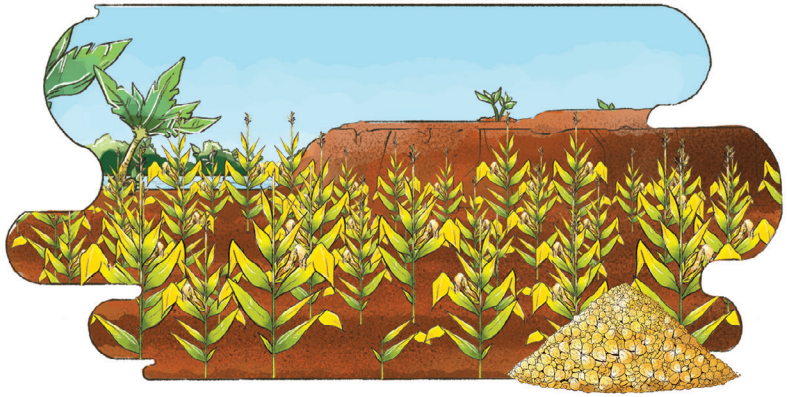
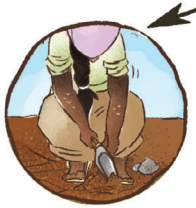
Lesson: If yields are low and the soil is reddish, soil acidity should be tested



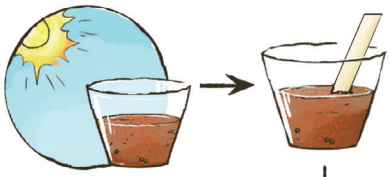
1. If low yields, reddish soil

2. Purchase pH strip from vendor



3. Remove soil from deep below and add lots of water

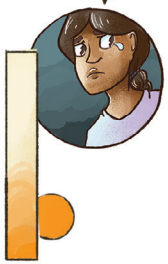
4. Let sit overnight



5. Add pH strip

8. Spread limestone before sowing

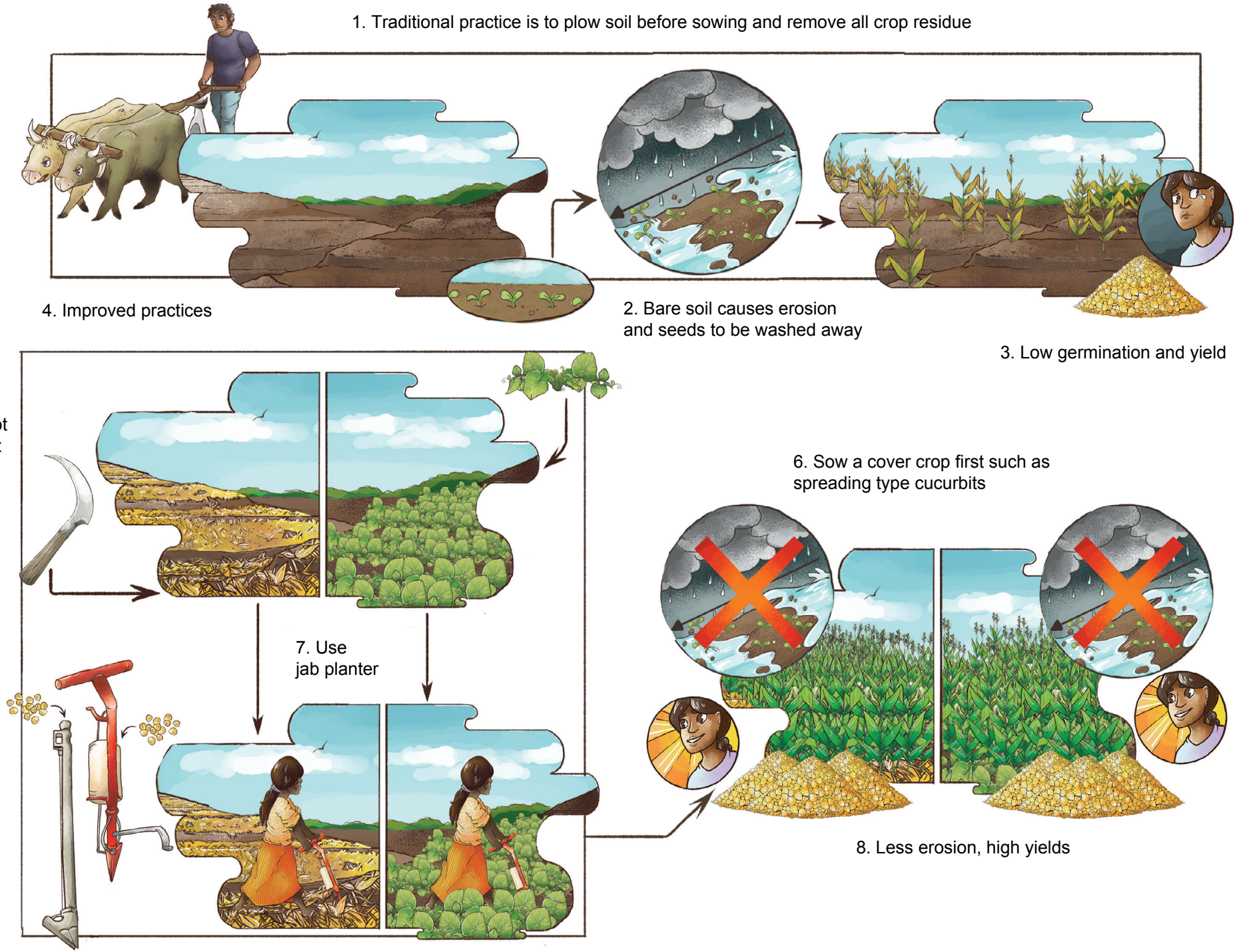
6. If green colour: soil acidity is fine and high yields are possible



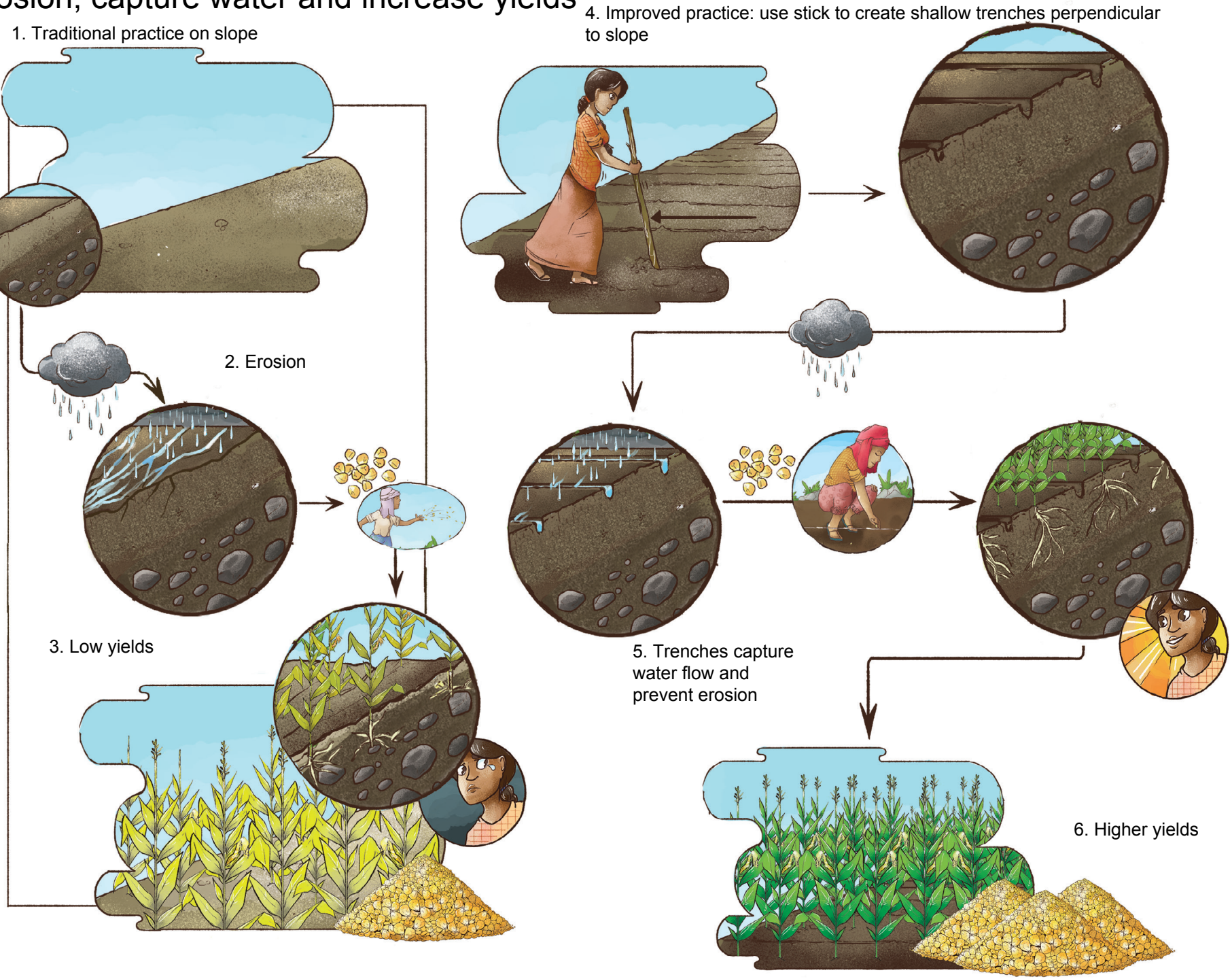
7. If orange colour: need to purchase limestone from vendor to reduce acidity

9. High yield

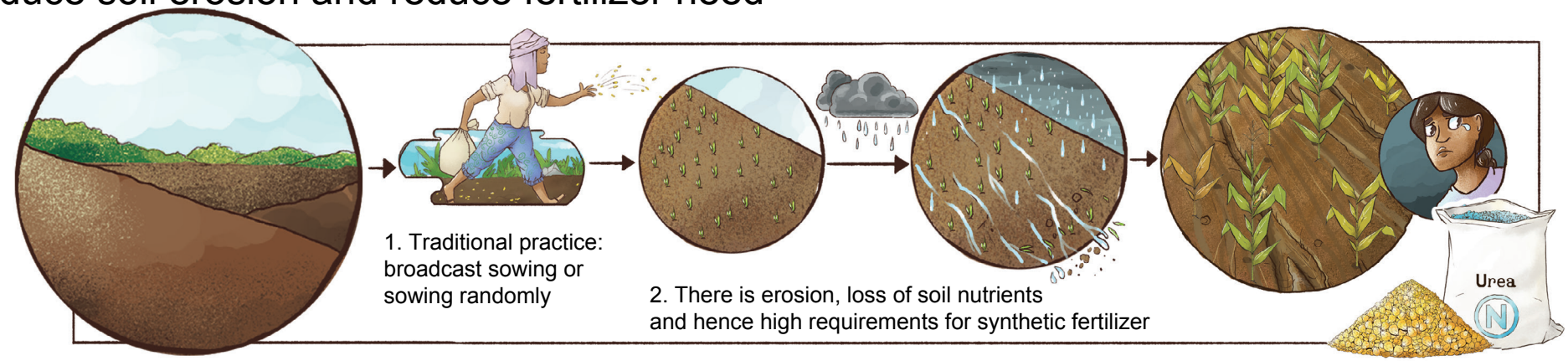
Lesson: Not leaving the soil bare reduces soil erosion and improves yields



Lesson: Creating shallow trenches with a stick perpendicular to a slope will reduce soil erosion, capture water and increase yields



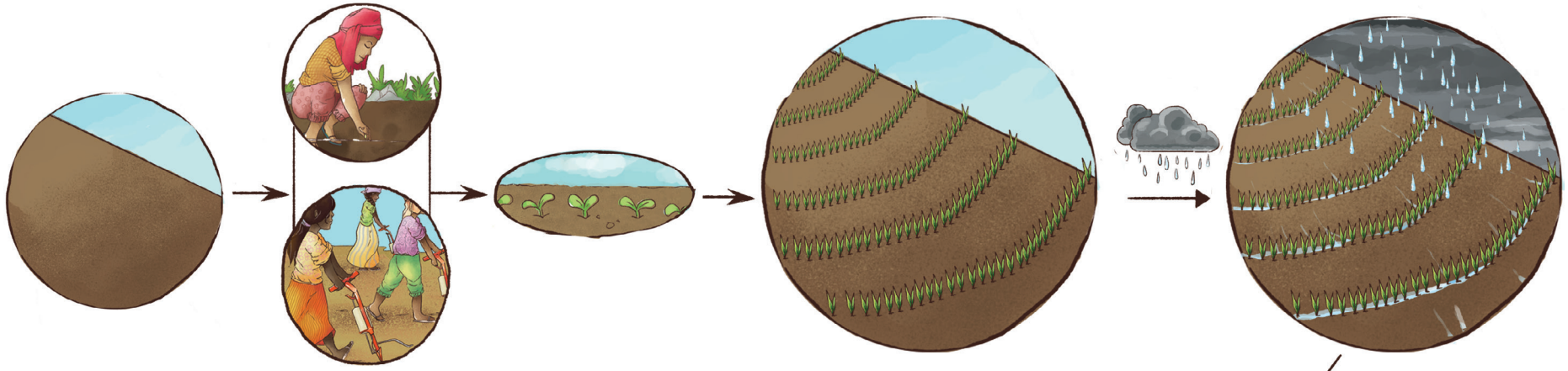
Lesson: On non-terraced, sloped land, sowing crops in rows perpendicular to the slope will reduce soil erosion and reduce fertilizer need



1. Traditional practice: broadcast sowing or sowing randomly

2. There is erosion, loss of soil nutrients and hence high requirements for synthetic fertilizer

3. Low yield

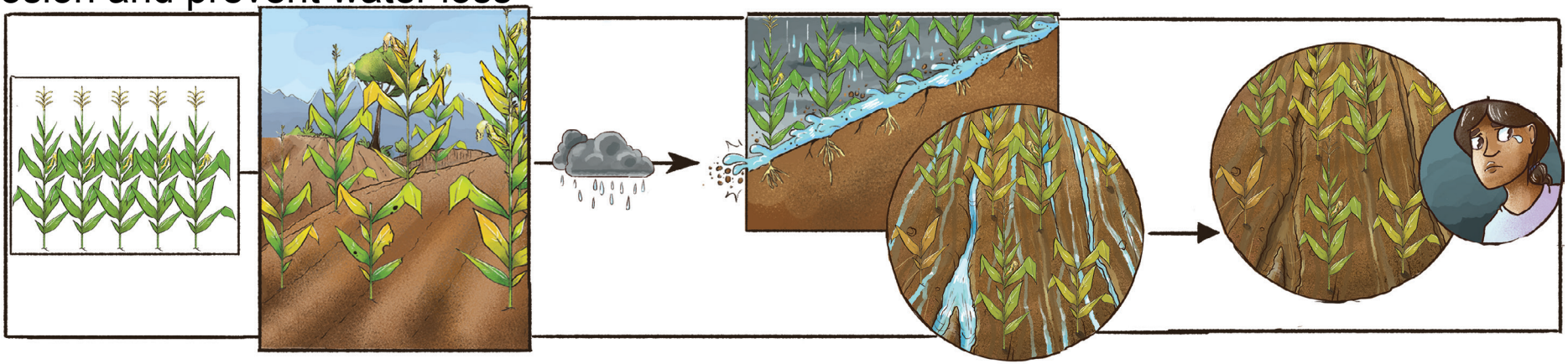


4. Improved practice: using hand or jab planter, sow in rows perpendicular to the slope

5. Less soil erosion, less need to purchase synthetic fertilizer

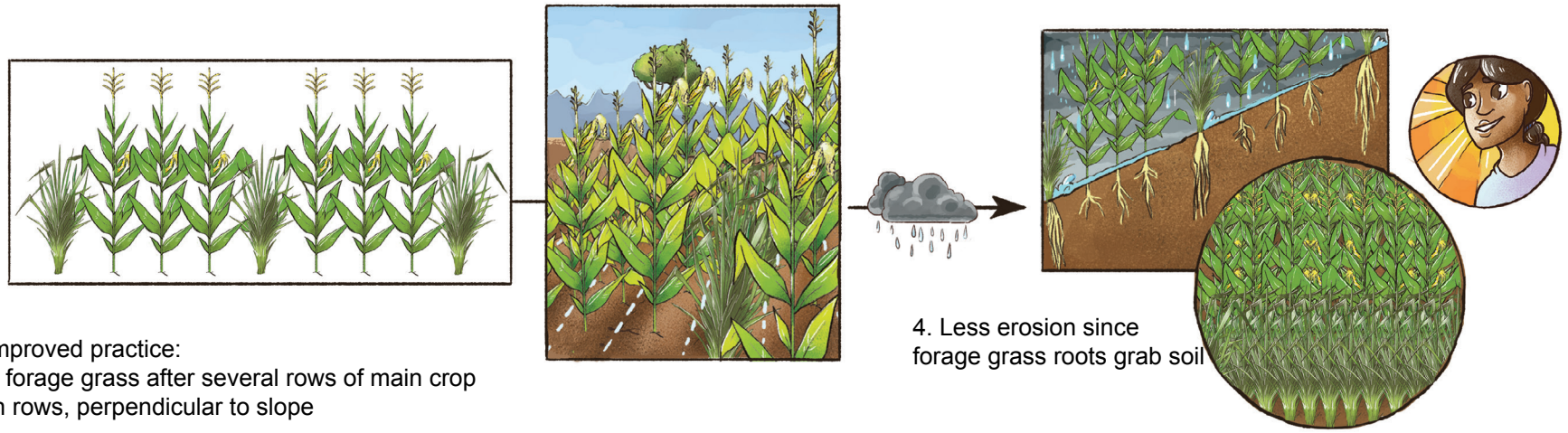
6. High yield

Lesson: On sloped, non-terraced land, sowing vetiver or other forage grasses will reduce erosion and prevent water loss



