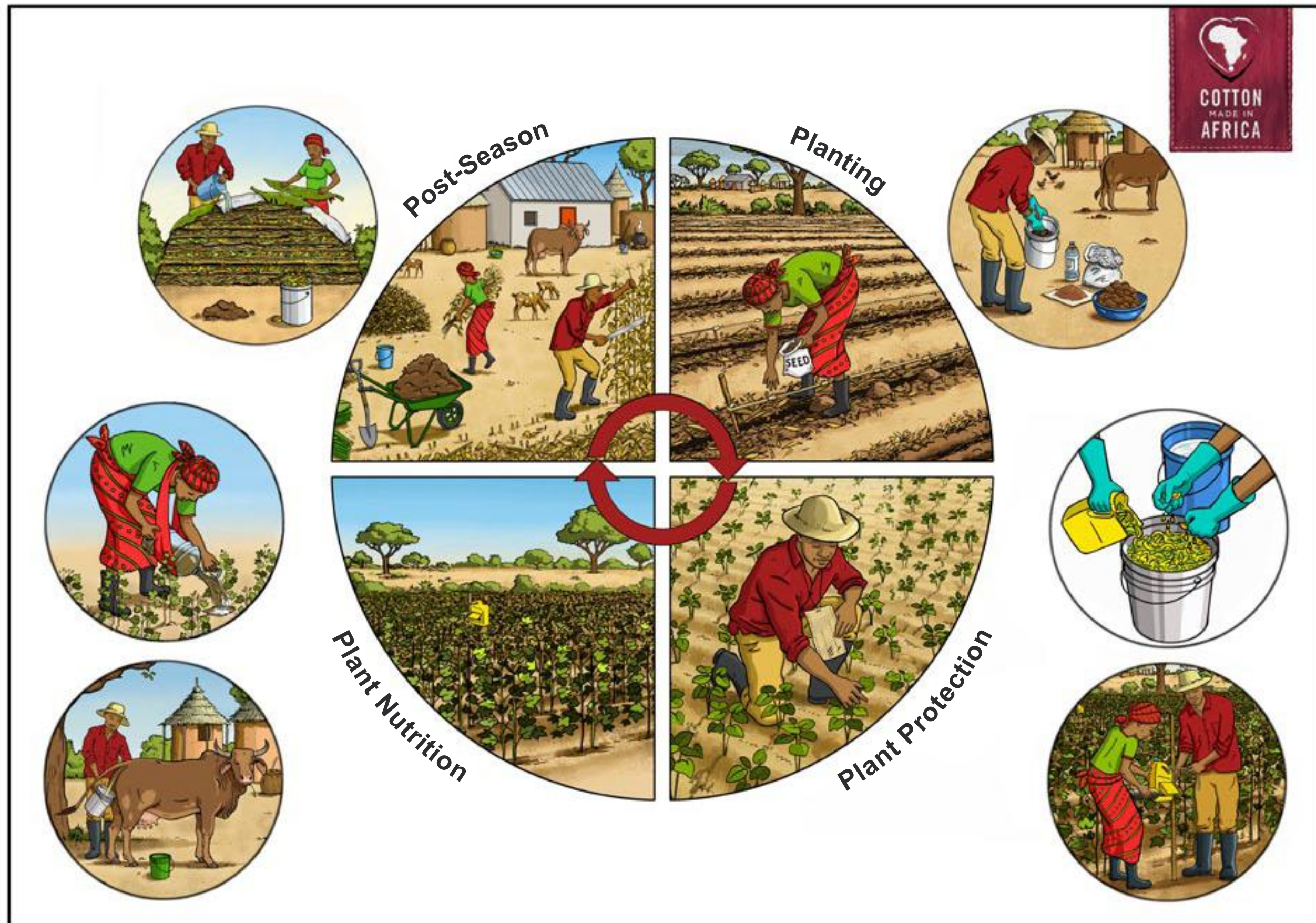


# Picture Block on Bio-intensive Integrated Production and Pest Management





# Foreword

“Cotton made in Africa” (CmiA), an initiative of the Aid by Trade Foundation (AbTF), aims at improving the social, ecological and economic living conditions of a large number of African cotton farmers and their family members. Together with partnering cotton companies, CmiA ensures training in modern, efficient and environmentally friendly cotton cultivation methods. Through its independent certification system, CmiA has set up social, economic and environmental criteria to follow the 3 P “People – Profit – Planet” philosophy.

With the bio-intensive Integrated Production and Pest Management (IPPM) approach, the Aid by Trade Foundation equips extension staff of the partners with knowledge and skills which, when well delivered to farmers, enhance production of healthy crops and minimize the use of toxic pesticides. The CmiA standard requires regular training to apply Integrated Production and Pest Management as defined by FAO. This Picture Block translates IPPM into tangible practices and aims to ensure a successful transfer from training to practice.

The present CmiA Picture Block “Bio-intensive Integrated Production and Pest Management” is a result of extensive exchange with partners in Southern Africa and experienced COMPACI consultants for Extension Services, namely Dr. Ben Sekamatte and Rudy van Gent, whom AbTF would like to thank for their valuable contributions. Illustrations have been put in line with the characters in the CmiA Picture Blocks “Children and Cotton Cultivation – Good Practices and worst Forms of Child Labour” and “Five Fingers Picture Block on Good Agricultural Practices”.

## Imprint

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# INTRODUCTION TO INTEGRATED PRODUCTION AND PEST MANAGEMENT

**Q1. What are some of the main challenges to effective Integrated Production and Pest Management in your area?**

- A1.
- Inadequate pesticide quantities and quality provided to farmers.
  - Commonly, peak spraying coincides with heavy rains and a lot of chemicals are wasted.
  - Lack of access to and/or money for fertilizers, leading to plants that are not well nourished.

**Q2. Why is it important for farmers to learn how to prepare and apply natural pesticides?**

- A2.
- Similar to using plants with medical properties instead of going to the doctor and paying for drugs, natural pesticides can be easily used to reduce pest pressure to a level where the plant can cope with it.
  - Inorganic pesticides are costly, can have adverse effects on humans and harmful to beneficial insects.
  - Botanical pesticides are more easily available to the farmer and cost less.

