaction, which can reduce aeration and root growth.
- Susceptible to erosion by wind and water.


Best Plants for silty Soil

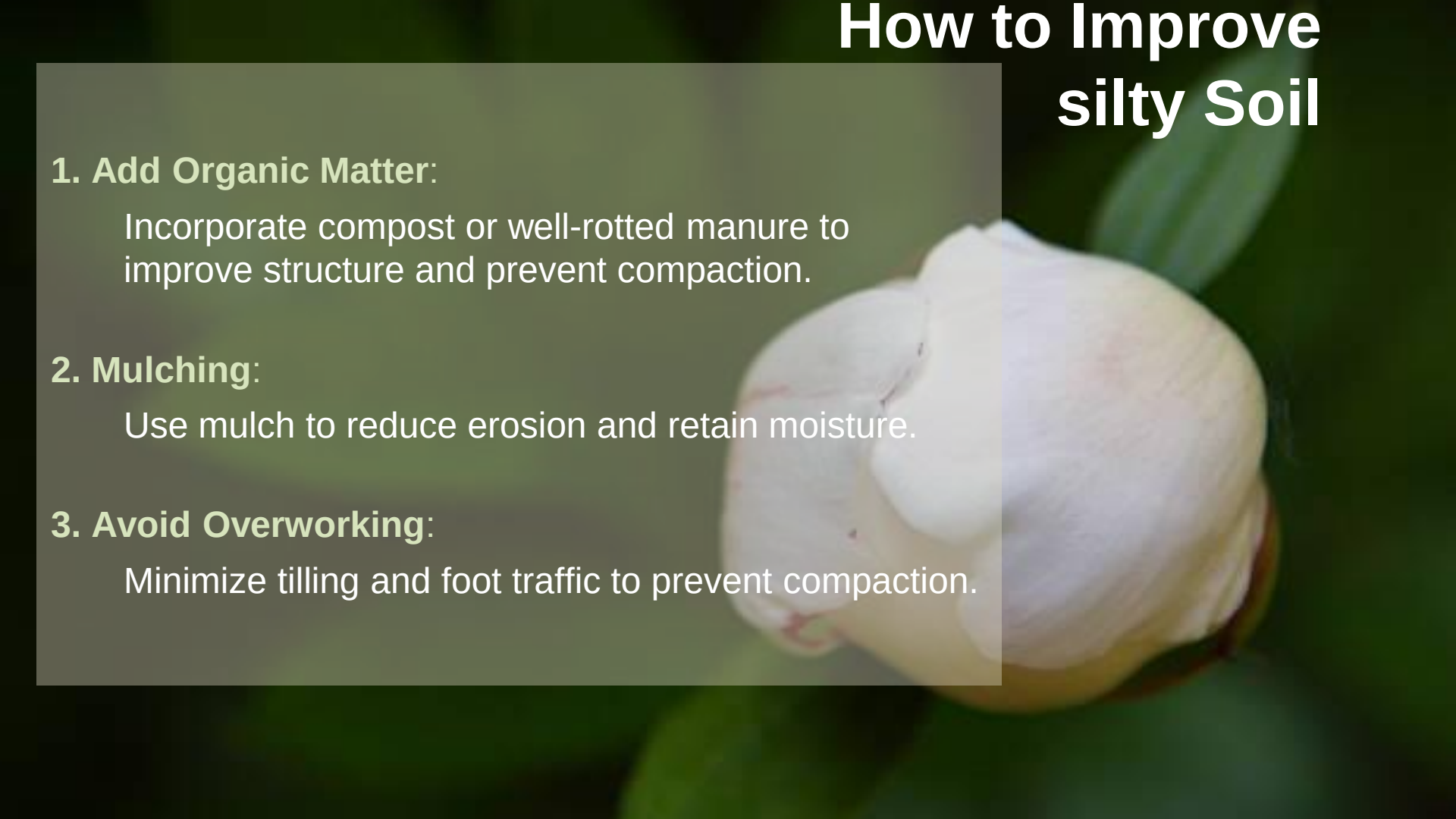
Vegetables:
Lettuce,
cabbage,
tomatoes,
cucumbers,
spinach.




Fruits: Apples, pears, plums..

Grains: Wheat, rice, corn

How to Improve silty Soil



1. Add Organic Matter:

Incorporate compost or well-rotted manure to improve structure and prevent compaction.