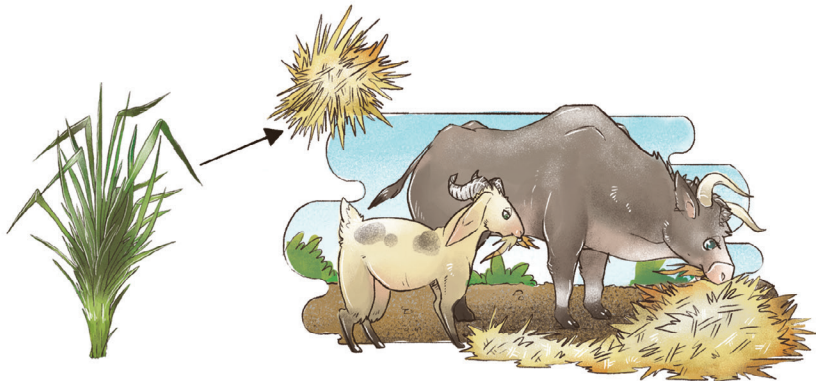
1. Traditional practice

2. Erosion



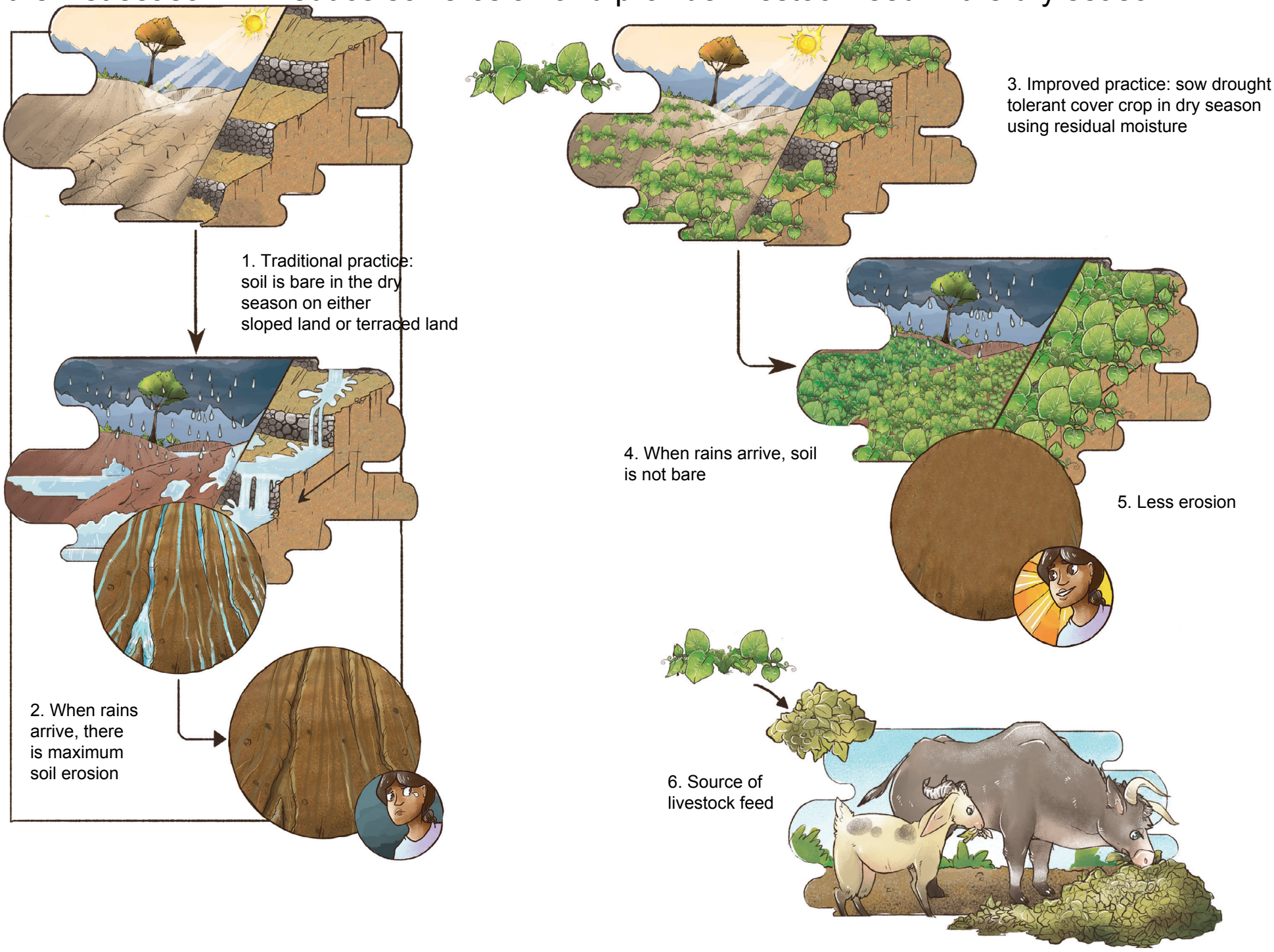
3. Improved practice:
sow forage grass after several rows of main crop
all in rows, perpendicular to slope

4. Less erosion since
forage grass roots grab soil

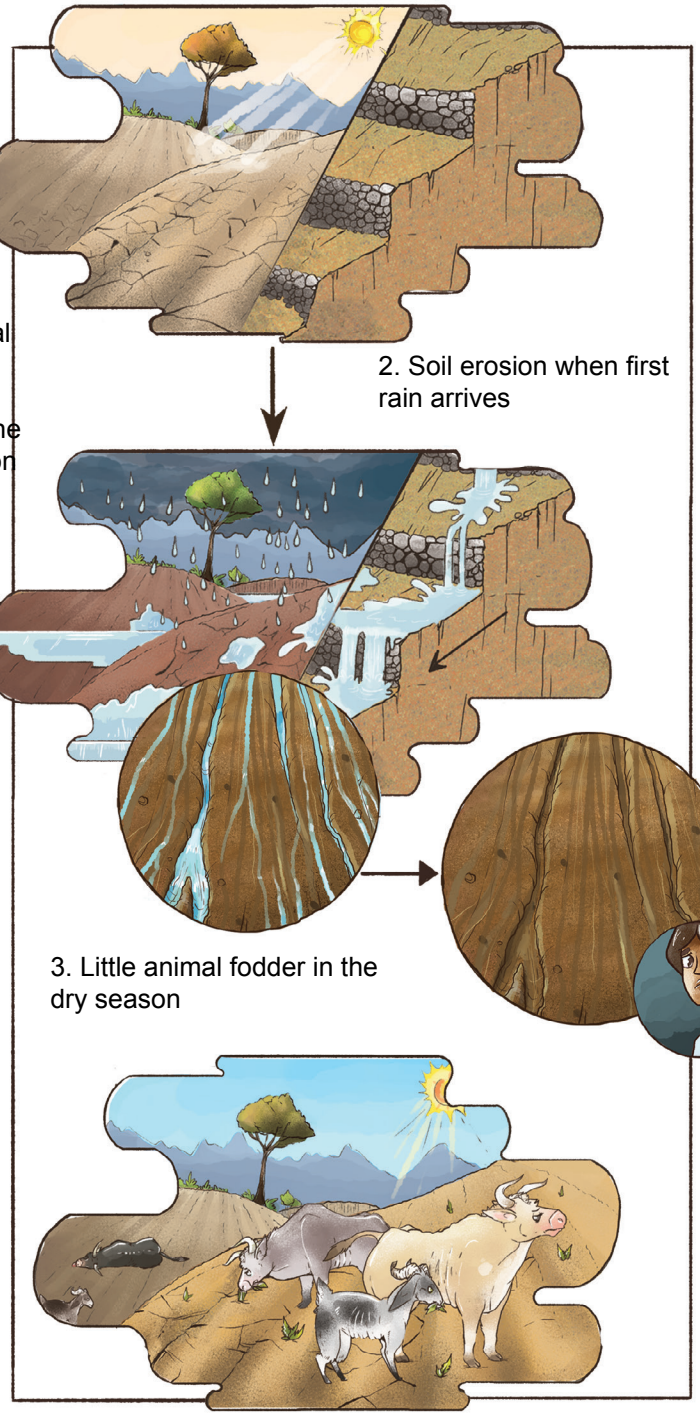


5. Forage grass can be fed to livestock

Lesson: Sowing a spreading type cover crop prior to the transition between the dry season and the wet season will reduce soil erosion and provide livestock feed in the dry season



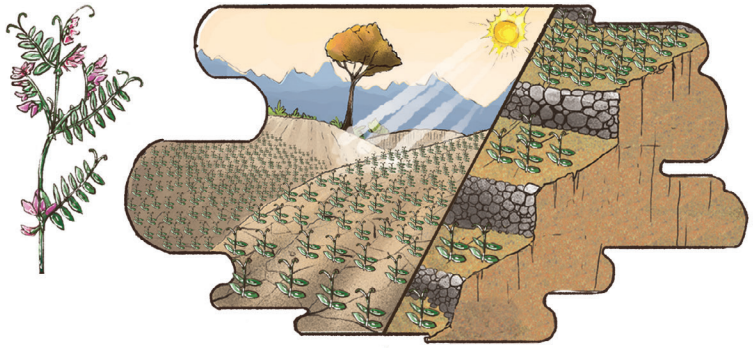
Lesson: Planting vetch in the dry season will reduce soil erosion, provide animal fodder and add nutrients to soil.



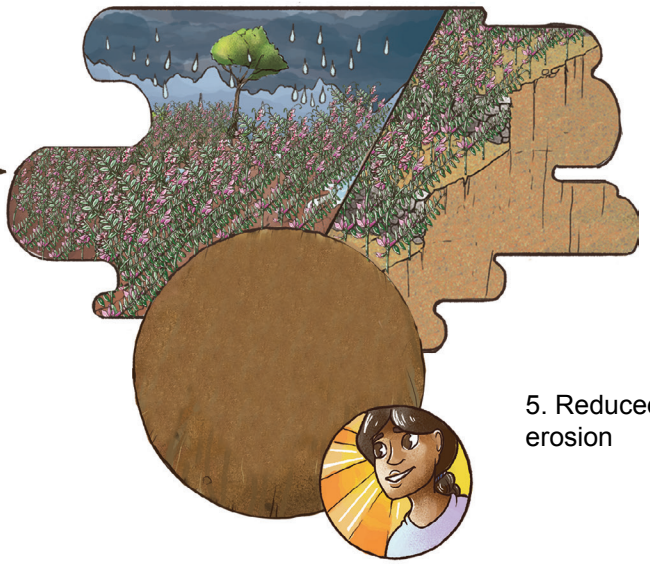
1. Traditional practice: nothing is sown in the dry season

2. Soil erosion when first rain arrives

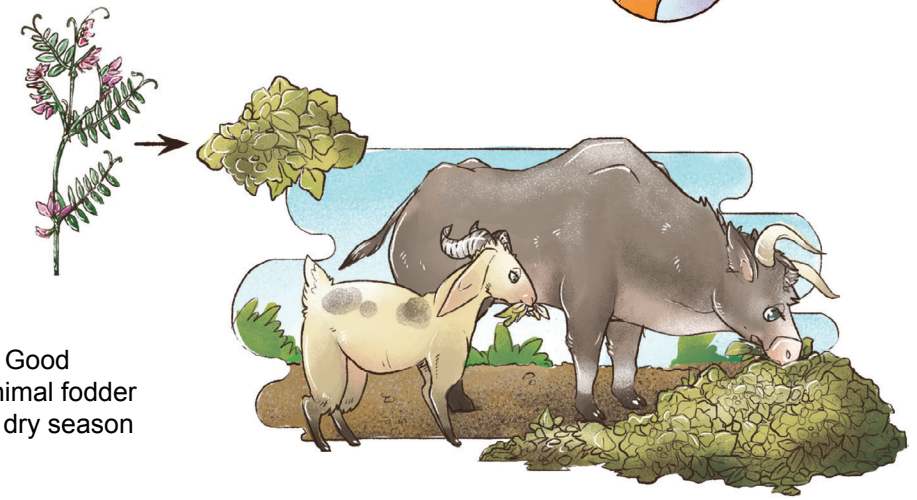
3. Little animal fodder in the dry season



4. Improved practice: sow vetch prior to the beginning of the rainy season

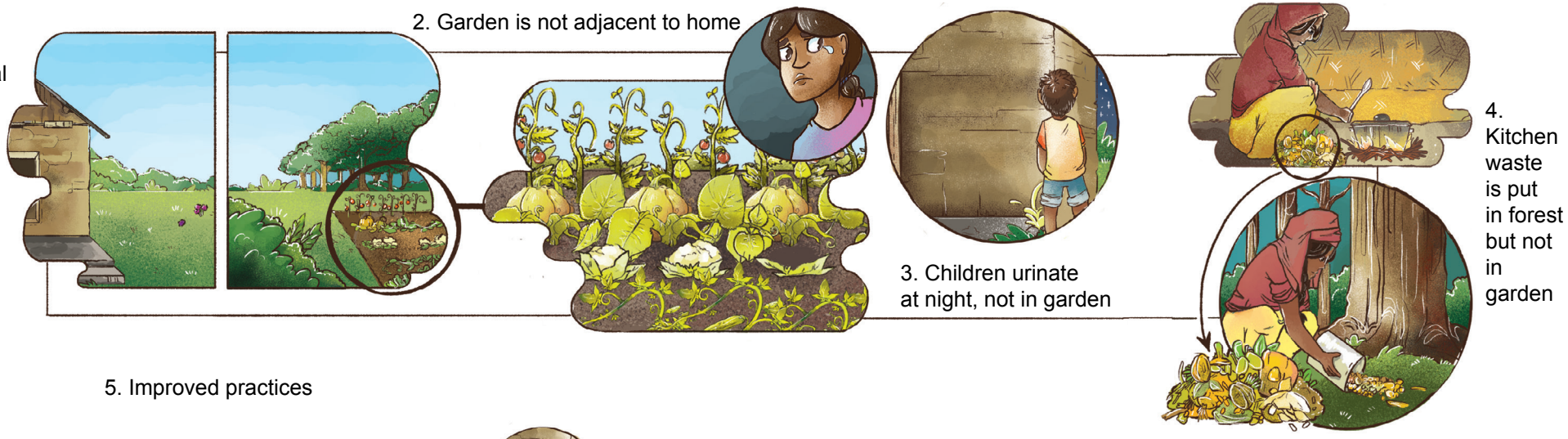


5. Reduced erosion

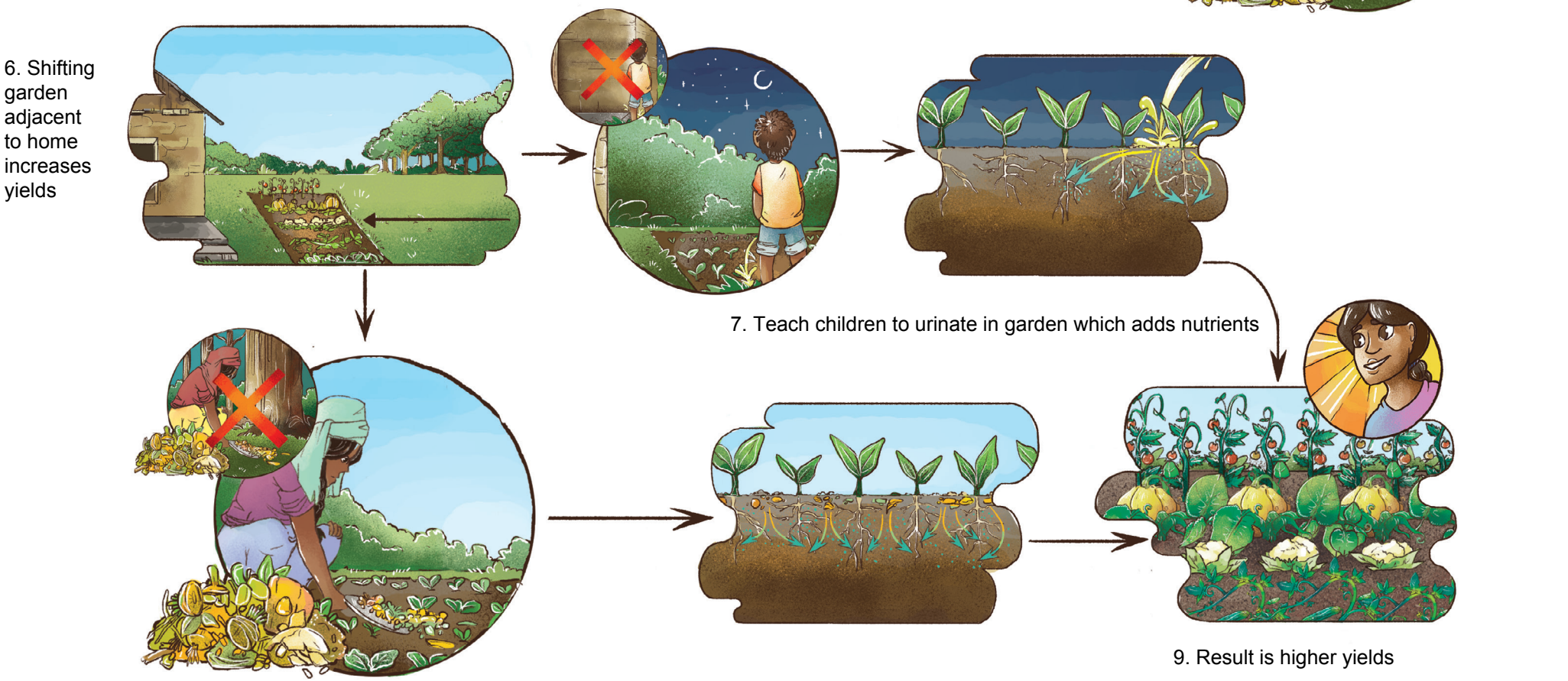


6. Good animal fodder in dry season

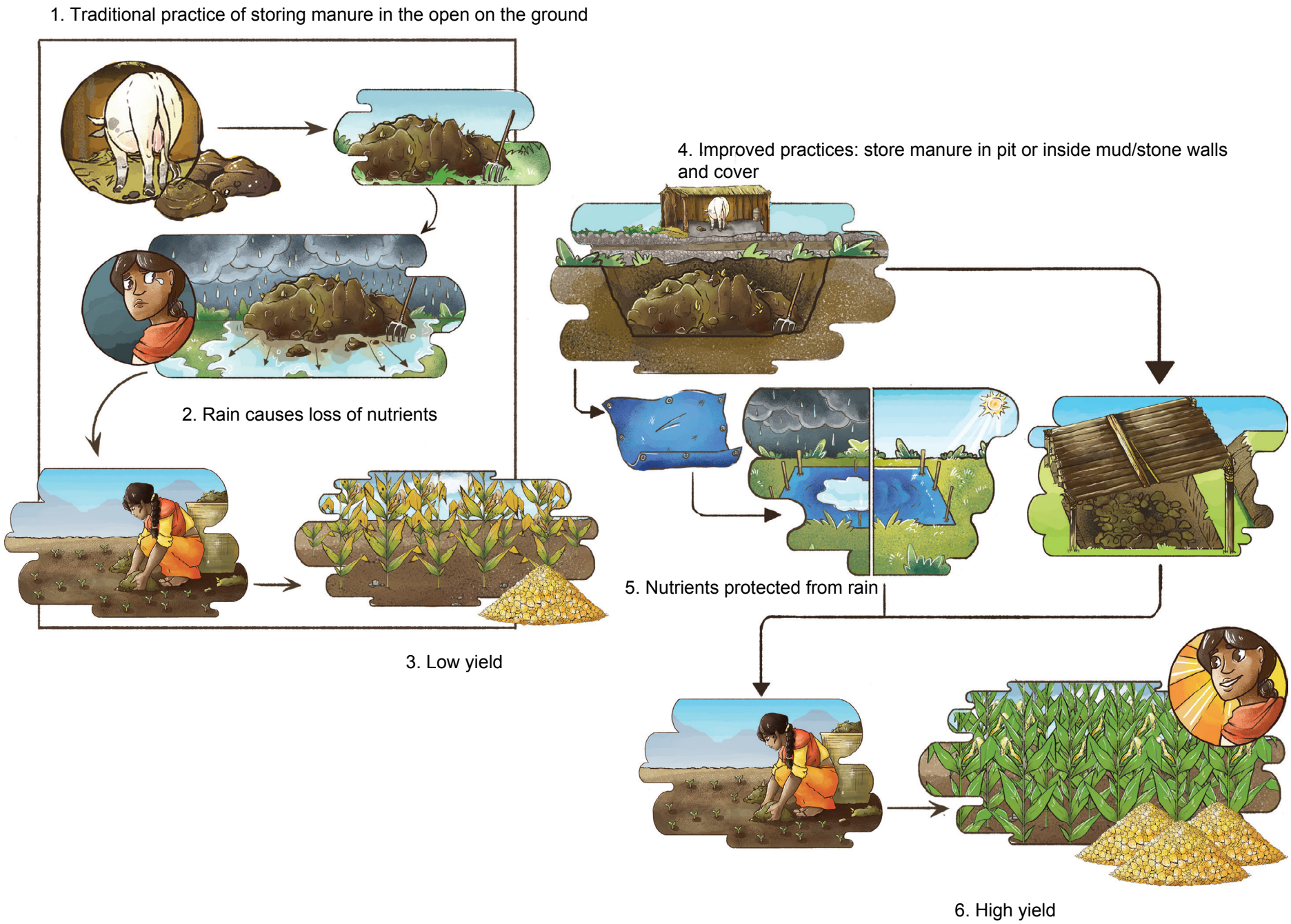
Lesson: Simple practices can improve yields of home gardens