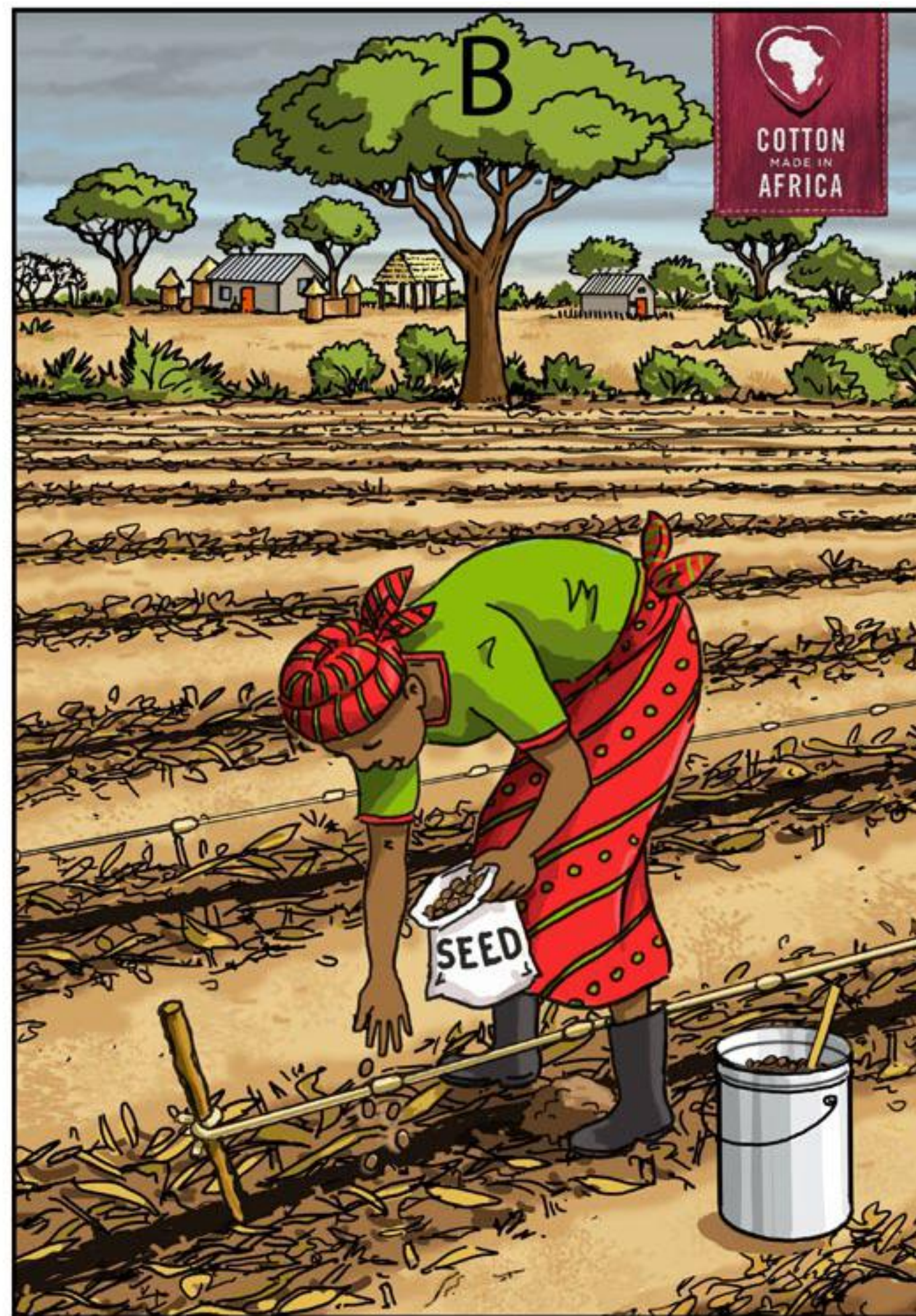
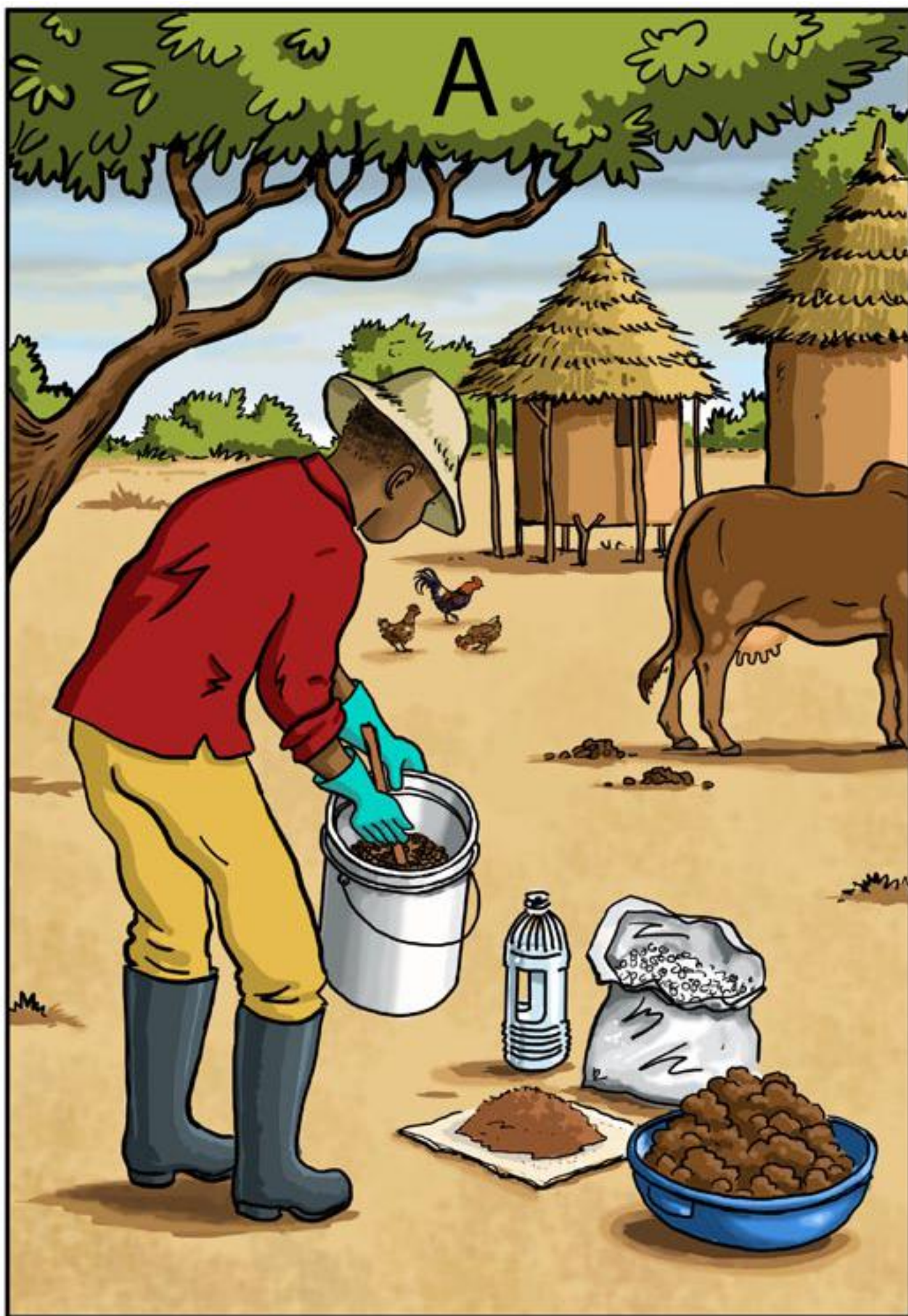
**Q3. What does one do to stay healthy?**

- A3. Eat a well-balanced diet which supports a strong immune system and is able to fight diseases.

**Q4. Why is it so important to integrate knowledge of pests with plant nutrition using natural fertilizers?**

- A4. Healthy crops are able to better deal with pest attacks. Similar to a well-nourished person, the plant can manage diseases and pest attacks much better on its own.