2. Mulching:

Use mulch to reduce erosion and retain moisture.

3. Avoid Overworking:

Minimize tilling and foot traffic to prevent compaction.

3- Clay soil

Clay Soil is a dense, heavy soil type composed primarily of very fine clay particles

It is known for its ability to retain water and nutrients.

but can be challenging to work with due to its compact nature.

3- Clay soil

Texture:

Sticky and smooth when wet.

Hard and clumpy when dry.

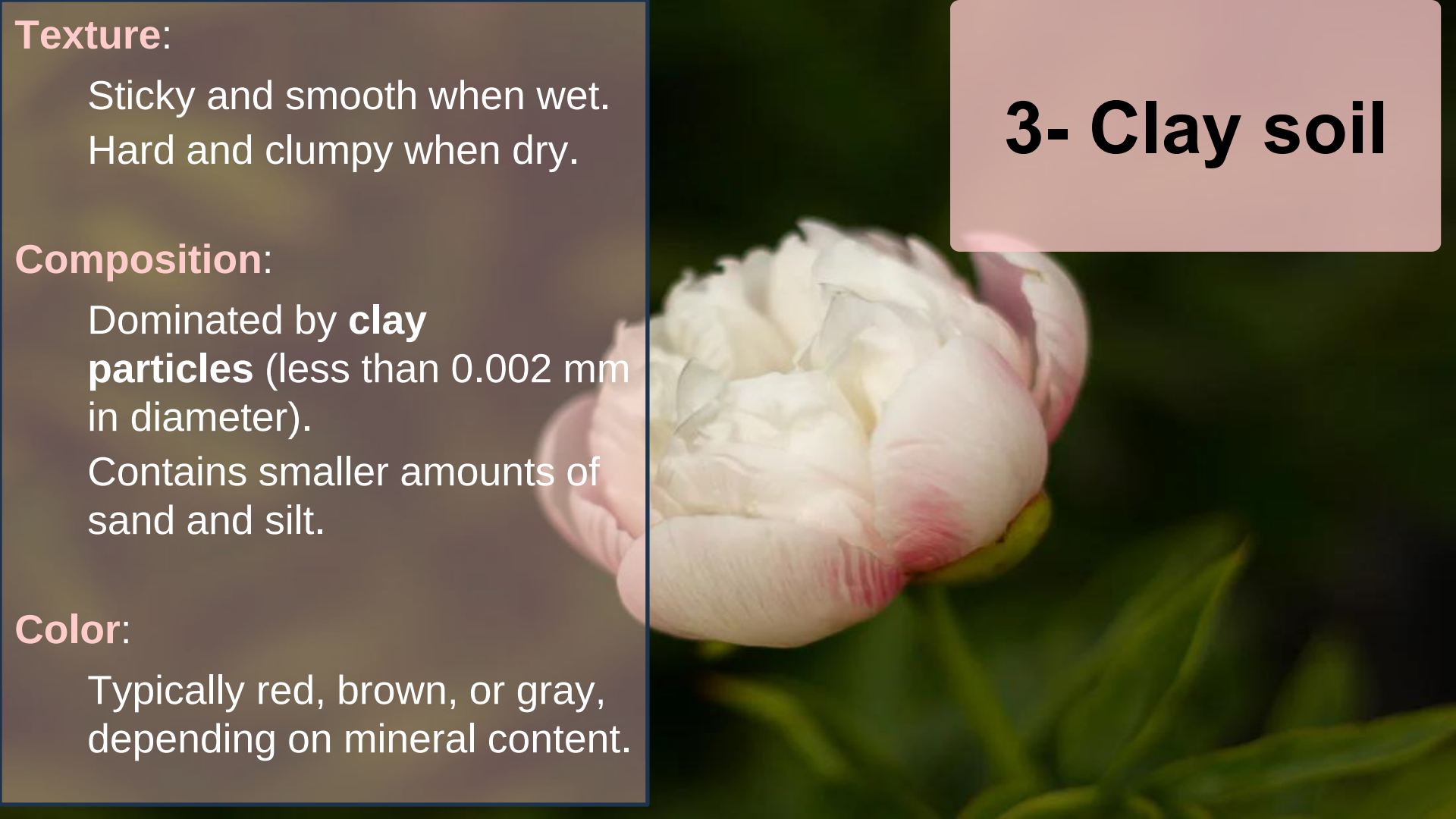
Composition:

Dominated by **clay particles** (less than 0.002 mm in diameter).