5. Improved practices

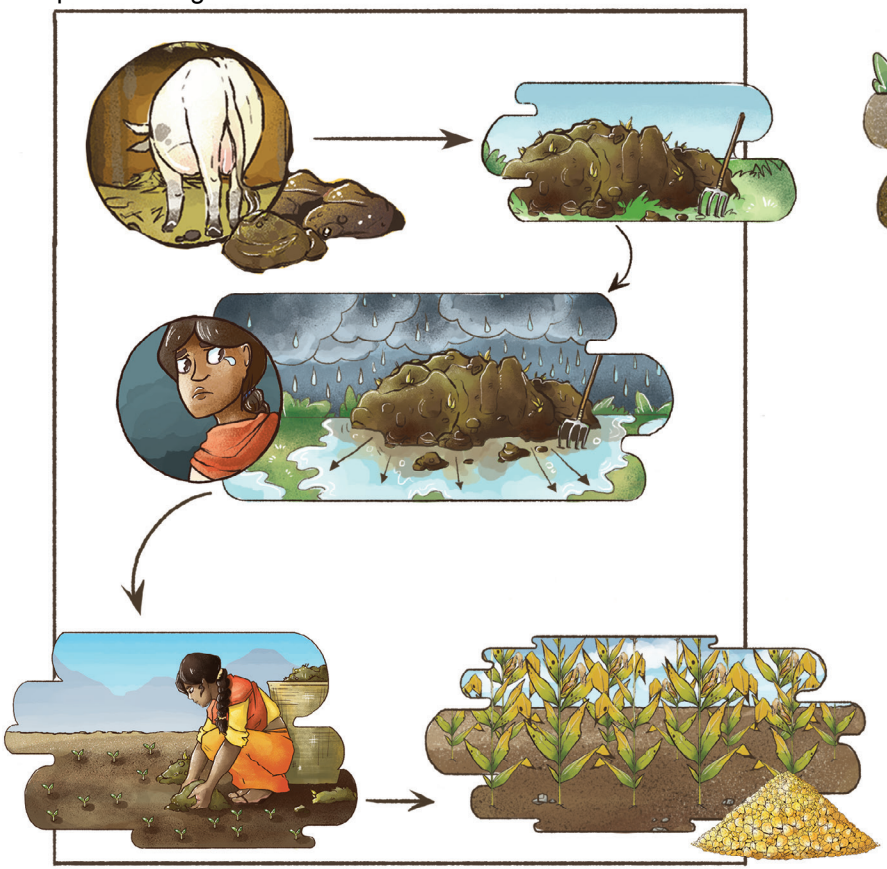


Lesson: Covering manure from rain will prevent loss of its nutrients



Lesson: Covering manure from rain will prevent loss of its nutrients

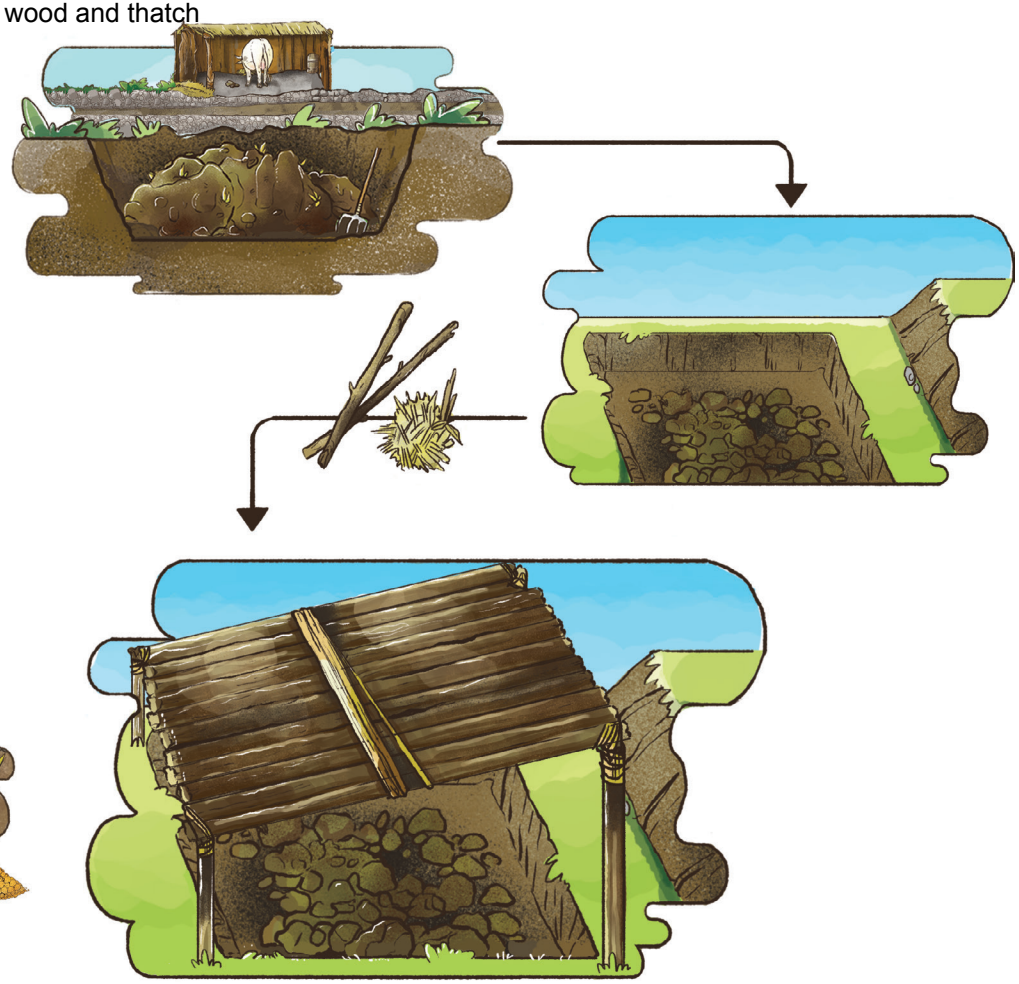
1. Traditional practice of storing manure in the open on the ground



2. Rain causes loss of nutrients

3. Low yield

4. Improved practices: store manure in pit and cover with wood and thatch



5. Nutrients protected from rain

6. High yield

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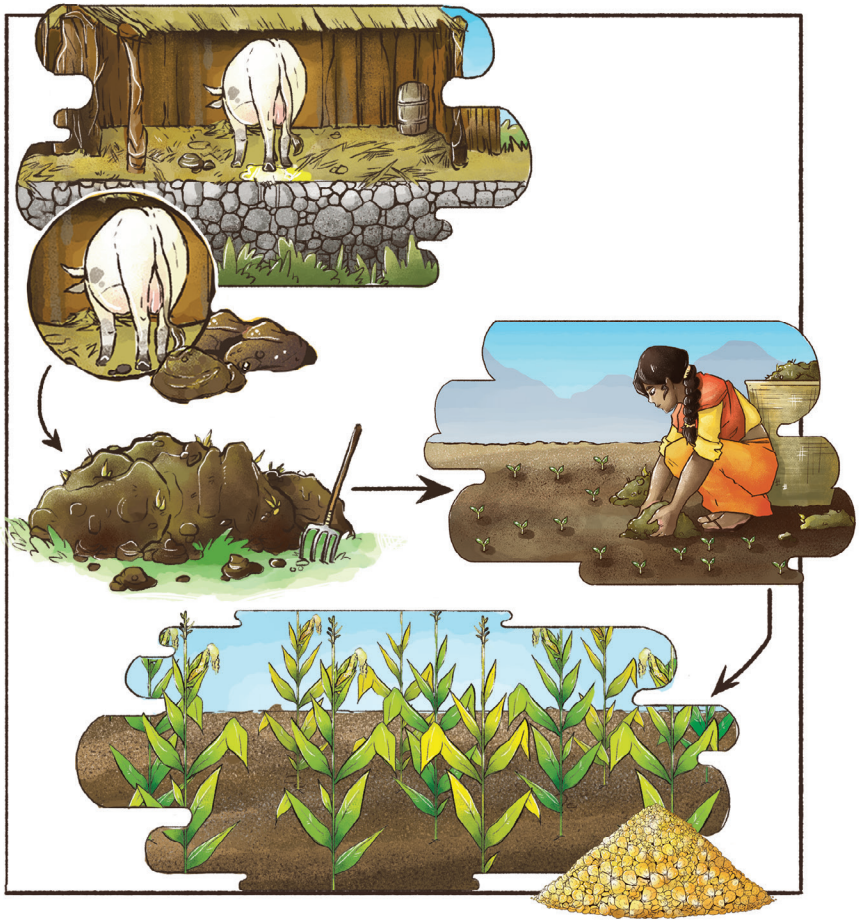
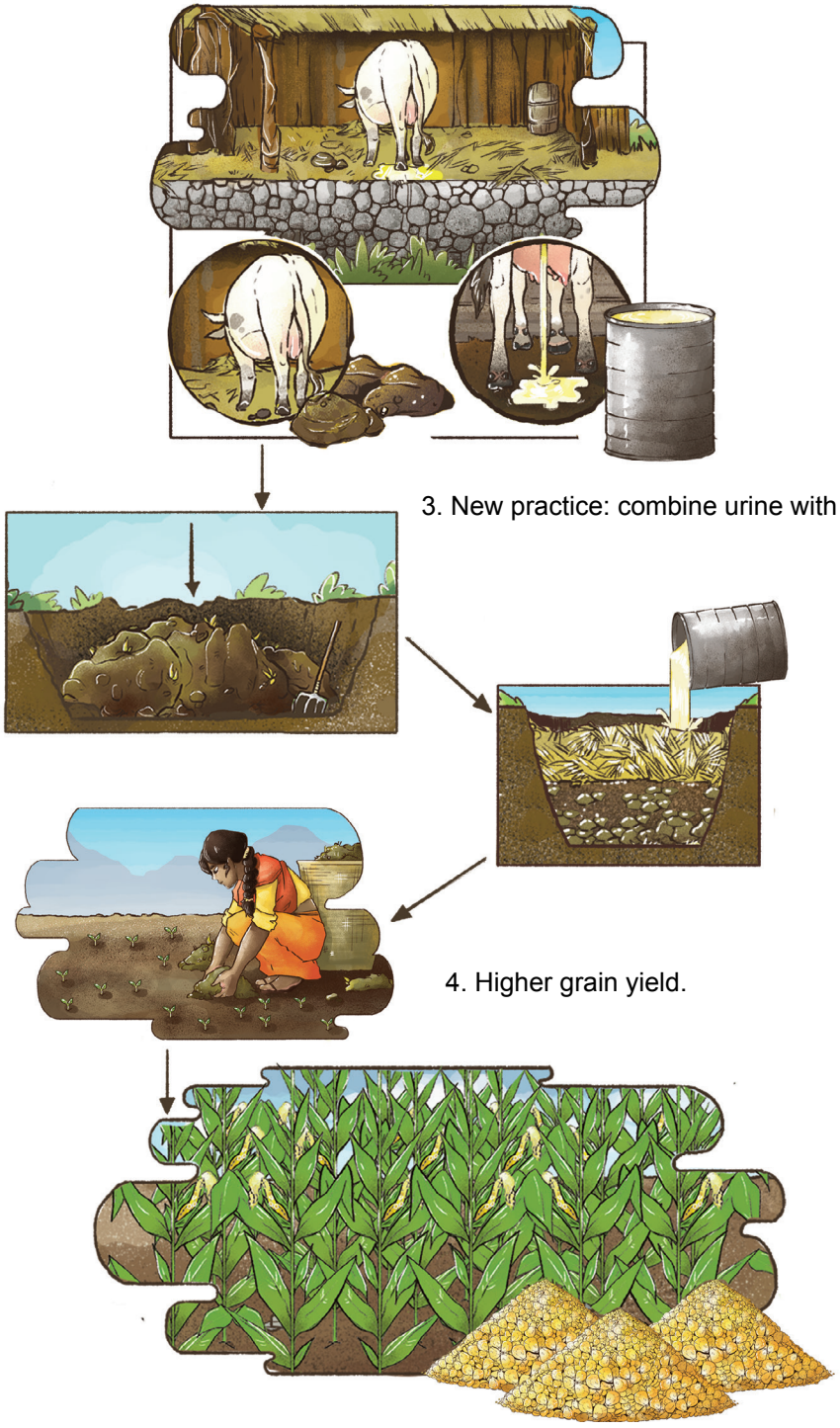
Lesson: There are methods to improve the nutrients of manure (Part 1)

1. Traditional practice: livestock urine is not collected



2. Manure gives lower grain yield.

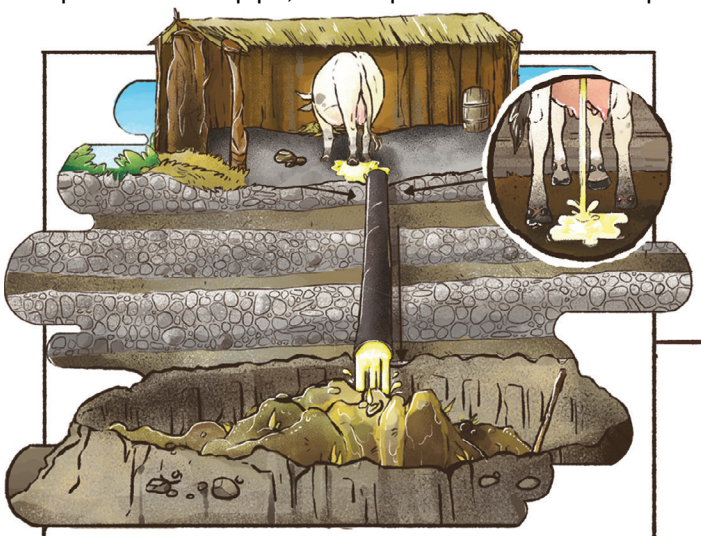


3. New practice: combine urine with manure

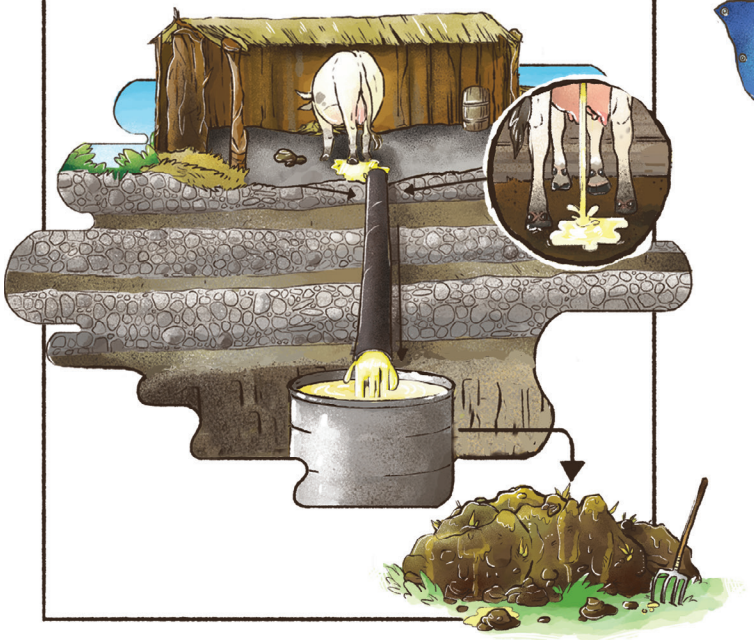
4. Higher grain yield.

Lesson: There are methods to improve the nutrients of manure (Part 2)

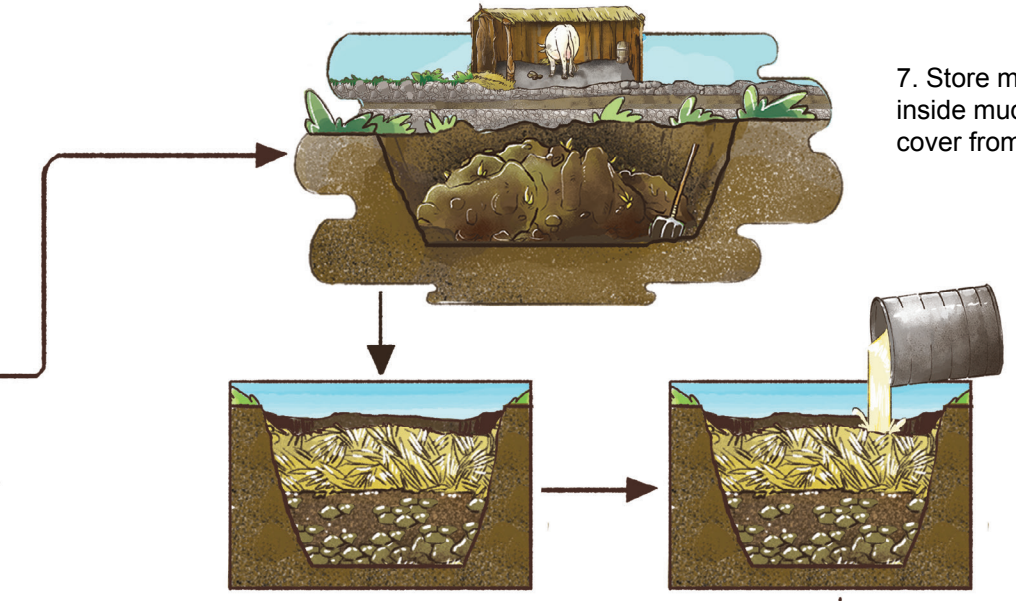
5. Collect urine by using concrete floor that is sloped towards a pipe, and empties into the manure pit.