## Dressing Cotton Seeds with Cow Dung

**Q1. What do you see in the picture on the left?**

- A1.
- A man (*His name is Nicodemus*)
  - A bag of fuzzy seed
  - A tray with fresh cow dung
  - A large plastic bucket for mixing
  - A peg for stirring while mixing seeds with cow dung
  - A bottle with water to be used for the mixture
  - Termite soil

**Q2. What is Nicodemus doing?**

A2. Nicodemus is dressing cotton seeds with a mixture of cow dung, water and termite soil.

**Q3. How does he mix the different materials?**

A3. First, he mixes 1 kg of cow dung with 0.5 kg of termite soil and adds water in a sufficient amount to mix smoothly. He stirs one hectare package (i.e. about 15 kg) of fuzzy seeds in this mud until each seed is coated and appears like a small ball.

**Q4. Why is it important to wear gloves when mixing already treated seeds?**

A4. The seeds are already treated with pesticides to protect the plant from diseases and early pest attacks. To avoid skin irritation or other negative effects, it is important to wear gloves. This work should only be done by healthy adults; NEVER by children and pregnant and nursing mothers.

**Q5. What are the benefits of dressing seeds with cow dung?**

A5. Cow dung has numerous beneficial microorganisms that protect seeds from soil pathogens. Additionally it is packed with nutrients and growth hormones. This will boost germination and give the young plant a good start by providing nutrients from the beginning.

**Q6. Can you also dress other seeds than cotton?**

A6. Yes, the same procedure can be applied to maize seeds or any other crop to be planted on your plots.

**Q7. What do you see in the picture on the right?**

A7. A woman, probably Nicodemus' wife (*Her name is Mama*)

**Q8. What is Mama doing?**

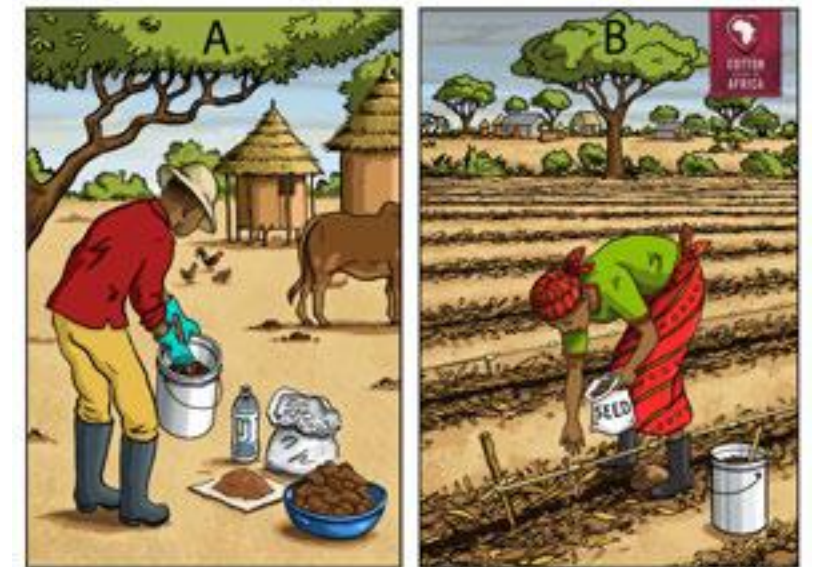
A8. She is planting the cotton seed dressed with cow dung. (*The same bucket in which Nicodemus mixed the seeds can be seen next to Mama.*)

**Q9. When is she doing this?**

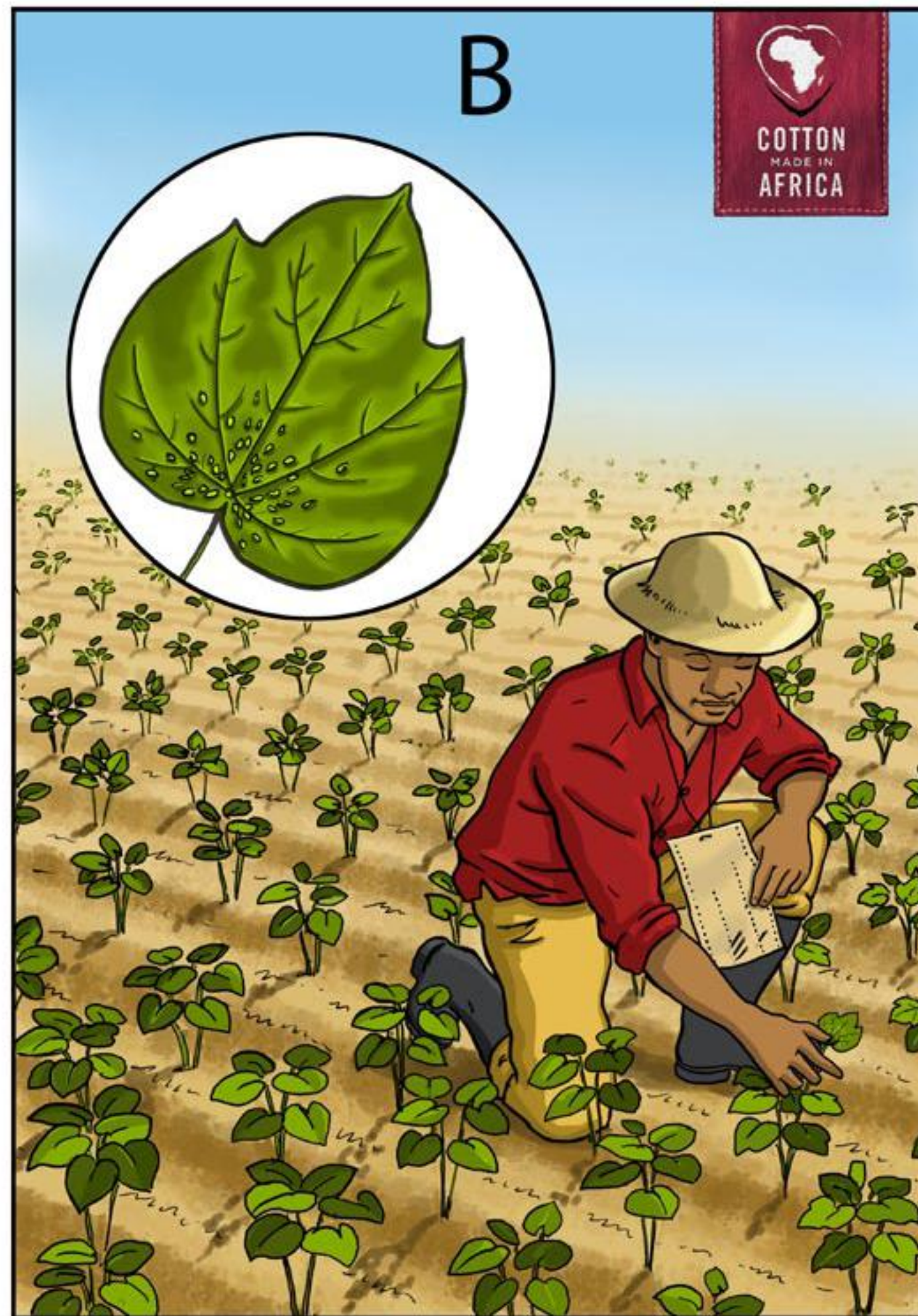
A9. She is doing this only after the dressed seeds have dried up a while, so after one or two hours after her husband dressed the seeds.