Contains smaller amounts of sand and silt.

Color:

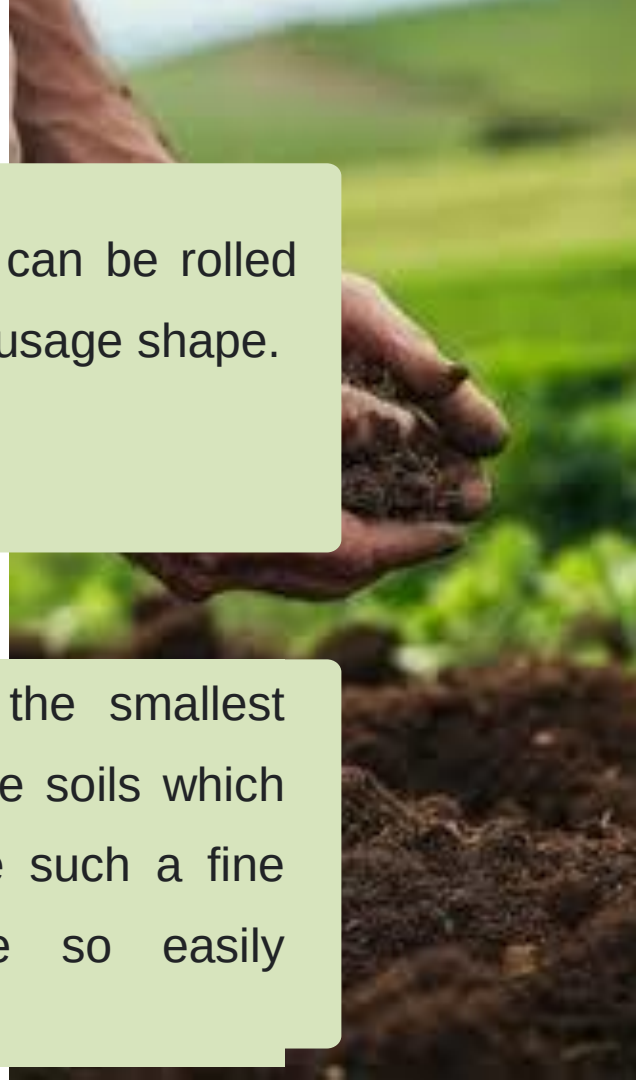
Typically red, brown, or gray, depending on mineral content.



How to Identify clay soil

Clay soils have a finer texture and will stick together if wet.

This type of soil can be rolled into a ball or a sausage shape.



Clay soils may be a reddish brown or darker brown color and shiny when wet

Clay soils have the smallest particle size of the soils which is why they have such a fine texture and are so easily compacted.

Properties of clay soil

Drainage

Poor drainage due to tiny pore spaces between particles.

Prone to waterlogging.

Water Retention

Excellent water retention; holds moisture for long periods.

Nutrient Retention

High nutrient retention due to its ability to hold onto minerals and organic matter.

Properties of clay soil

Aeration

Poor aeration; compact structure limits oxygen flow to plant roots.

Workability

-Difficult to work with when wet (sticky) or dry (hard and clumpy).

-Prone to compaction.

Temperature

Warms up slowly in spring, delaying planting.

Advantages of Clay Soil

•High nutrient content, making it fertile.

•Excellent water retention, reducing the need for frequent irrigation.

Disadvantages of Clay Soil

•Poor drainage, leading to waterlogging and root rot.

•Hard to cultivate and work with, especially when wet or dry.

•Prone to compaction, which restricts root growth and aeration.

•Slow to warm up in spring, delaying planting.

Best Plants for clay Soil

Vegetables : Broccoli, Cabbage , Cauliflower

Fruits: Blackberries, Raspberries, Elderberries

How to Improve Clay Soil

1. **Add Organic Matter**:

   Incorporate compost, manure, or leaf mold to improve structure and drainage.

2. **Use Gypsum**:

   Apply gypsum to break up compacted clay and improve aeration.

3. **Mulching**:

   Use mulch to prevent surface crusting and retain moisture.

4. **Avoid Overworking**:

   Minimize tilling and foot traffic to prevent compaction.