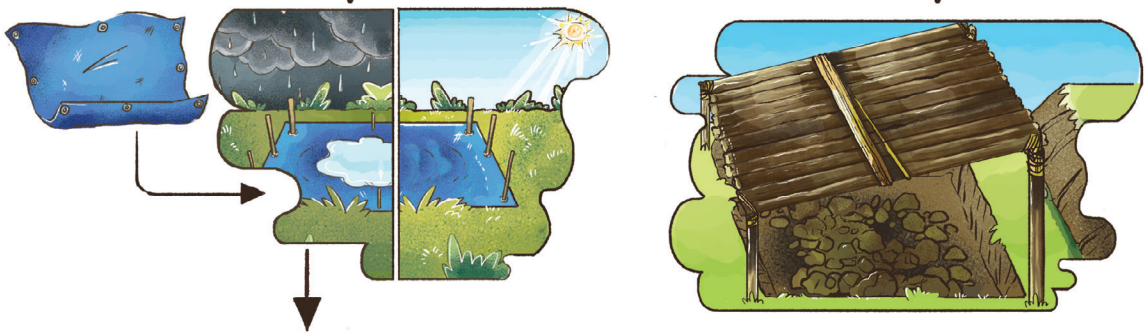


6. Alternative: urine pipe can go to a drum from which urine can be added to manure



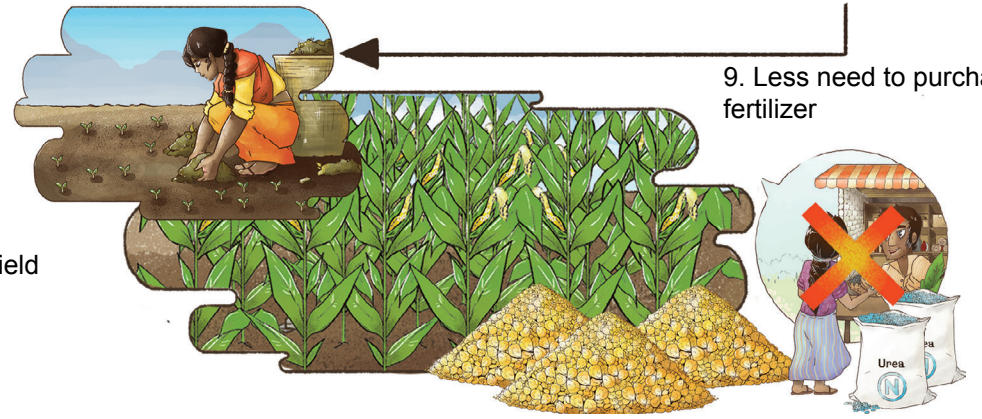
7. Store manure in pit or inside mud/stone walls and cover from rain





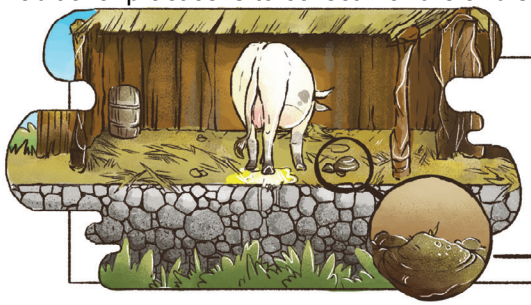
8. High yield

9. Less need to purchase fertilizer

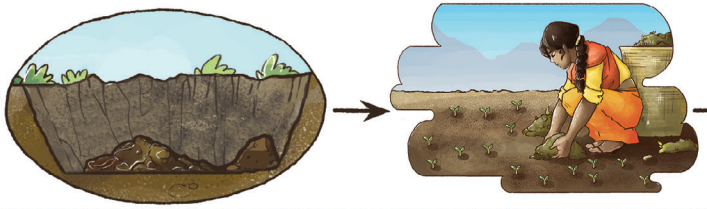


Lesson: Adding manure in layers with straw and soil in a container or pit will improve its nutrients

1. Traditional practice is to collect manure and store on ground or in pit



2. Spread manure

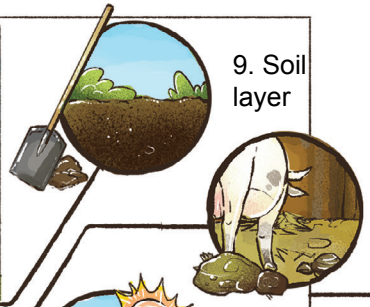


3. Low yield

4. Improved practice is to store manure inside walls, elevated, with repeating layers of straw, manure and soil

5. Create storage structure with sticks, mud or brick

9. Soil layer

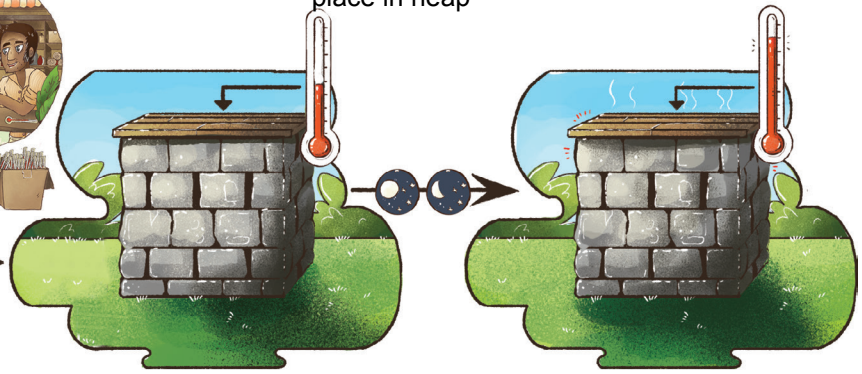


8. Manure layer

6. Bottom should be sticks to prevent water from soaking up

7. Layer of straw

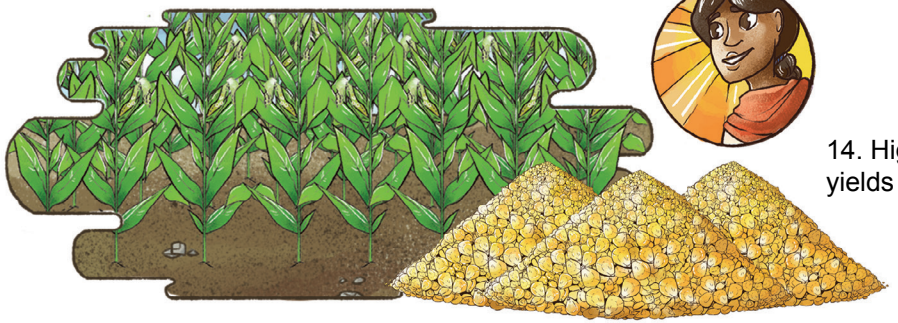
10. Optional: purchase thermometer at vendor and place in heap



11. If heap was built properly, it should become hotter over a period of weeks.

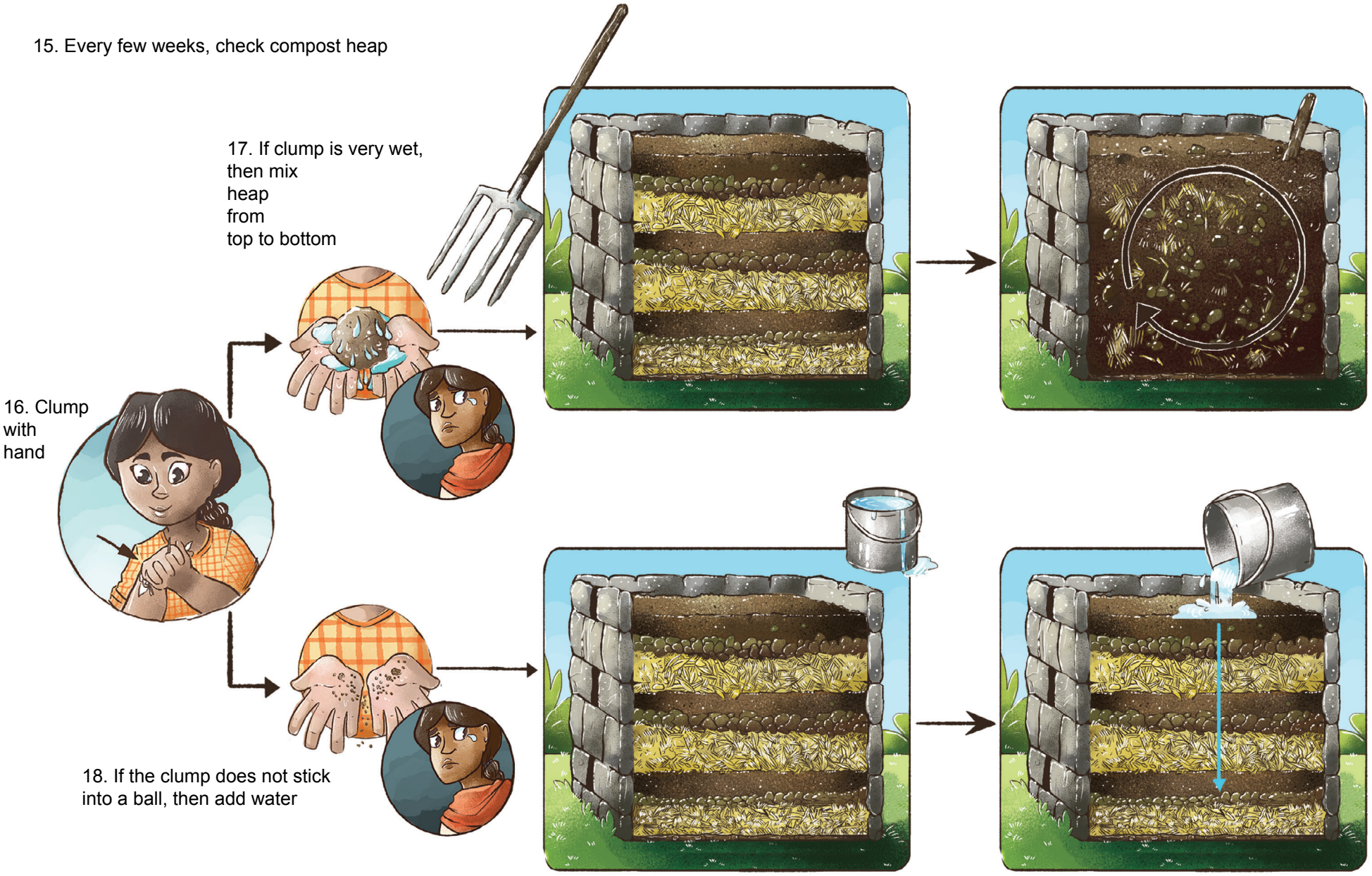
12. Let compost incubate for several weeks

13. Spread in field



14. Higher yields

Lesson: Adding manure in layers with straw and soil in a container or pit will improve its nutrients (continued)



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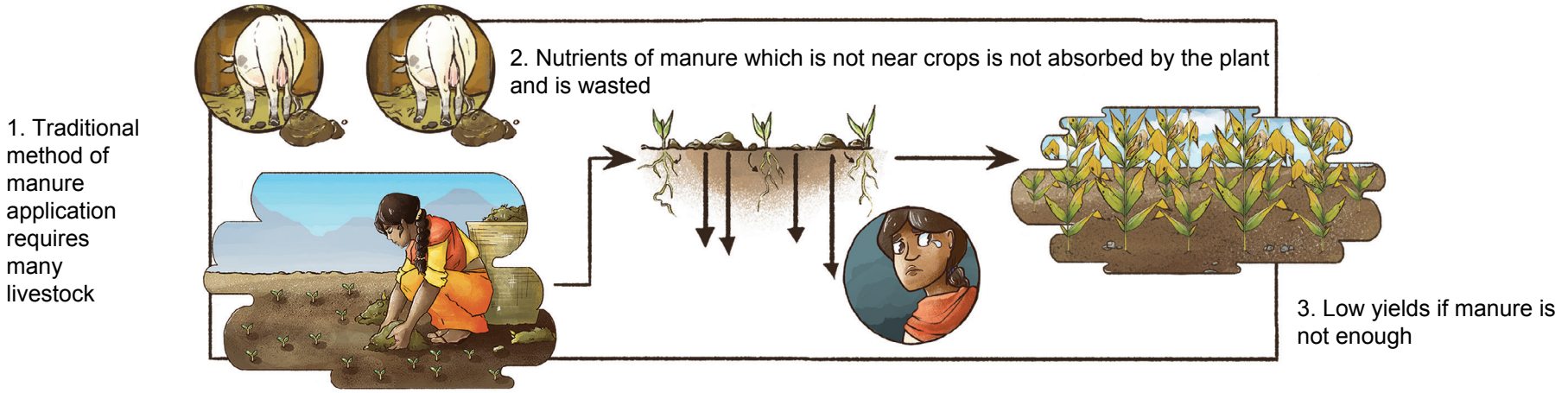
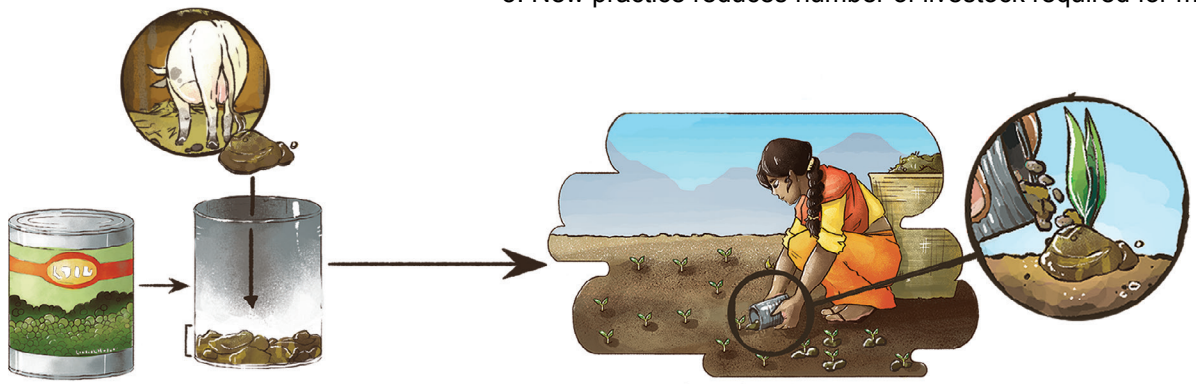
Lesson: Rather than traditional method of spreading manure, adding small amounts of manure directly to each seedling will reduce the total quantity of manure required

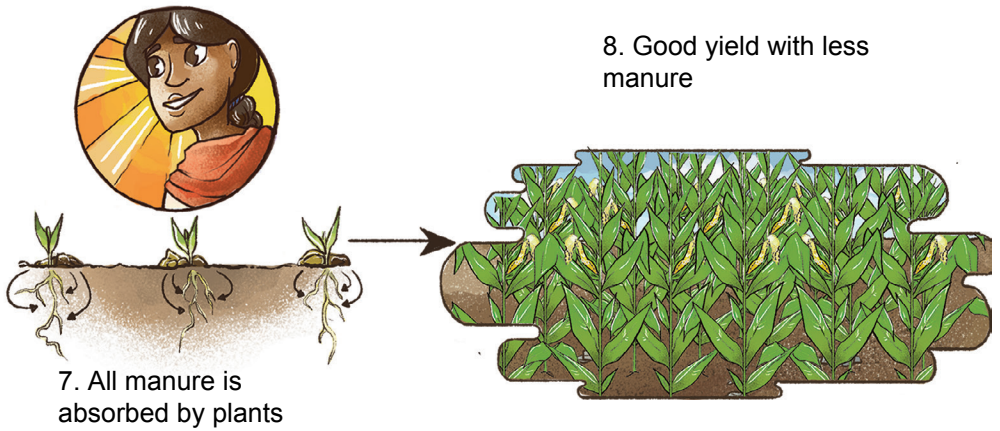


5. New practice reduces number of livestock required for manure production



4. Improved practice is to place manure inside tin can or container to spread

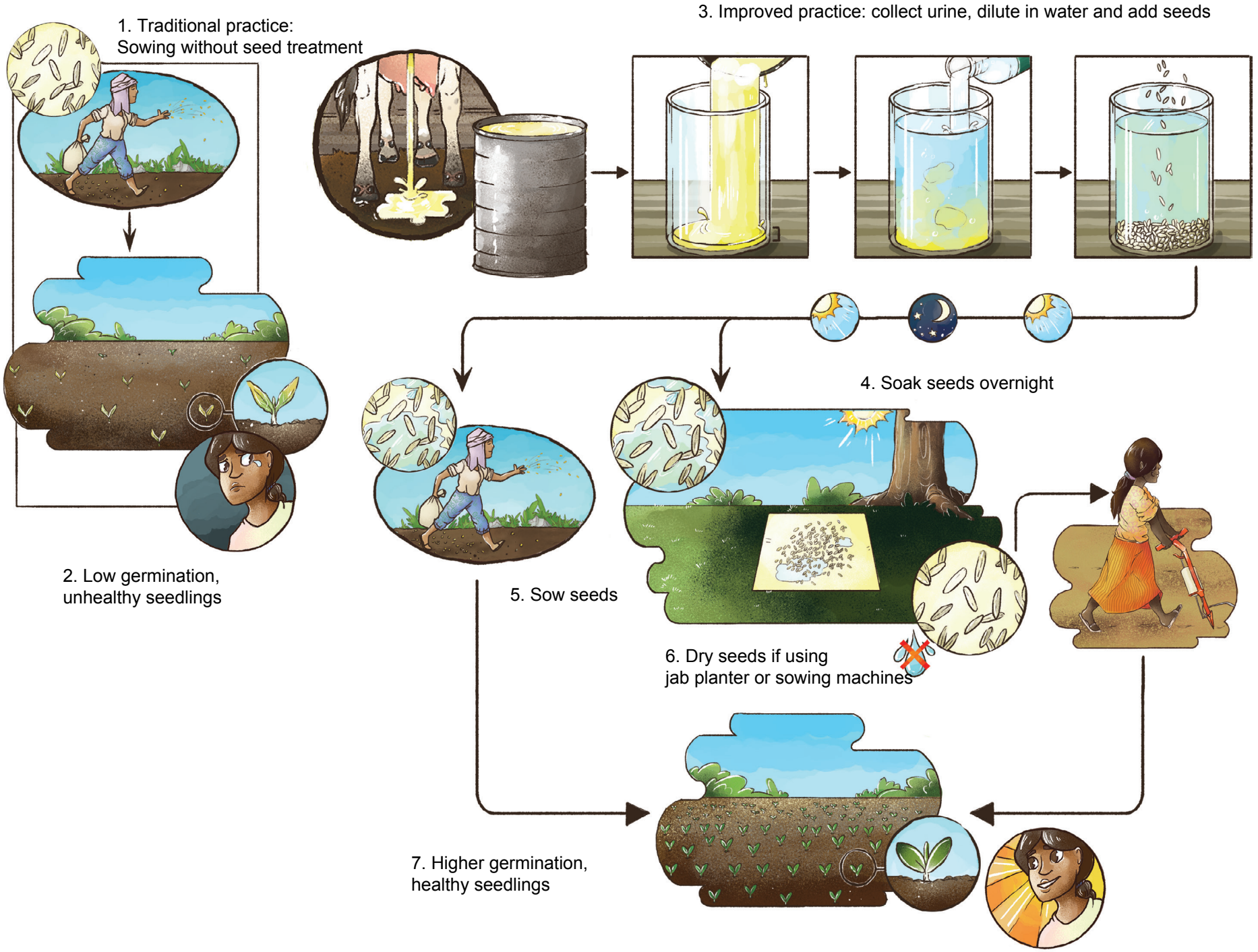
6. Spread manure from container directly to base of seed or seedling