**Advanced Level: Q10. Are there other possibilities to dress seeds?**

A10. Yes. Cow urine can be used in a similar way as cow dung. It is an effective fertilizer which will boost germination.









## MAKING OF A PEGBOARD AND EARLY SCOUTING

**Q1. What can you see in the left picture?**

- A1. • Nicodemus, his wife Mama and their daughter (*Nima*)
- A cardboard box
  - A knife
  - A string role
  - A little twig with thorns

**Q2. What do you think the family is doing?**

- A2. • Nicodemus is picking wholes into a piece of cardboard that he previously cut from a box with a knife.
- His wife Mama is rolling off a piece of string.
  - The little girl Nima looks up a photo of a pegboard in a book.
  - The family is preparing a pegboard similar to the one the girl is looking at in the book.

**Q3. What do you see in the right picture?**

- A3. • Nicodemus holding a pegboard.
- A cotton field with small cotton plants.

**Q4. What do you think Nicodemus is doing?**

- A4. He is scouting the family's cotton crop.

**Q5. When should scouting start?**

- A5. One should start scouting 3 to 4 weeks after germination. In addition to scouting for pests, one should also check how healthy the crop is and if it needs foliar fertilizers.

**Q6. Why should the family start scouting at this early stage of crop growth?**

- A6. • This is the time when aphids attack the cotton seedlings.
- This is also the time when beneficial insects attack early colonies of aphids in the field and multiply fast to keep pest populations low.

**Q7. What actions might this family do after scouting?**

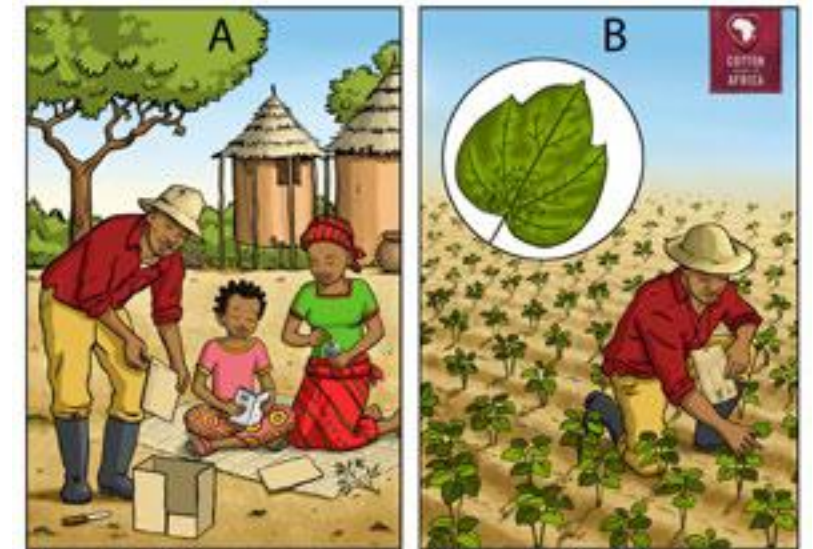
- A7. • Do nothing if they find no aphid attack.
- They may prepare a botanical extract of insecticidal plants readily available in the environment and spray the crop, if the aphids are still below threshold level.
  - Spray with a chemical insecticide/aphicide when aphids are at or above threshold level.

**Q8. What disadvantages are connected to spraying a chemical aphicide?**

- A8. • A strong aphicide can damage the beneficial insects whose population at this time of the season is still developing.
- Rain, which might appear every day at this time of the season may just wash off the insecticide and no effects are achieved.
  - The family will have to pay for the aphicide.

**Q9. What are the advantages of spraying a botanical extract?**

- A9. • Plant material to be used for a botanical insecticide is readily available in your surroundings.
- Botanicals are softer and therefore are less harmful for beneficial insects.
  - Botanicals will not remain for long on the plants, so the family will not have to wait for a long time if they want to harvest crops that were exposed to the application.
  - The family will not have to pay for the botanical.









## Preparation of Leaf Extracts

### Q1. What do you see in the left picture?

A1. Nicodemus, Mama, their daughter Nima and their son Samson preparing a plant-based pesticide.

*(Note to the trainer: this product can also be called “botanical”, “natural pesticide” or “bio-pesticide”)*

### Q2. Which leaves can you use to make a botanical spray?

A2. (Starter Level) You can either use leaves from neem, gliricidia or lantana.

(Advanced Level) Tephrosia, or other plants locally used to repel mosquitos.

### Q3. What are the necessary steps to have plant-based pesticides ready for spraying?

- First you harvest mature leaves from the lower – mid level of the plant.
- Then you pound the leaves in a wooden mortar.
- You fill a 3-liter plastic jerry can with the pounded leaves until it is full.

*(Note to the trainer: a volume of 3 litre will give an approximate weight of 2 kg mashed leaves. In case farmers do not have a 3-liter jerry can available, other containers, like 5 litre cooking oil containers can be used. Measure the volume of three litres and, if no measuring unit is present, cut to the required size.)*

- Pour the 2 kg of pounded leaves into a bucket containing 20 litres of clean water and stir well.
- Cover the bucket and store for 12-24 hours.
- Carefully filter the semi-fermented leaf extract twice. For first filtering, a polybag can be used. The mixture can be filled into a second bucket. After that, the second filtering can be done by covering the knapsack sprayer opening with a piece of cotton cloth. This will ensure no big pieces clog the nozzles of the sprayer.
- You are now ready to spray your crop.

### Q4. When should you spray a plant-based pesticide?

- Only after scouting and based on results that indicate spraying is necessary.
- Plant-based pesticides, which are softer than chemical pesticides, can also be sprayed when scouting results show pests still below the threshold level.
- Plant-based pesticides have less negative effects on beneficial insects. Therefore it is especially valuable to spray plant-based pesticides early in the season when beneficial populations still are increasing their numbers.

### Q5. Why is double filtering so important when pouring the extract into the knapsack sprayer?

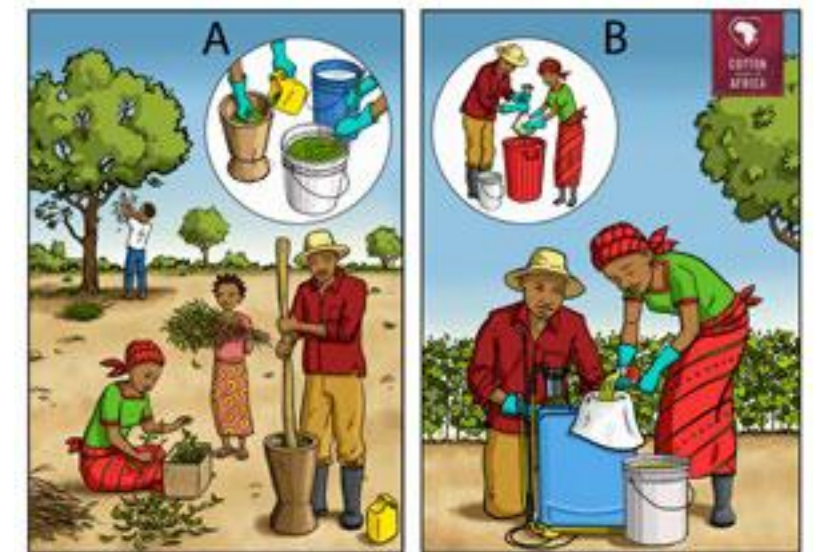
A5. It is important to minimize blocking of nozzles of the sprayers.

### Q6. How long can the preparation be kept?

A6. It is recommended to only prepare the amount of plant-based pesticide to be sprayed on one field/at one time. If it is raining the day after you prepared the plant-based pesticide, it should be sprayed the next day. It is recommended to spray the plant-based pesticide within 3 days after its preparation.

### Q7. When is the best time to spray?

A7. As the active substances of the plant-based pesticides are destroyed by sunlight, it is recommended to spray in the late afternoon, or early in the morning.









# FRUIT EXTRACT PREPARATION

## Q1. What do you see in the picture?

A1. Nicodemus and his wife Mama preparing a natural pesticide from *Solanum* fruits.

(Note to the trainer: Use local name used in the region for '*Solanum incanum*'.)

## Q2. How do you prepare such a natural insecticide?

- A2.
- First you harvest mature fruits of *Solanum*.
  - Put on gloves and goggles and use the knife to dissect the fruits into 4 sections and squeeze the cut pieces into the 3 litre jerry can until it is full.
  - Pour the cut fruits (2 kg) into a 20 litre bucket filled with clean water and stir well.
  - Cover the bucket and store for 12-24 hours. Make sure children and animals do not have access to the bucket.
  - Carefully filter the solution into the second 20 litre bucket. For first filtering you can use a polybag. After filtering, put 10 litres (half of the bucket) back into the first bucket after thoroughly cleaning it. Fill both buckets with clear water up to 20 litre. Stir well. You now have 40 litres of a plant-based pesticide ready for use.
  - Use a piece of cotton cloth to filter the solution again when filling the solution into the tank of the knapsack sprayer. This will ensure that no big pieces block the nozzles of the sprayer.

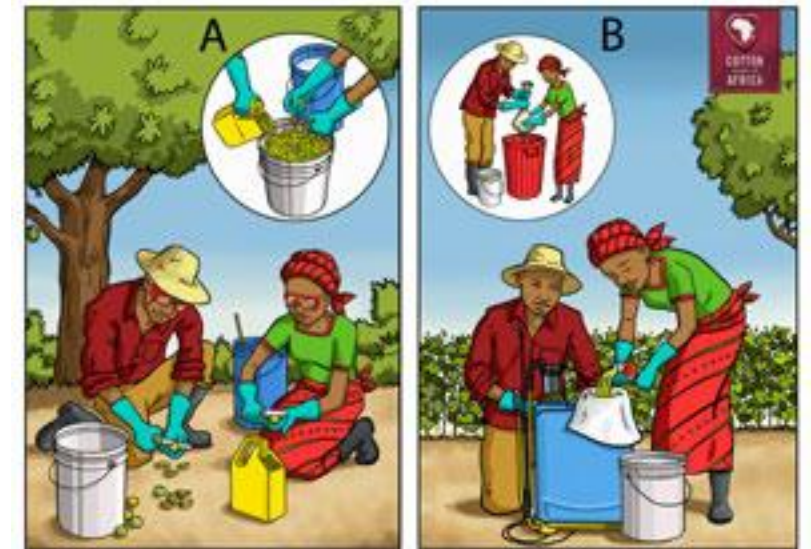
## Q3. Are there other fruits that can be used?

A3. Yes, there are many other fruits and seeds that can be used, for example chilli or neem seeds.

## Q4. What's the difference between leaf and fruit extracts?

- A4.
- (Mature) Fruits might not be available throughout the season.
  - Fruits can be very strong, therefore a higher dilution (1:20 / 5%) is recommended.

(Note to the trainer: When preparing the fruit extracts, safety precautions should be taken. The person handling the fruits should be wearing gloves and goggles. This task should only be done by healthy adults. No kids or women who are pregnant or nursing should be involved in this task.)









# MOLASSES TRAP PREPARATION AND HOW TO PUT IT INTO THE FIELD

**Q1. What do you see in the picture on the left?**

- A1. • Nicodemus and his wife Mama
- A 3 or 5 litre bright yellow jerry can
  - A bottle that contains molasses
  - A string
  - A knife
  - A long wooden peg

**Q2. What do you think the couple is doing with these items?**

- A2. They are making molasses traps by cutting the jerry cans.  
(See picture to check dimensions for cutting).

**Q3. Why should the two flaps be left on and not cut off the trap?**

- A3. The flaps help in stopping rain water from filling the trap and diluting the molasses.

**Q4. Why are molasses traps important for this family?**

- A4. The family is able to save money by making their own traps cheaply from material locally available.

**Q5. But why are the traps specifically important?**

- A5. • They enable the farmer to trap bollworm moths before they lay any eggs on the cotton crop. This reduces the damage to squares and bolls.
- By reducing the number of eggs laid, the farmer may reduce the number of insecticides sprays. This leads to improved profits because of reduced production costs.
  - Catching bollworms gives a good indication when you need to intensify your scouting efforts specifically for bollworms and intervene early, when bollworms are still easy to control.

**Q6. What do you see in the picture on the right?**

- A6. The couple is putting up a molasses trap in their cotton field.

**Q7. When exactly should you put up the molasses trap?**

- A7. The molasses traps should be set up latest 4-6 weeks after germination, in order to catch the first generation of early bollworms.

**Q8. How exactly do you fix them in your field?**

- A8. Get a peg which is long enough to be kept throughout the season (1.5 – 2.0 m) and use a 0.5 m string for hanging the molasses trap.

**Q9. How high should the trap be above the crop canopy?**

- A9. At least 30 cm.

**Q10. How many traps should a farmer place in an acre / hectare field?**

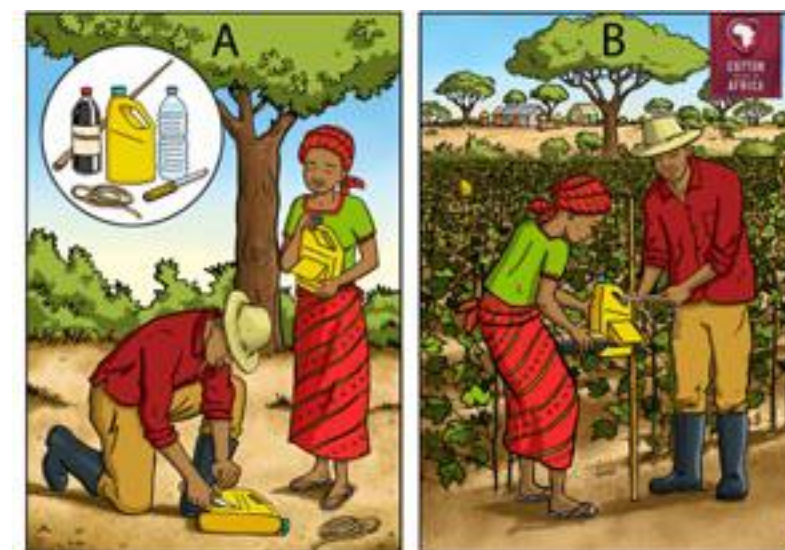
- A10. A minimum of 3 traps in a hectare field, and a minimum of 2 traps in an acre field.