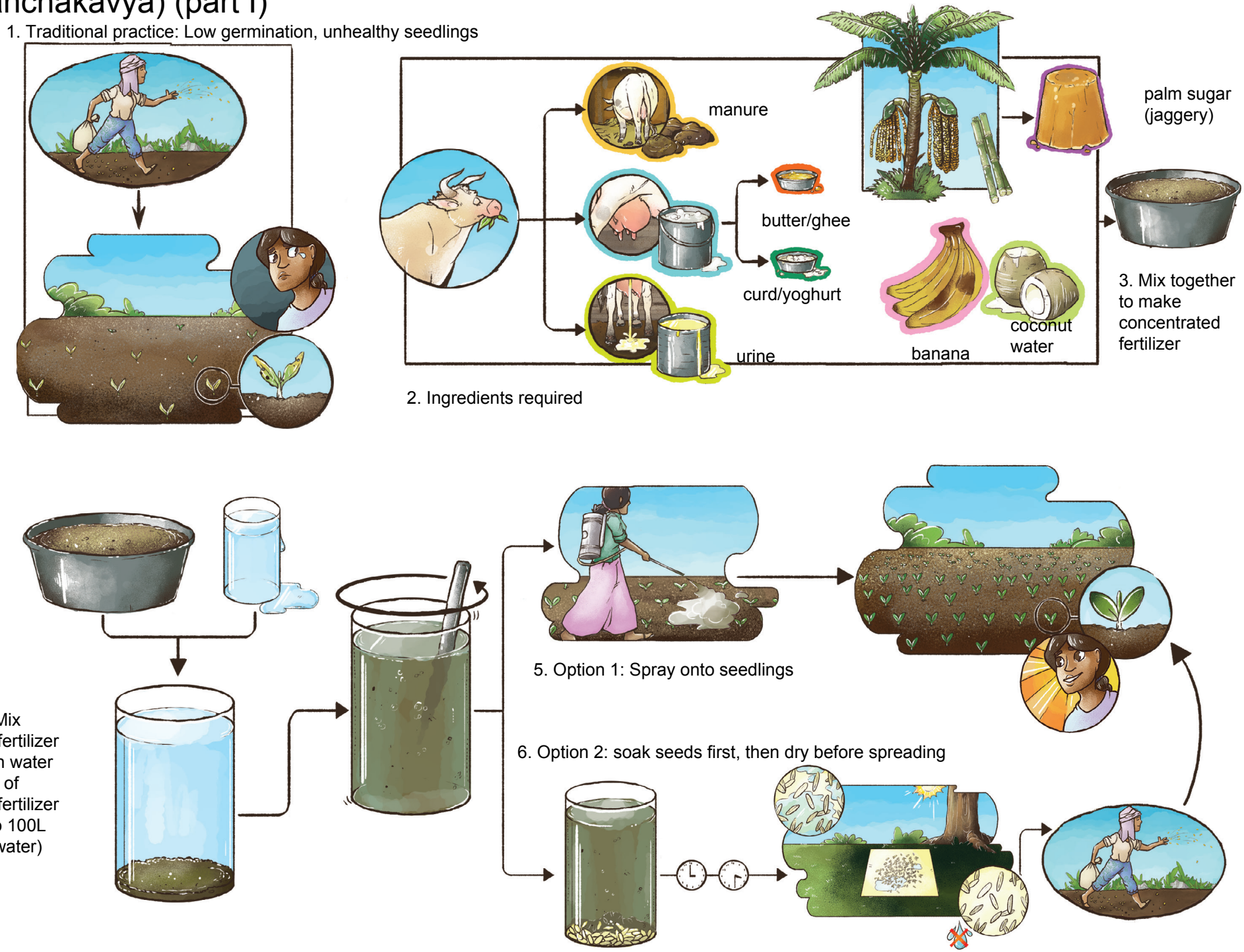
7. All manure is absorbed by plants

8. Good yield with less manure

Lesson: Treatment of seeds with livestock urine will improve seed germination and health



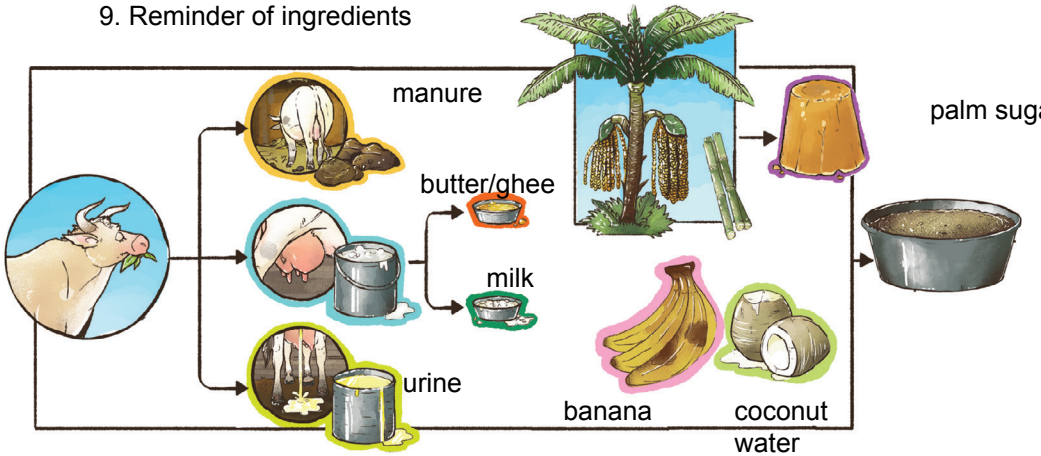
Lesson: An indigenous biofertilizer improves germination and improves seedling health (panchakavya) (part I)



Lesson: An indigenous biofertilizer improves germination and improves seedling health (panchakavya)(part 2)

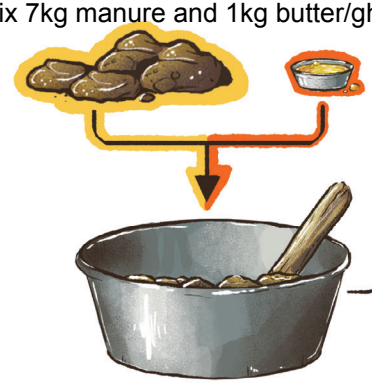
8. Details of biofertilizer recipe:
Mixtures shouls be kept in shade and kept open but covered with a mosquito net

9. Reminder of ingredients



10. Mix together

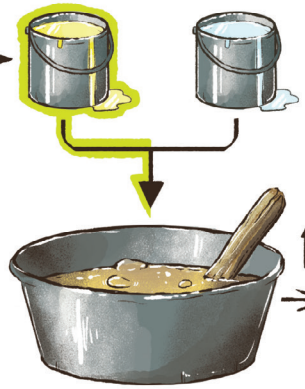
11. Mix 7kg manure and 1kg butter/ghee



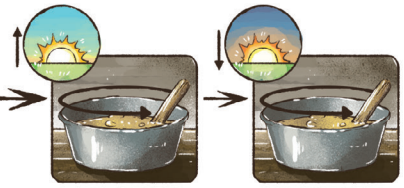
12. Mix morning and evening

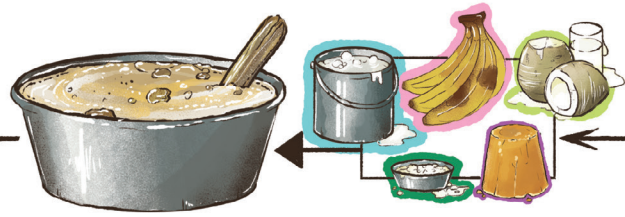
13. Keep for 3 days

14. Add 10L cow urine and 10L water

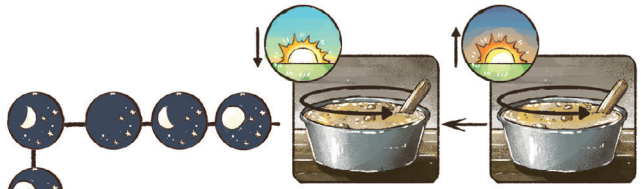


15. Mix each morning and evening for 15 days

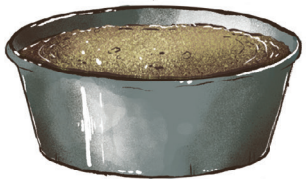




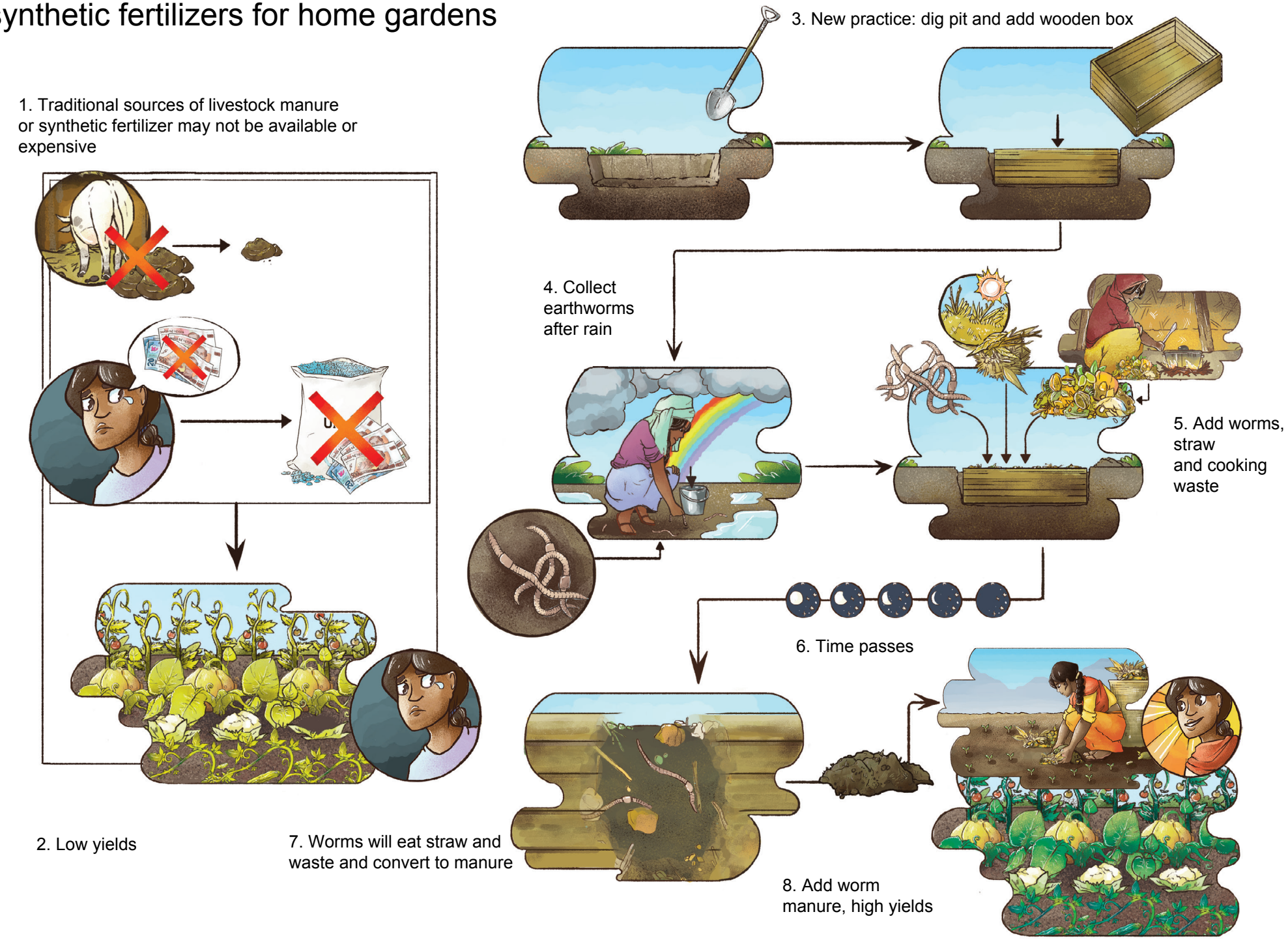
16. After 15 days, add:
cow milk - 3L
yoghur/curd - 2L
fresh coconut water - 3L
jaggery/palm sugar - 3kg
ripe banana - 12 bananas



17. Incubate for 15 more days



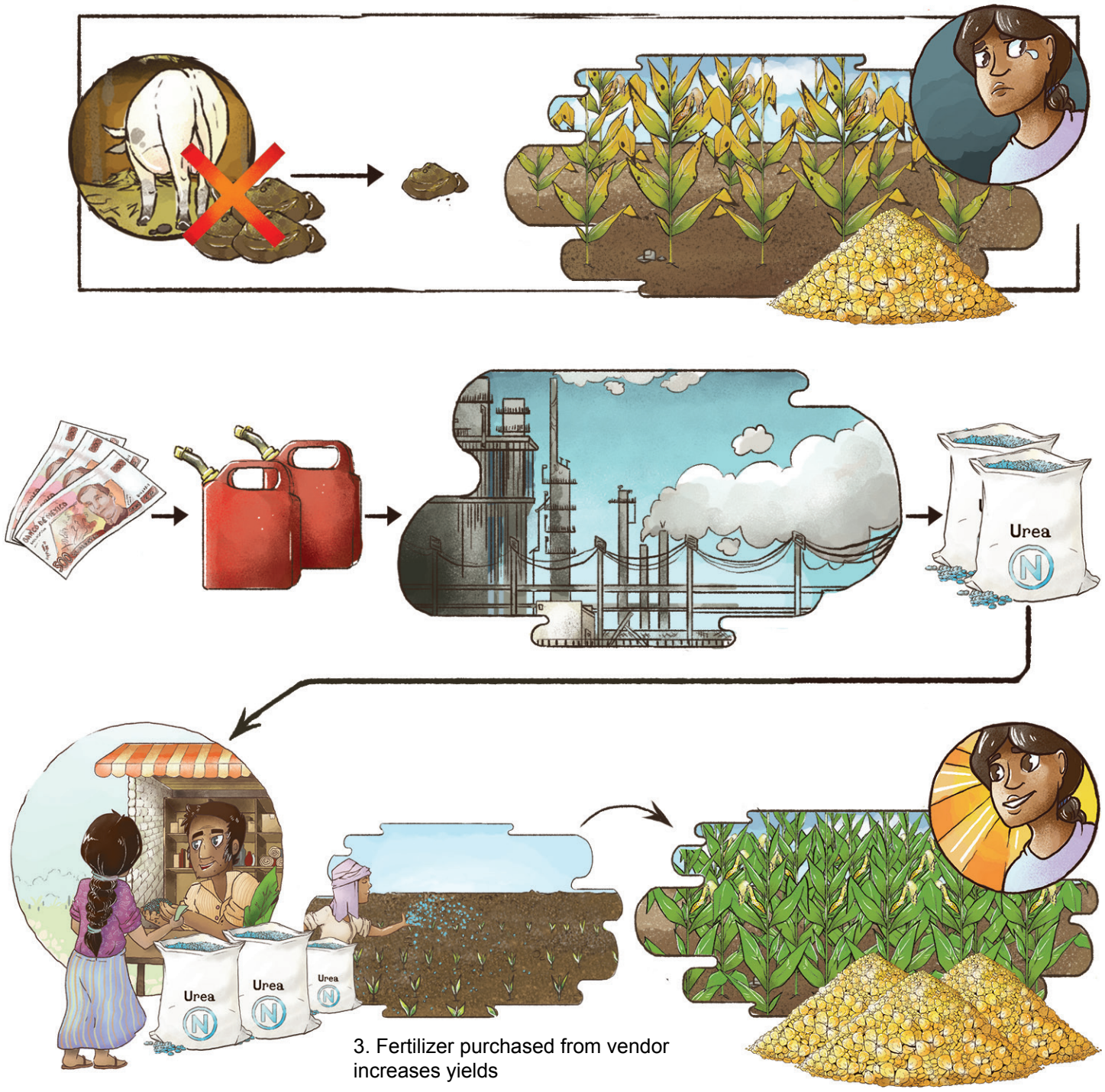
Lesson: Manure made with the help of worms can be an alternative to livestock manure or synthetic fertilizers for home gardens



Lesson: Synthetic nitrogen fertilizer raises crop yields

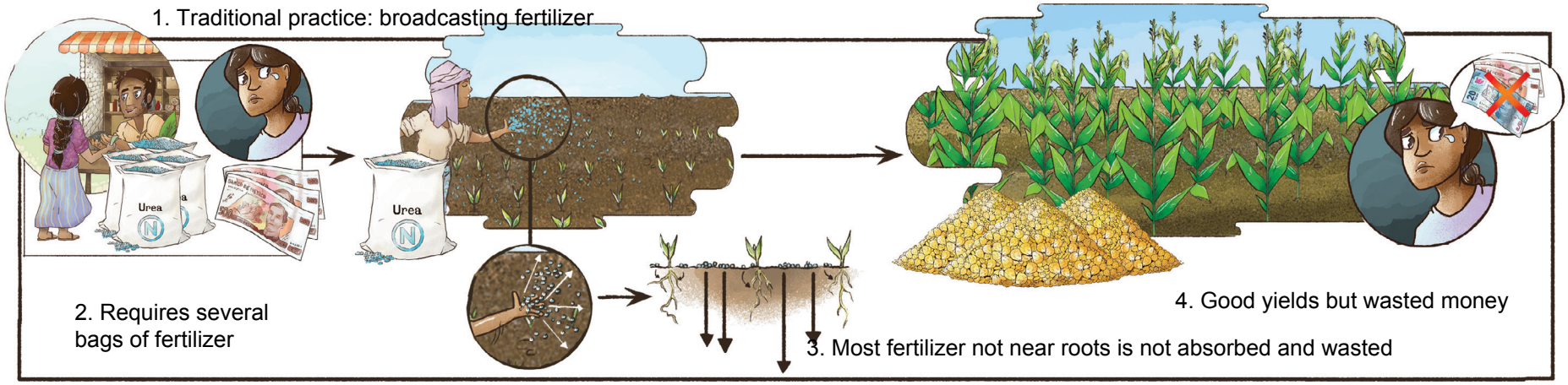
1. If not fertilizer or manure, crop yields are low

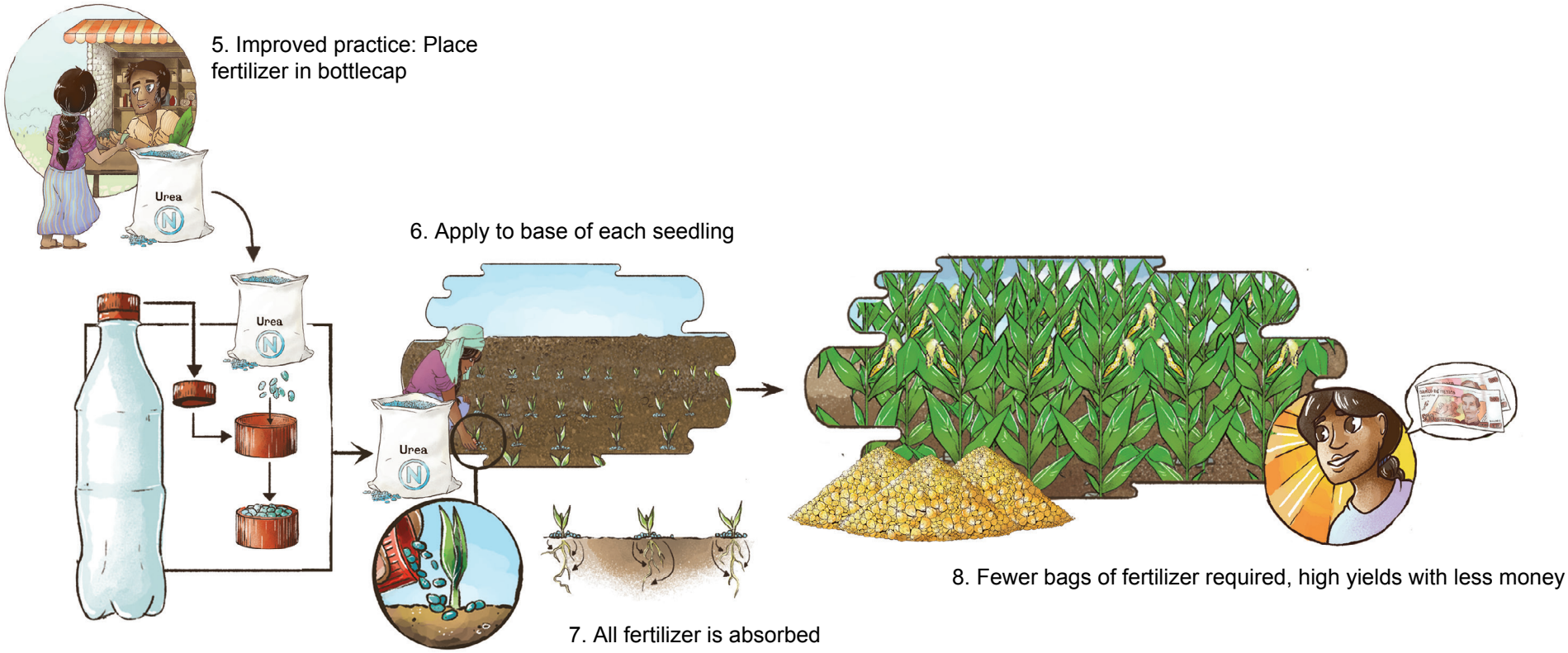
2. Synthetic nitrogen fertilizer is created in factories using natural gas or petrol, hence when petrol prices increase, fertilizer price will increase



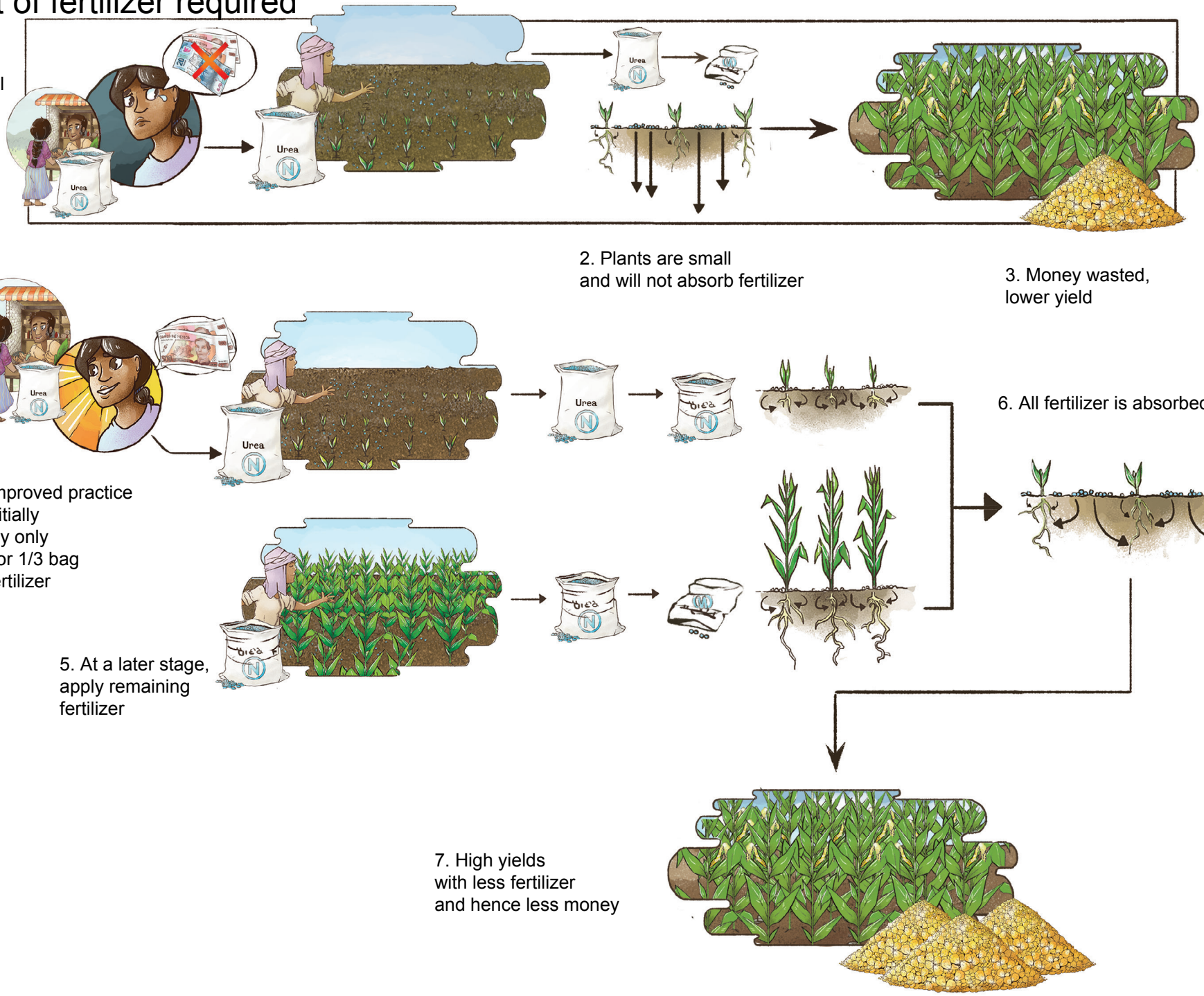
3. Fertilizer purchased from vendor increases yields

Lesson: Rather than random broadcasting of fertilizer, adding small amounts using a bottle cap directly to each seed or seedling reduces the total amount of fertilizer required

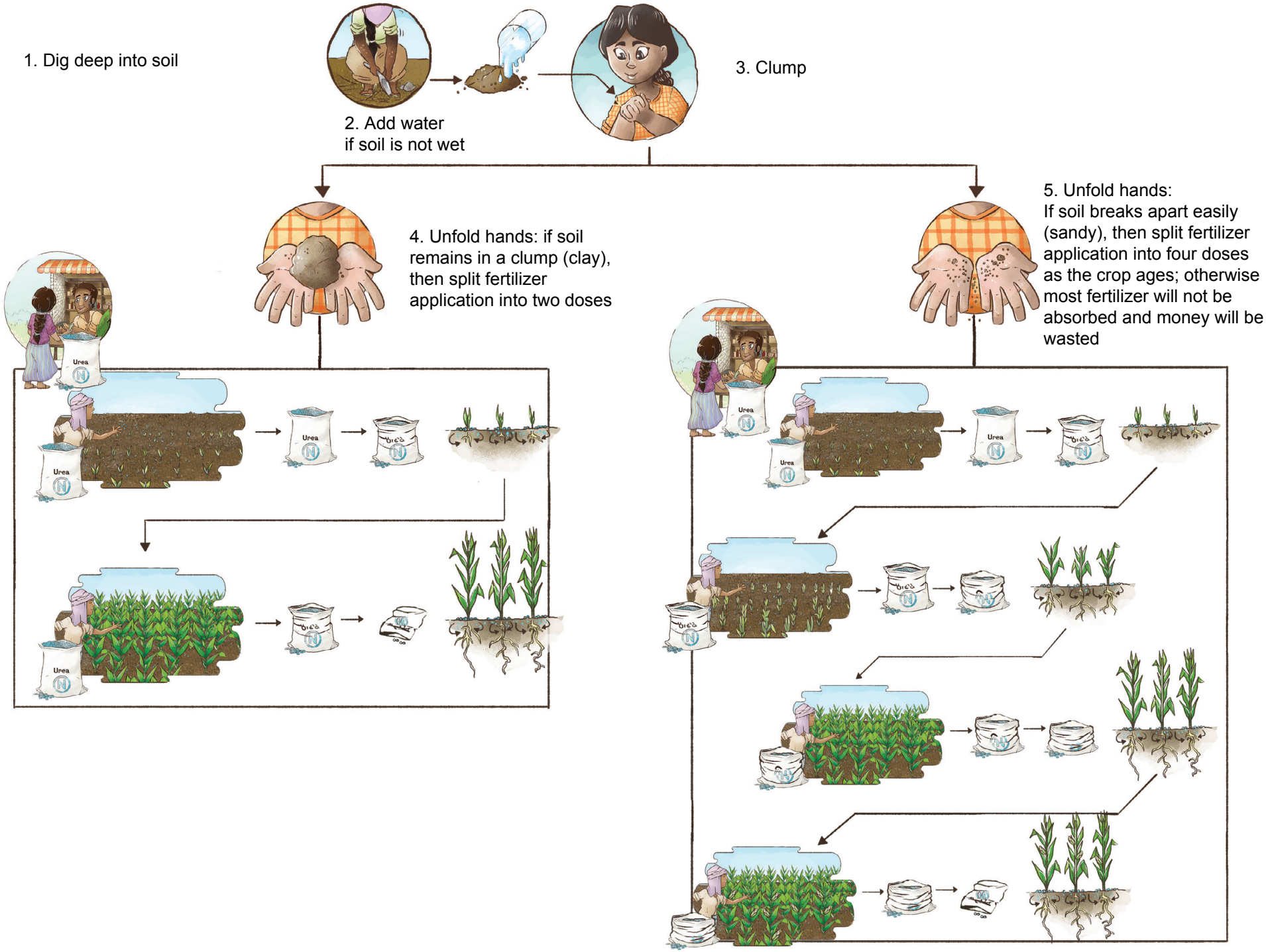




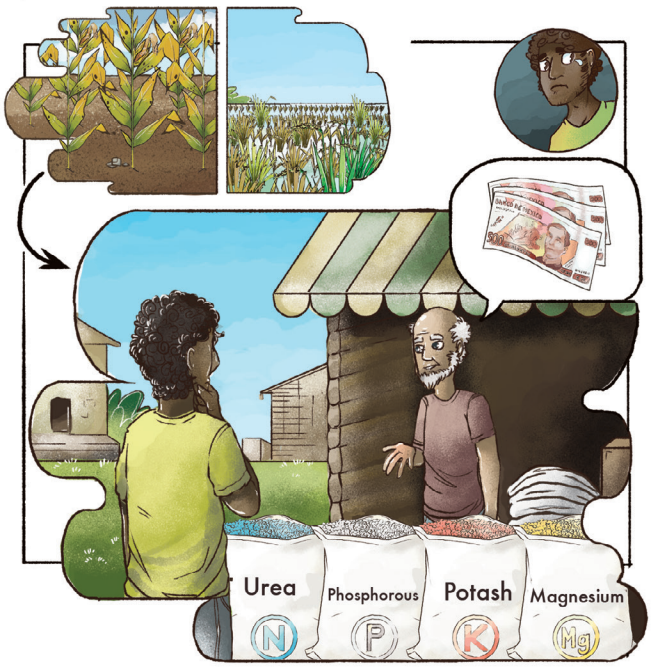
Lesson: Rather than applying all fertilizer in a single dose, splitting the doses will reduce the amount of fertilizer required

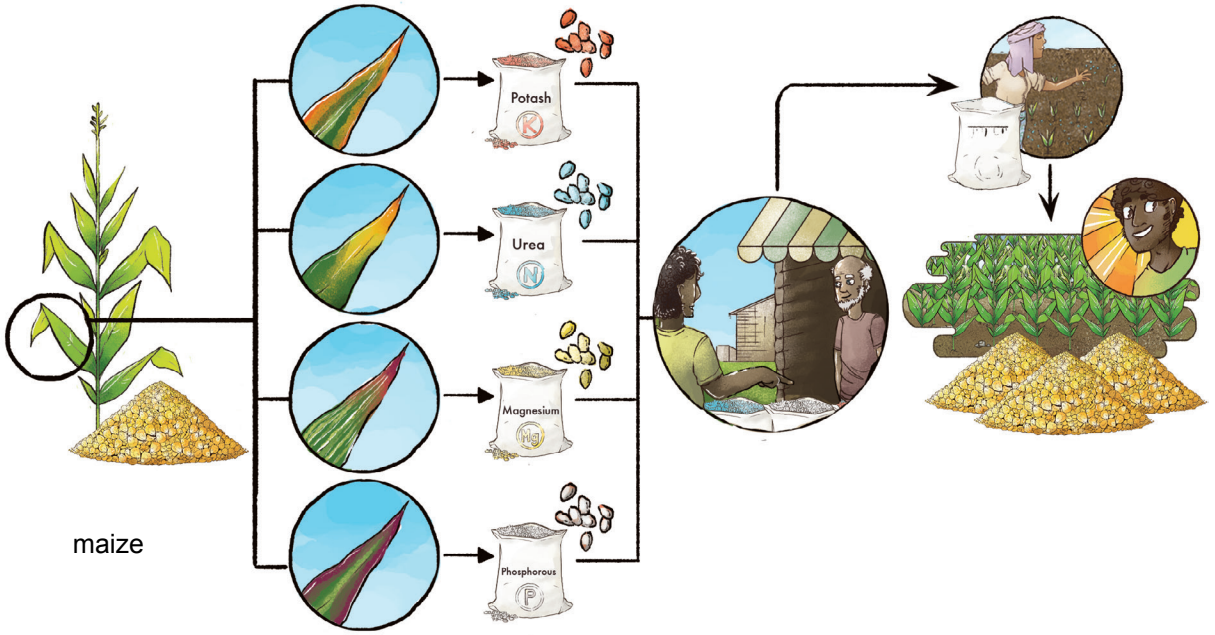


Lesson: Artificial fertilizers should be applied differently on different soil-texture types



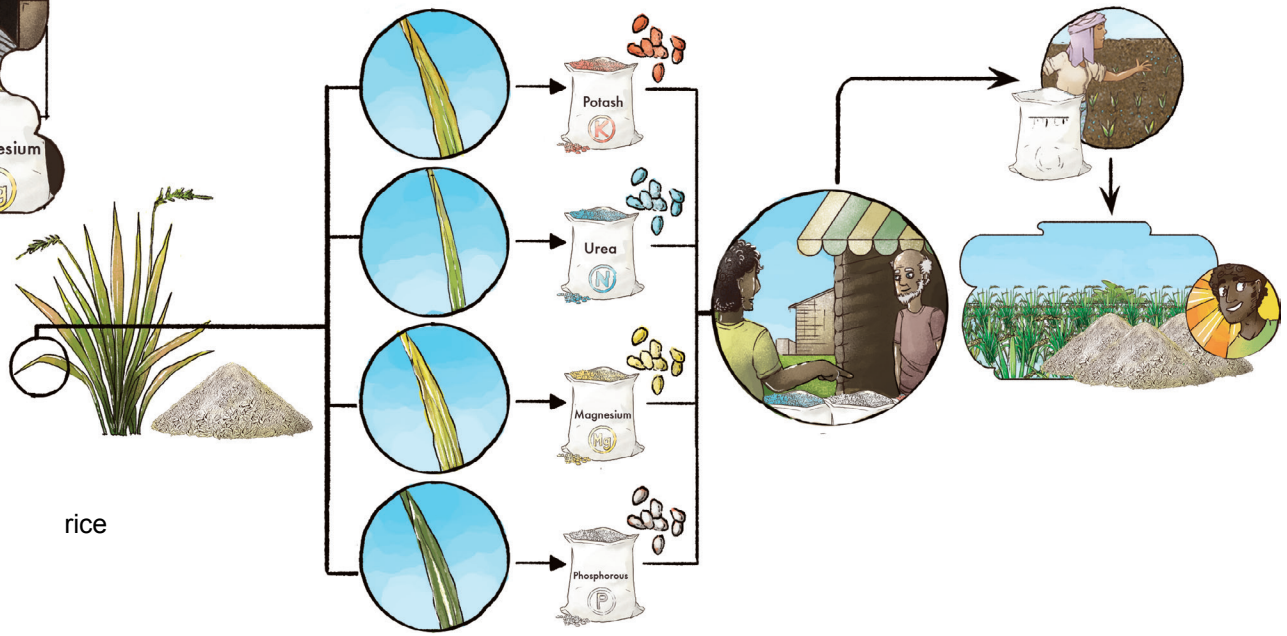
1. Traditional practice: crops are sick but the reason is unknown. To fix, a farmer purchases different fertilizers or pesticides but none may solve the problem.