**Q11. How do you prepare the molasses solution?**

- A11. • Put 100 ml of undiluted molasses into an empty bottle and then add 250 ml of clean water to the molasses. Shake the bottle well until you have a uniform molasses solution.
- Pour the molasses solution into the trap.

**Q12. What should you do after the molasses trap has been set-up?**

- A12. • Regularly check if the trap is still well fixed to the peg.
- Regularly check the solution and refill the trap with clean water to avoid the solution from drying up. Once the water is added, you stir gently to maintain a uniform liquid solution throughout the season.









## COW URINE MIXTURE – NATURAL FOLIAR FERTILIZER PREPARATION

### Q1. What do you see in the picture on the left?

A1. Nicodemus collecting cow urine before he is milking his cow in the morning.

*(Note to the trainer: Some farmers recommend putting grass into the bucket that serves to collect the urine. This avoids that the cow is disturbed by an unusual noise.)*

### Q2. How long can you keep cow urine?

A2. Avoid keeping the cow urine under direct sun. The longer it ferments, the more effective it is.

### Q3. What do you see in the picture on the right?

A3. Nicodemus and his wife Mama preparing a foliar fertilizer spray using a mixture of cow urine.

### Q4. How do you prepare a foliar fertilizer?

A4. • Cover the tank of your knapsack sprayer with a piece of cotton cloth for filtering.  
• Put one litre of cow urine into of the knapsack sprayer and add 15 litres of clean water to fill up the sprayer and shake it well.

### Q5. When should you spray the cow urine-water mixture?

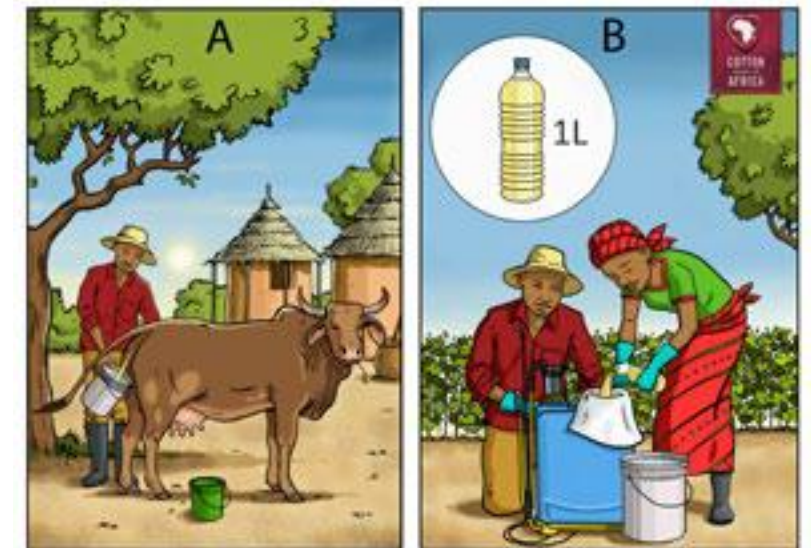
A5. • The mixture should be sprayed weekly before flowering and bi-weekly at flowering if no top dressing with granular fertilizers is done.  
• The mixture should be sprayed either early in the morning or late in the afternoon.  
• The mixture can be sprayed on the cotton plants using 8-10 knapsacks every two to three weeks during the period of boll formation. 8-10 litres of pure cow urine per hectare are recommended.

### Q6. Why should farmers only add one litre of cow urine into the sprayer?

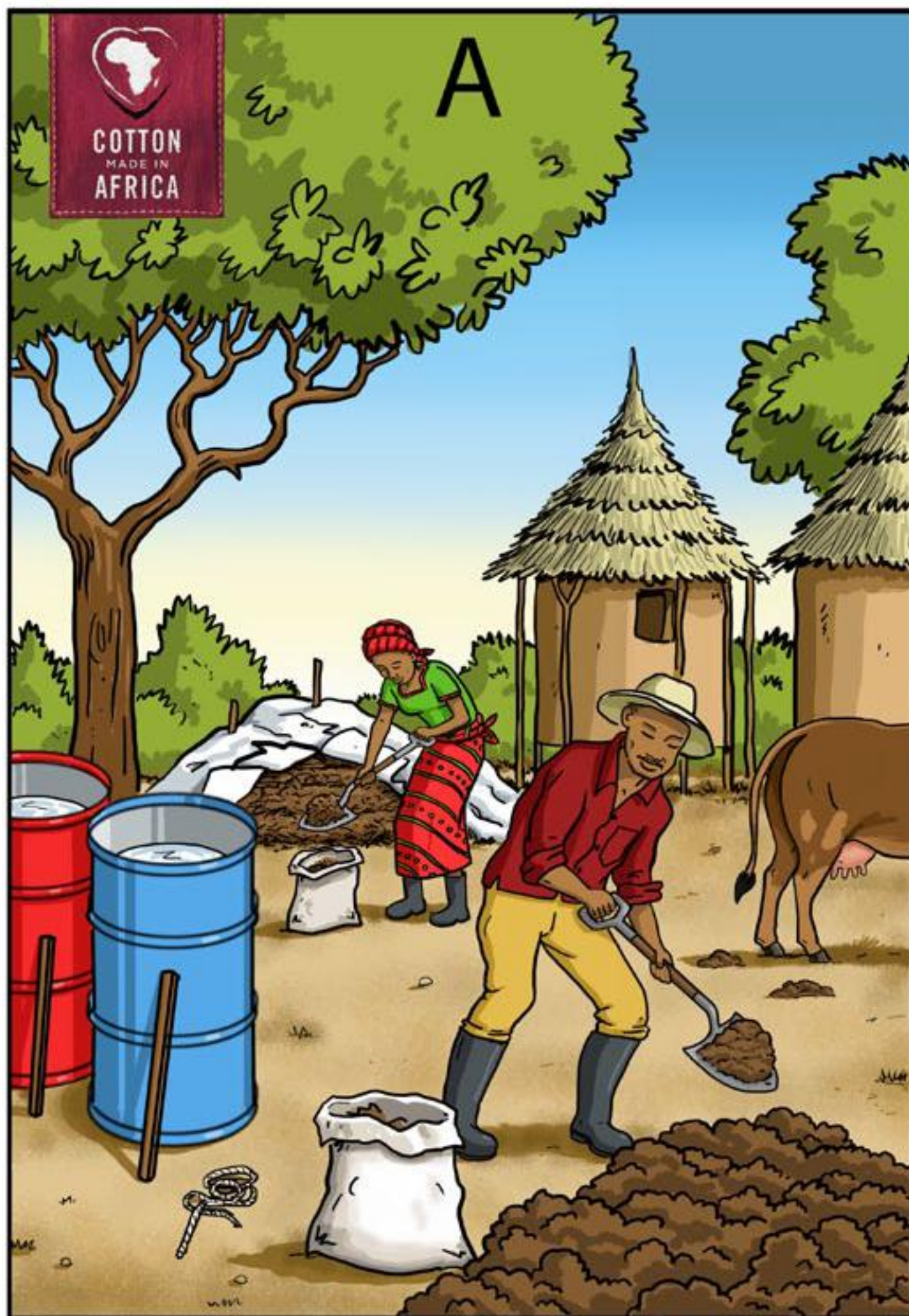
A6. If the concentration of the cow urine is higher, it can scorch the leaves, and thereby cause damage.