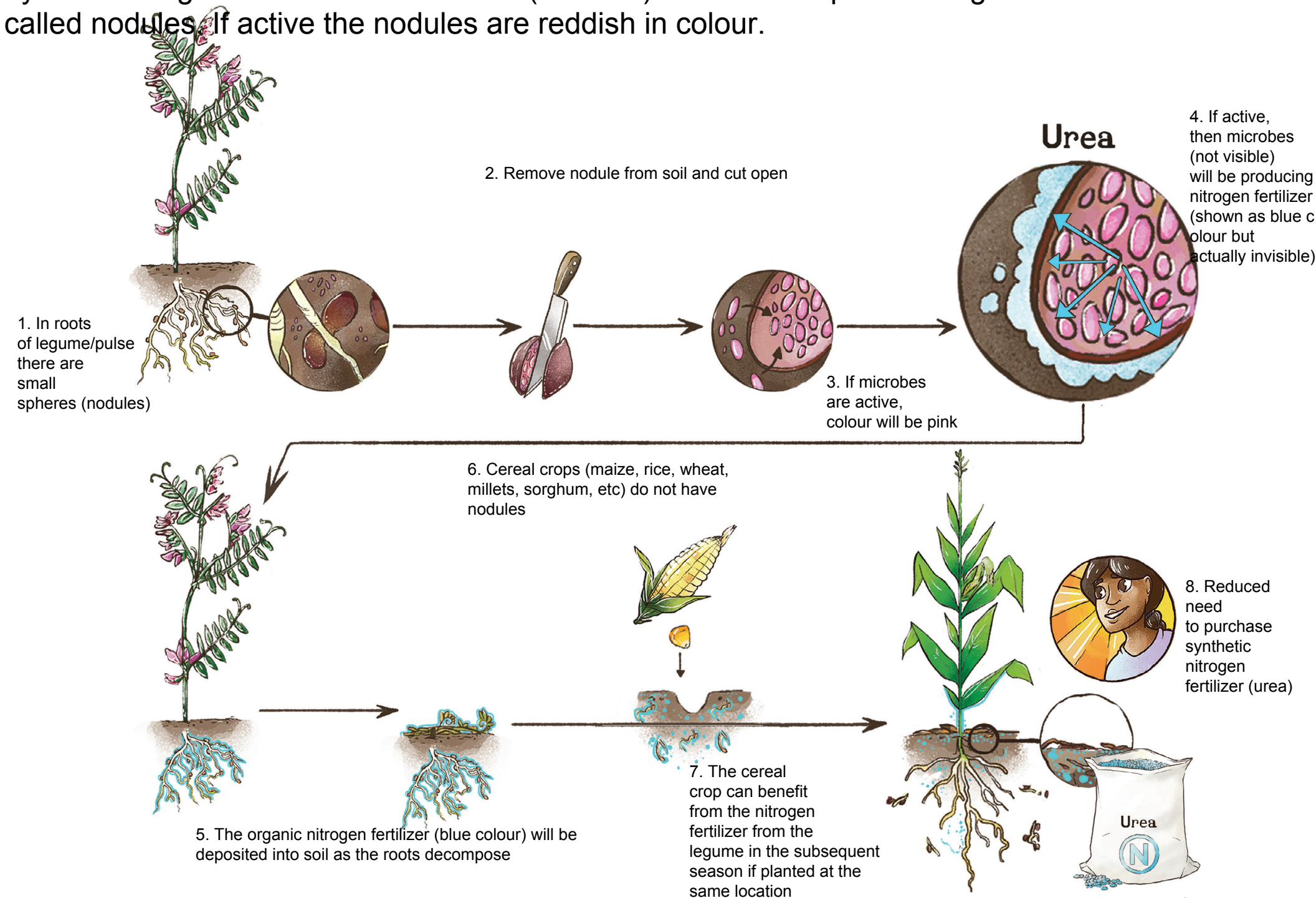
maize

2. Improved practice is look for a change in the colour and pattern on the leaves, then purchase the appropriate fertilizer if needed to achieve good yields



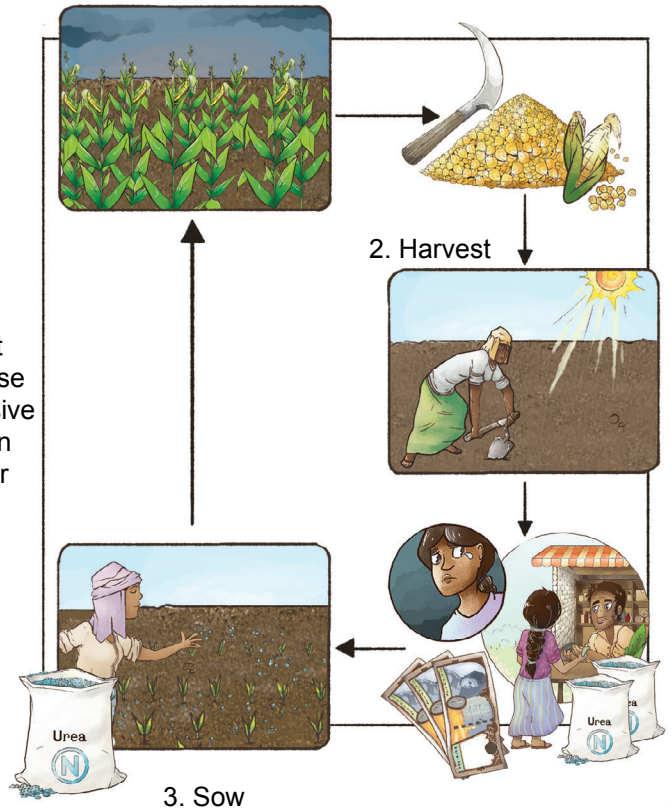
rice

Background educational lesson: A legume (bean) or pulse can produce organic nitrogen fertilizer by associating with beneficial microbes (rhizobia) that inhabit spherical organs in the roots called nodules. If active the nodules are reddish in colour.



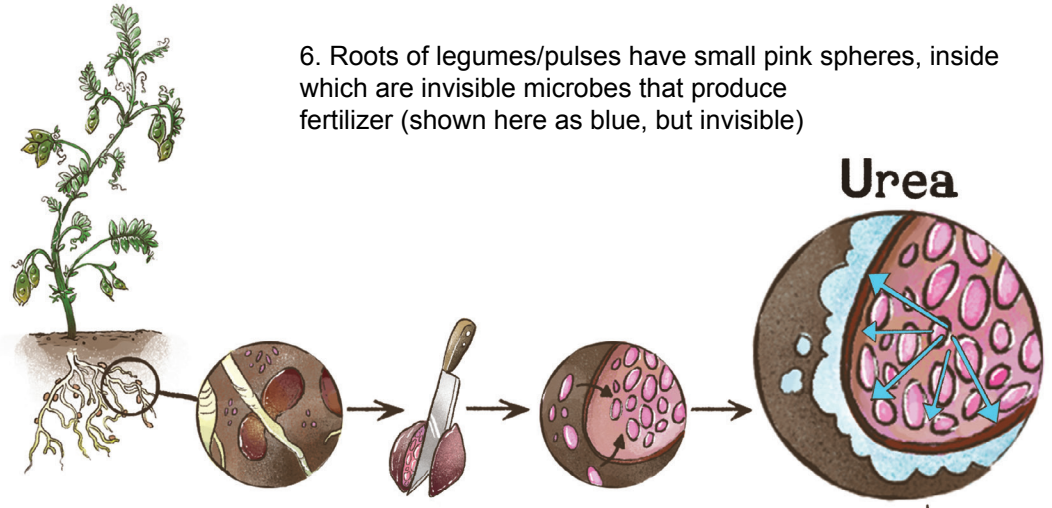
Background educational lesson: The roots of legume and pulses have little spheres in which helpful microbes make natural nitrogen fertilizer to reduce need to purchase artificial fertilizer.

1. Bad practice: plant sole crop of maize wheat, rice, millet in all seasons (no legumes, no pulses)

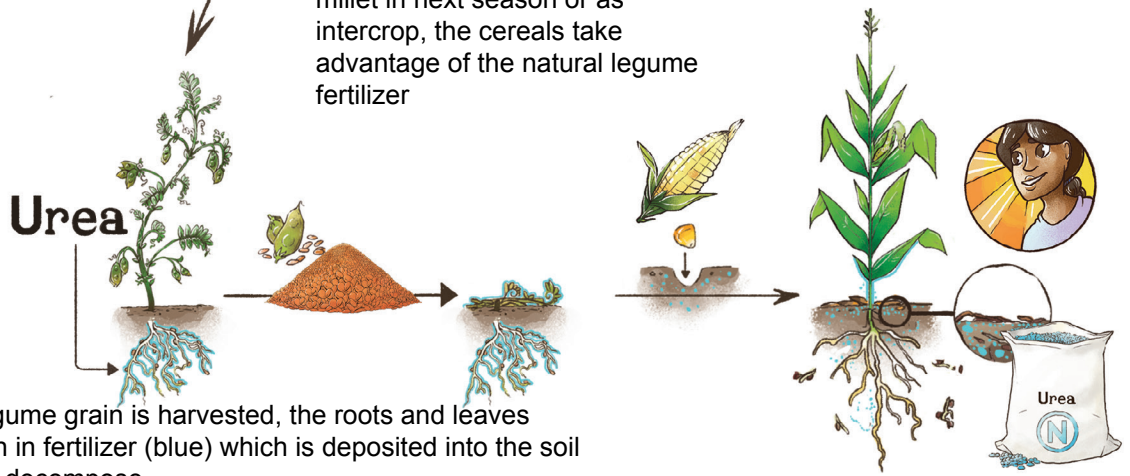


5. Improved practice: Plant legumes or pulses (e.g. lentil) as intercrop or in next season

6. Roots of legumes/pulses have small pink spheres, inside which are invisible microbes that produce fertilizer (shown here as blue, but invisible)



8. If sow maize, rice or wheat or millet in next season or as intercrop, the cereals take advantage of the natural legume fertilizer



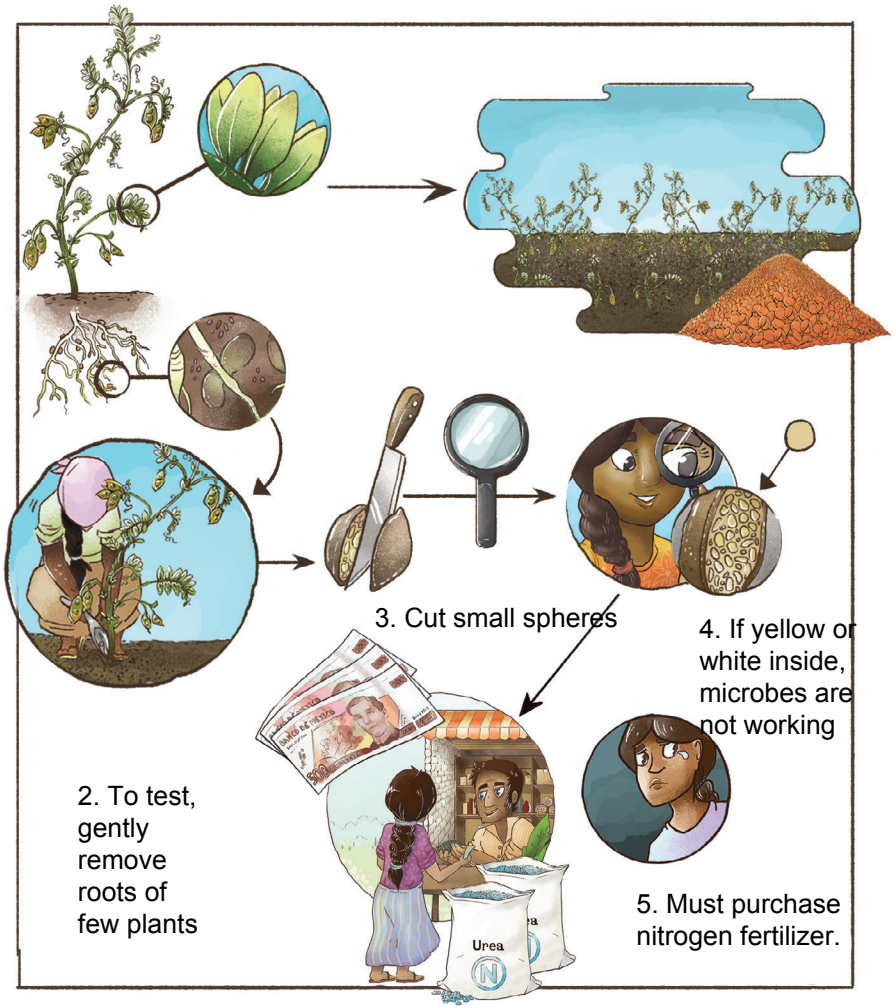
7. After legume grain is harvested, the roots and leaves remain rich in fertilizer (blue) which is deposited into the soil when they decompose

9. Less need to purchase nitrogen fertilizer

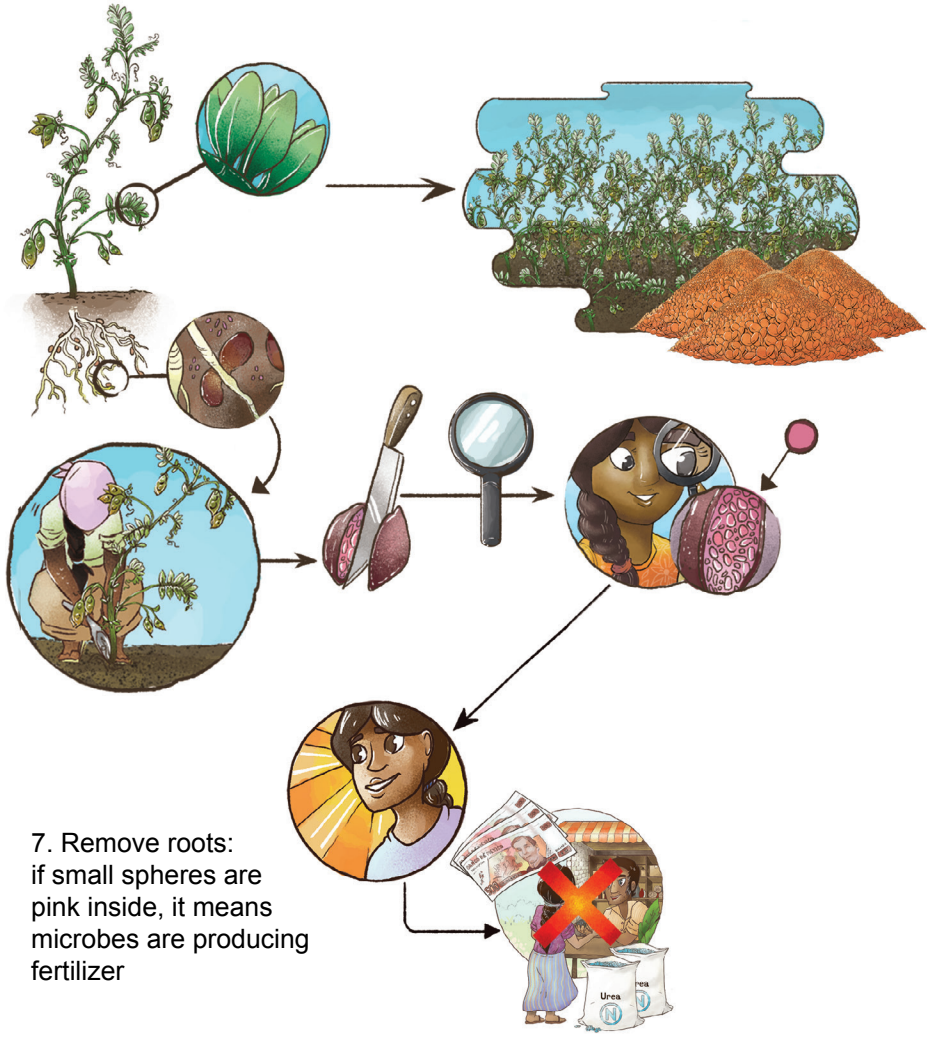
Manish N. Raizada, Ph.D.; Lisa Smith, Illustrator

Lesson: If small spheres on legume roots are only yellow inside, they do not contain healthy microbes to make natural nitrogen fertilizer, but a pink colour inside means they are producing fertilizer

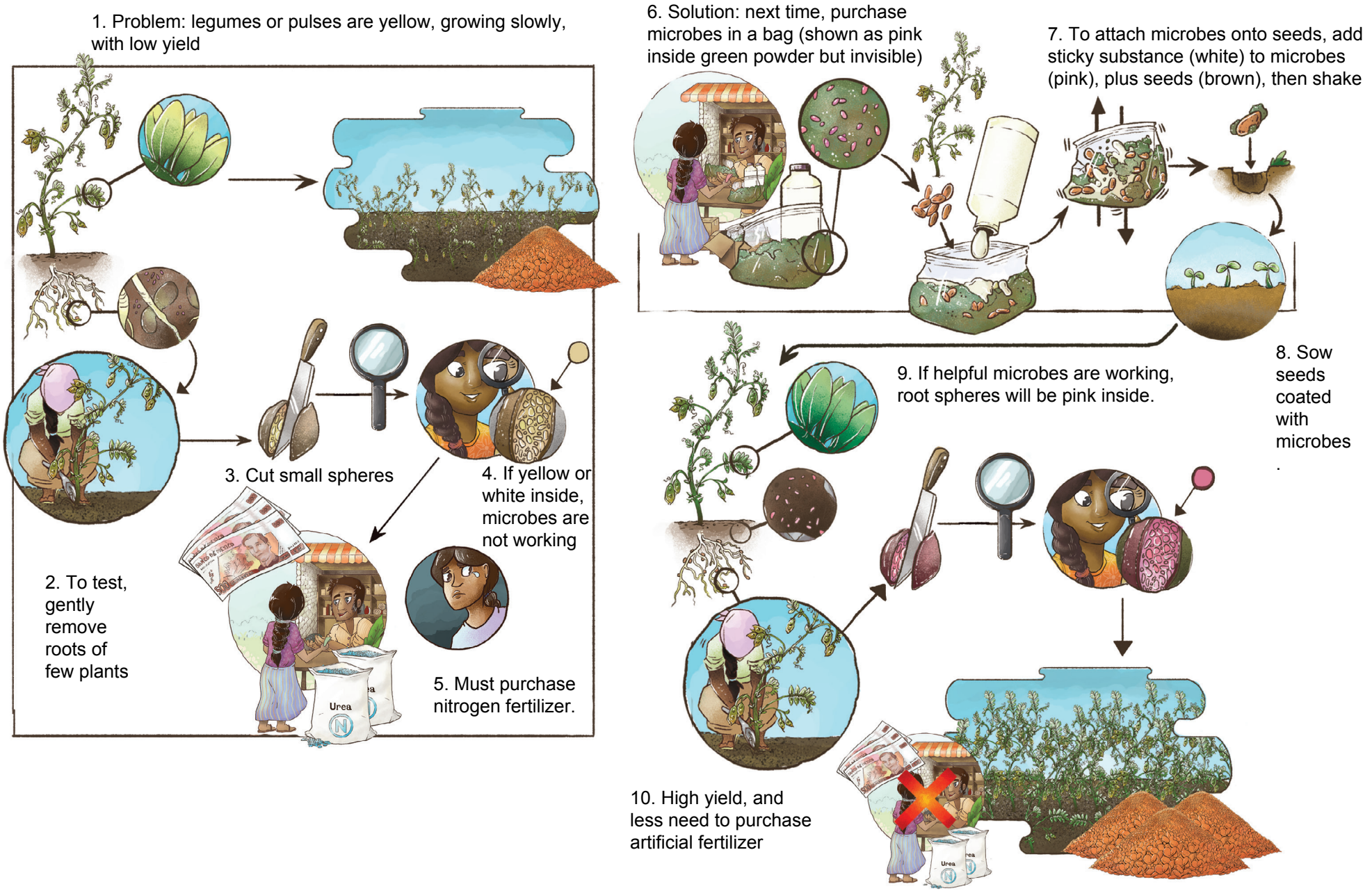
1. Problem: legume leaves such as lentil are yellow causing low yields: might be disease or lack of fertilizer