### Q7. Why should the farmer not spray more often or longer in the season?

A7. • If there are excess nutrients, the cotton plant will continue to build new leaves instead of concentrating on boll formation.  
• Excess nitrogen will attract more aphids, causing unnecessary pest attacks which might require more pesticide applications.









# COMPOST AND MANURE TEAS - HOW TO PREPARE LIQUID FERTILIZERS

**Q1. What do you see in the picture on the left?**

- A1. • Nicodemus and his wife Mama
- A cow
  - Two heaps, one for manure and another for compost
  - Two 200 litre drums of water
  - Two thick wooden sticks of 1 meter length
  - A plastic piece to cover the drum
  - Two poly sacks where manure and compost are put into
  - A small rope which is used to tie the sack before it is suspended

**Q2. What do you think the couple is doing?**

A2. They are preparing natural liquid fertilizers.

**Q3. What is Mama doing?**

A3. She is putting compost from the heap into a bag using a shovel.

**Q4. What about Nicodemus?**

A4. He is putting animal manure into a bag using a shovel.

**Q5. What do you think the animal manure is for?**

A5. Natural fertilizers can either be prepared by using compost or manure, but if both sources are available, it is recommended to mix them.

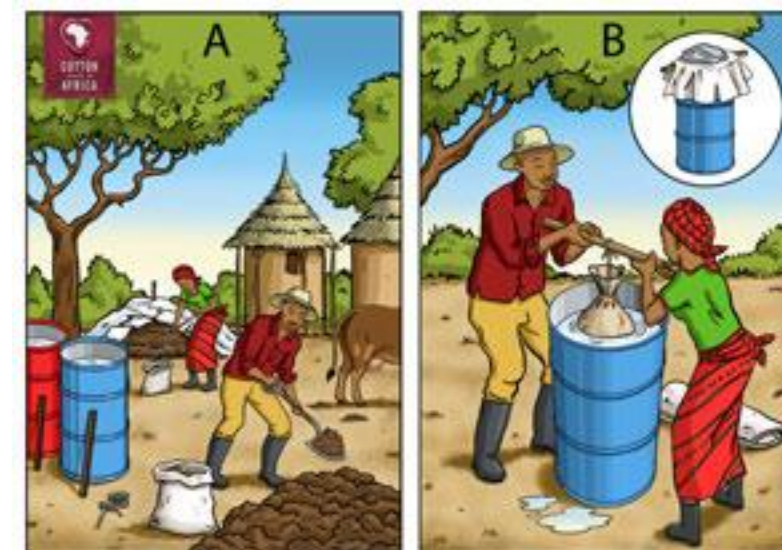
**Q6. What is the couple doing in the picture on the right?**

A6. They are dipping the mixture of compost and animal manure into a 200 l drum.

It is also possible that they are turning the 20-25 kg bag around to facilitate fermentation.

**Q7. What is the plastic sheet next to the drum used for?**

A7. To cover the drum after stirring the mixture of manure and water.



**Q8. Why is it important to cover the drum?**

A8. The cover ensures that the nutrients / nitrogen does not evaporate into the air.

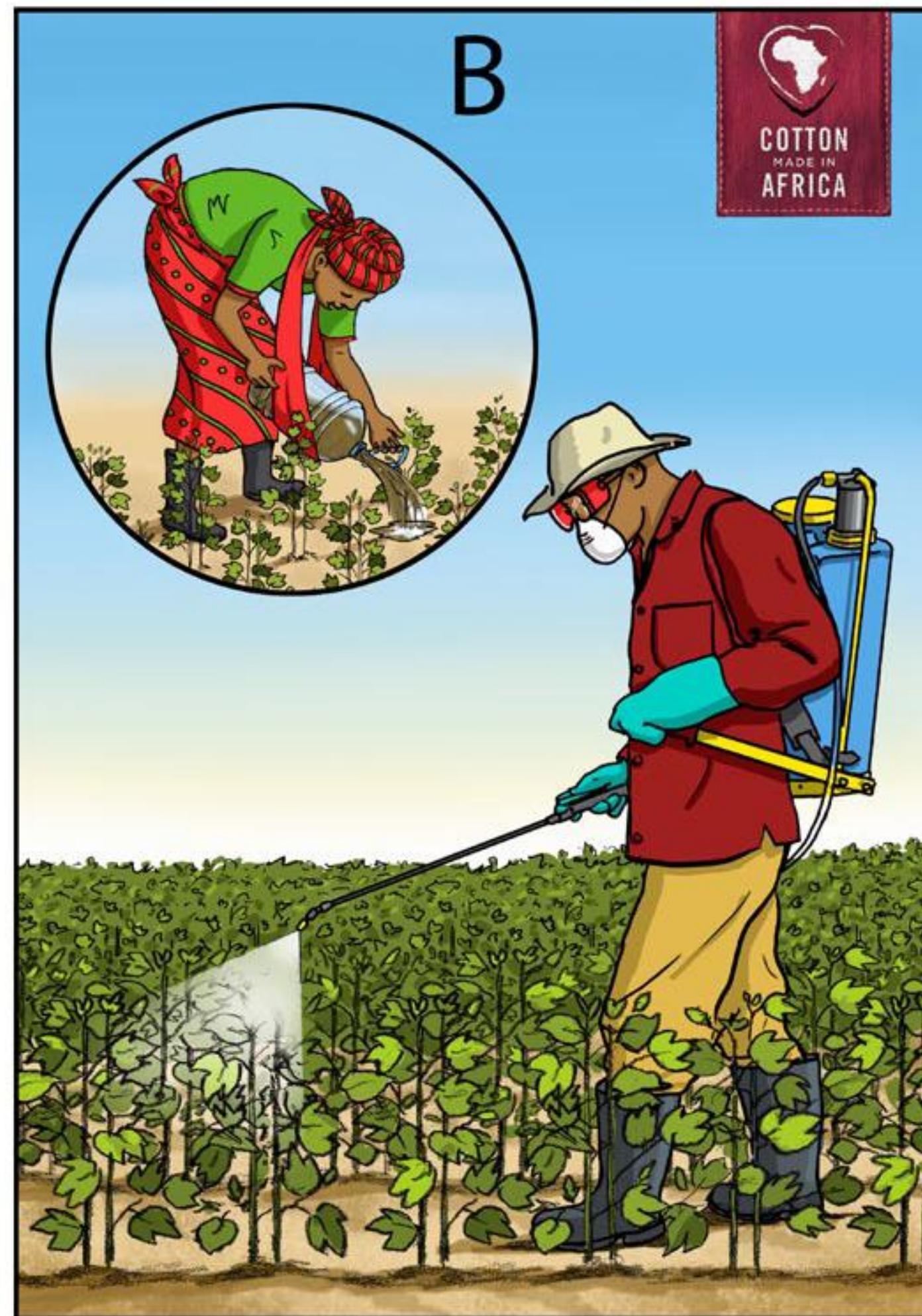
**Q9. How long does it take until the liquid fertilizer is ready for use?**

A9. The compost or manure mixture has to ferment for at least 10-15 days. Every two to three days it needs to be stirred using the wooden stick. The water will turn grey to blackish. In addition, a strong smell will give a good indication when the liquid fertilizer is ready for use. The bag can be removed after the solution is ready for use.