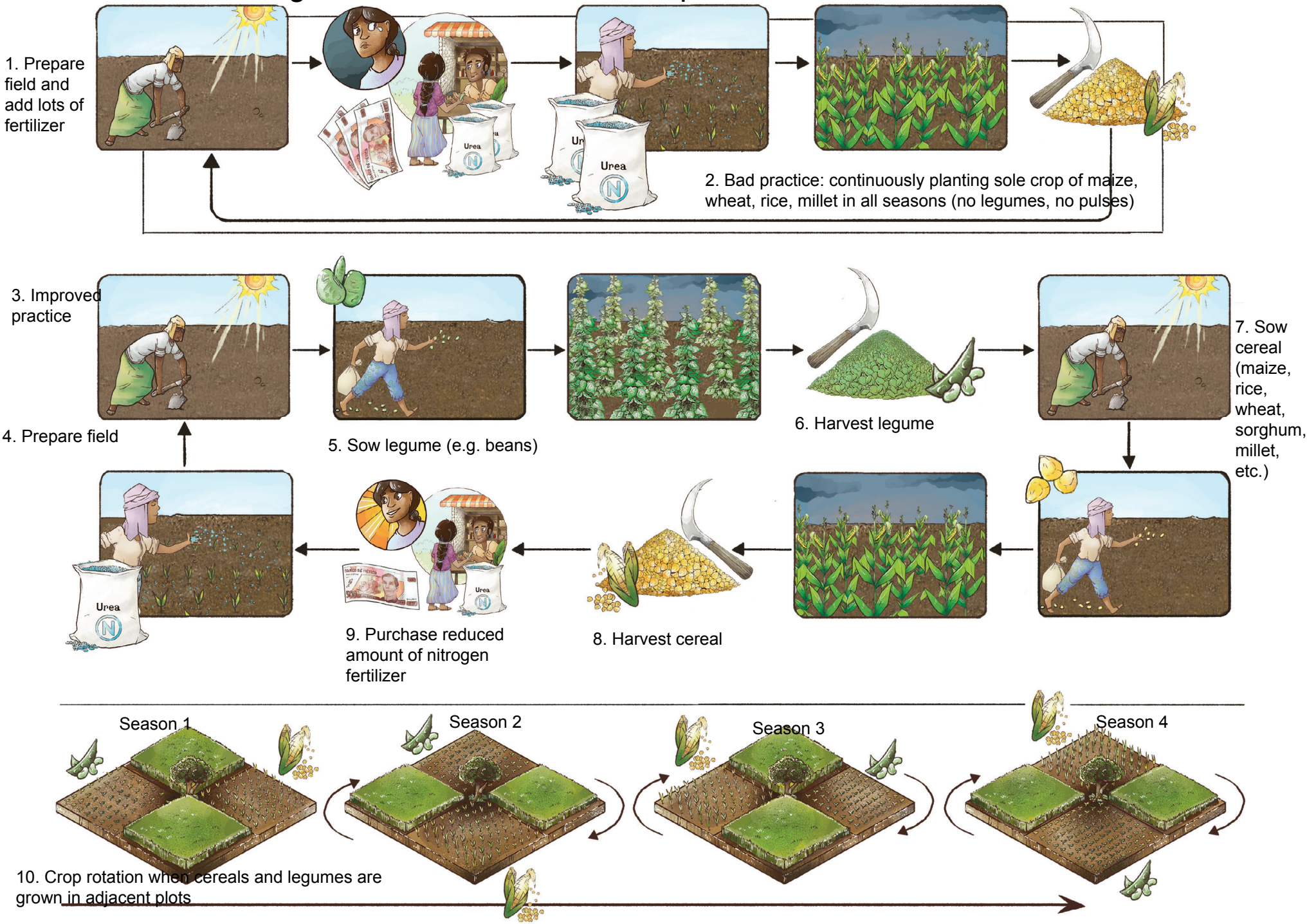
6. Good situation: legume plants appear green.



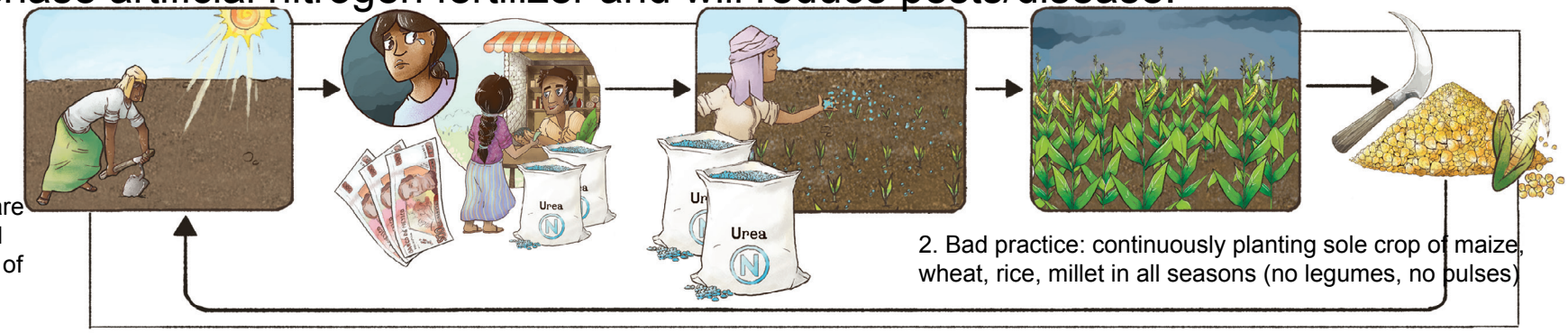
Lesson: If helpful microbe inside small spheres of legume roots are not making natural nitrogen fertilizer, the problem may be fixed in the future by purchasing healthy microbes called rhizobia and coating onto seeds. Seeds may also be purchased already coated with the microbes.

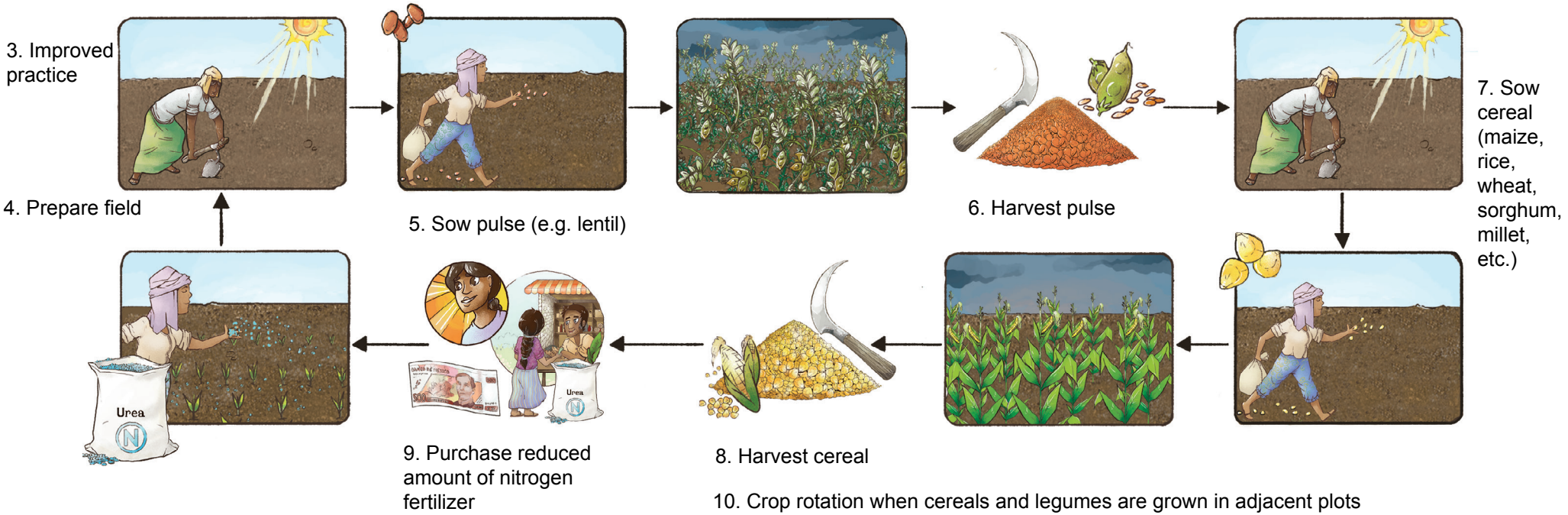


Lesson: Rotating a cereal crop (e.g. maize) with a legume crop (e.g. beans) will reduce need to purchase artificial nitrogen fertilizer and will reduce pests/disease.

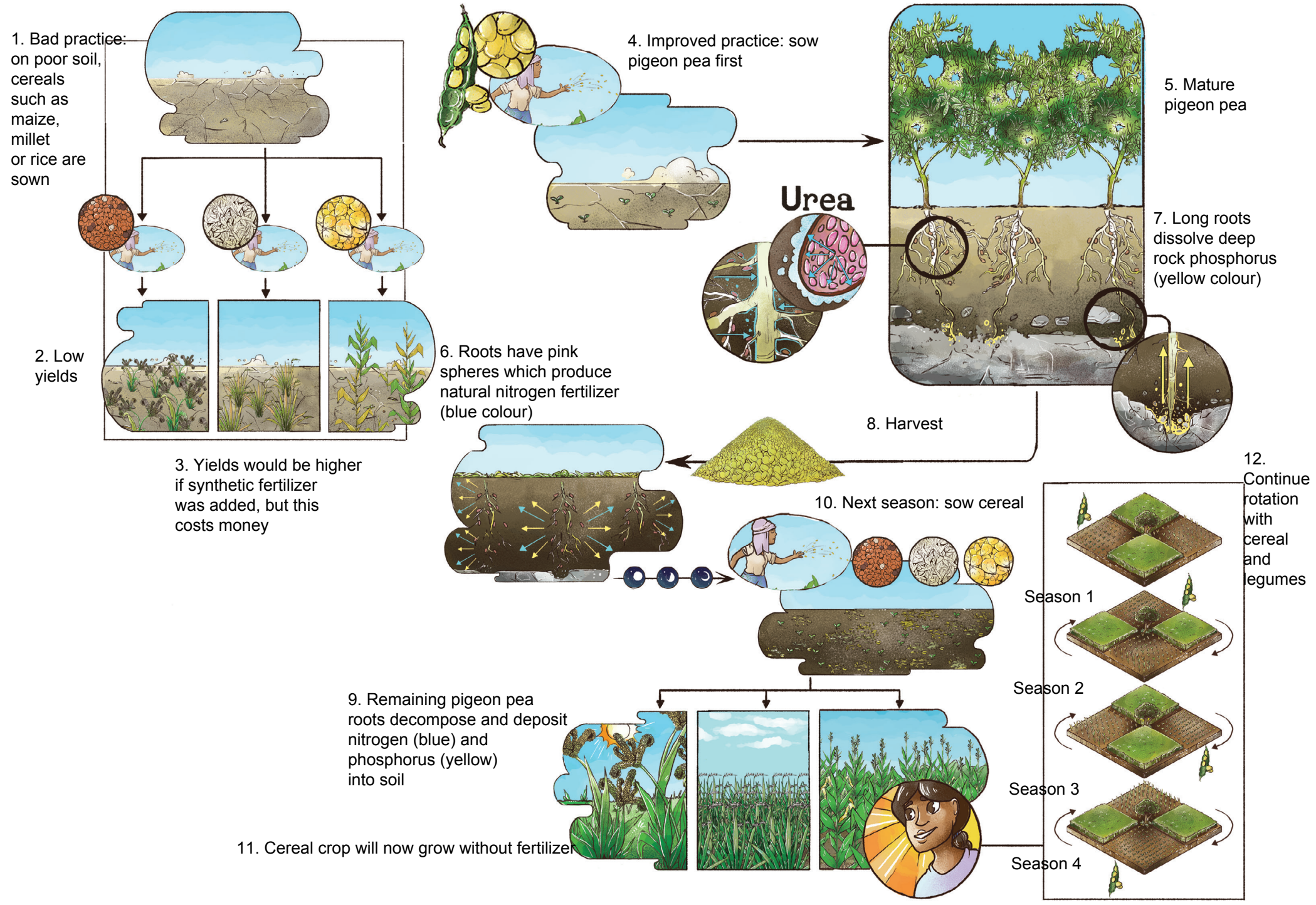


Lesson: Rotating a cereal crop (e.g. maize) with a legume pulse crop (e.g. lentils) will reduce need to purchase artificial nitrogen fertilizer and will reduce pests/disease.

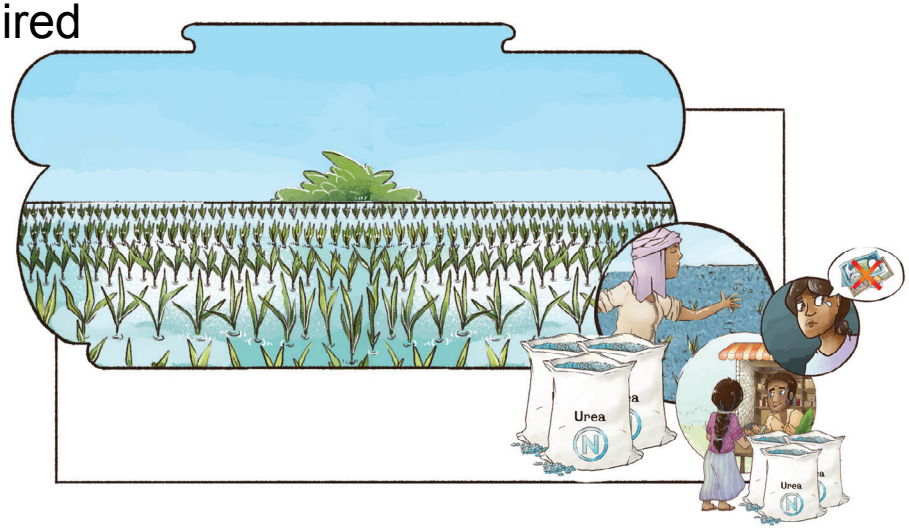




Lesson: When soil is poor, it is better to plant pigeon pea first instead of a cereal crop

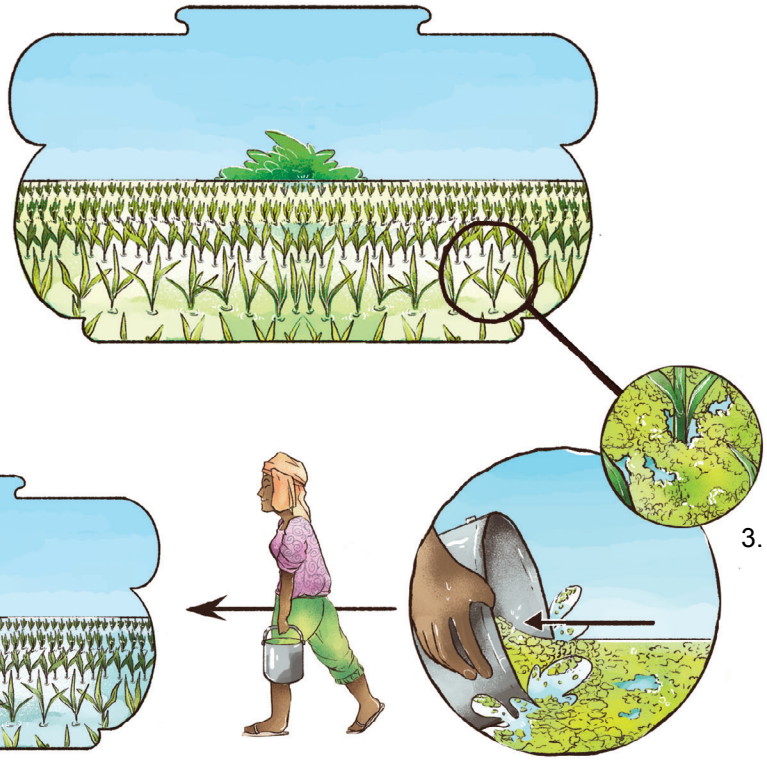


Lesson: In a rice paddy, water algae called Azolla can reduce the amount of nitrogen fertilizer required



1. Traditional practice: no water algae, and hence many bags of artificial nitrogen fertilizer must be applied

2. Improved practice: go with buckets to rice paddy with green algae

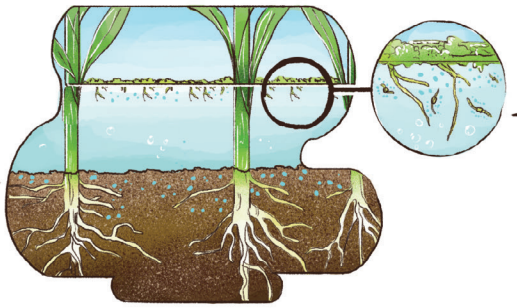


3. Collect algae

4. Deposit algae

5. Algae will grow

6. Algae associates with microbes to produce natural nitrogen fertilizer



7. Good yield with fewer bags of artificial nitrogen fertilizer needed