**Q10. How long can the liquid fertilizer be used?**

A10. Once the liquid fertilizer is ready for use, it should be used within 10 days. Keep the drum covered at all times until it is empty.







## LIQUID FERTILIZERS – HOW TO APPLY THEM

**Q1. What do you see in the picture on the left?**

- A1. • Nicodemus and his wife Mama.
- Nicodemus is preparing to spray a liquid fertilizer that has been drawn from the drum.
  - Mama is filling liquid fertilizer into a large empty plastic bottle.

**Q2. What do you see Nicodemus doing exactly?**

- A2. He is carefully filtering the liquid manure drawn by his wife Mama from the large drum into a knapsack sprayer. He uses a piece of cloth for the filtering.

**Q3. What do you see Mama doing in the picture on the right?**

- A3. She is using a plastic bottle to apply liquid fertilizer along plant rows. This process is called drenching. It allows applying liquid fertilizers even when no knapsack sprayer is available. When applying liquid fertilizers drawn from chicken manure, drenching is the preferred application as one should avoid spraying leaves with chicken manure.

**Q4. What about her husband?**

- A4. He is spraying liquid fertilizer on plant leaves using a knapsack sprayer.

**Q5. What about the 10 litre jerry can with perforated lid?**

- A5. It is for dispensing the liquid onto soil along the plant rows instead of using a knapsack sprayer.

**Q6. What is the correct mixture of liquid fertilizer and water?**

- A6. The liquid fertilizer should be diluted 1:3, i.e. one litre of liquid fertilizer to be mixed with 3 litres of water. For a standard knapsack sprayer of 16 litres volume this means 4 litres of liquid fertilizer and 12 litres of water.

**Q7. How much of the ready-to-apply mixture should be sprayed on one acre/ on hectare?**

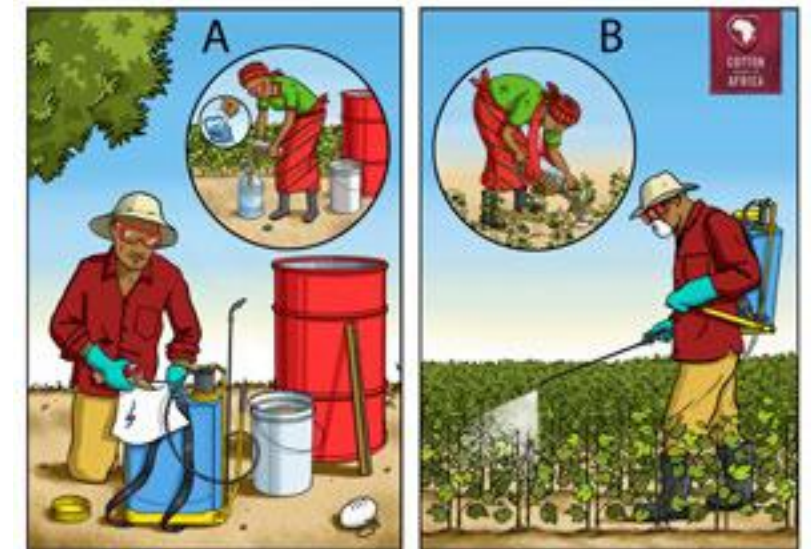
- A7. Approximately 800 litres per hectare or 300 litres per acre are recommended.

**Q8. When should one start applying liquid fertilizers?**

- A8. Start application 14 days after germination, just when thinning is completed. Change from manure tea to compost tea after 4 applications.

**Q9. When should the liquid fertilizer be applied?**

- A9. It is best to apply the liquid fertilizer after it has rained. It is recommended to spray early in the morning or late afternoon (after the rains have stopped).









## COLLECTING PLANT MATERIALS FOR A COMPOST HEAP

**Q1. What do you see in the picture?**

A1. Nicodemus and his wife Mama.

**Q2. What do you think they are doing?**

A2. Nicodemus is cutting maize stalks while his wife gathers them.

**Q3. Why are they doing this?**

A3. They are about to construct a compost heap.

**Q4. What items are they using to do this job?**

A4. 

- A wheel burrow full of animal manure, collected from the cow, chicken and goats around the home
- A shovel
- A 200 litres drum filled with water
- Cut bamboo poles
- Banana leaves
- Black soil

**Q5. What other materials, if available could be useful to add to the compost heap?**

A5. 

- Leguminous crop material
- Residues from any other crop material
- Rock phosphate
- Ash
- Cow urine

**Q6. Where is the best place for a compost heap?**

A6. 

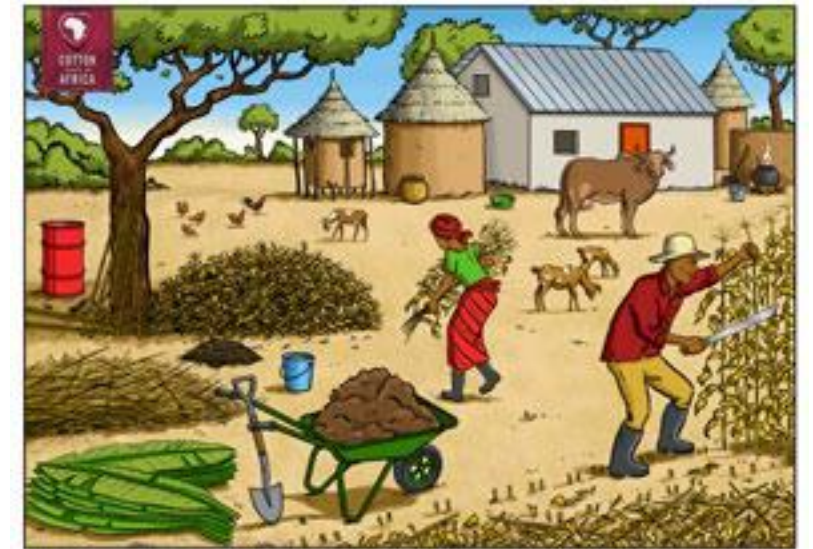
- The compost is ideally located near the field where it will be applied.
- The place should be shady, e.g. under a tree, and near a water source.
- Water-logged sites should be avoided.

**Q7. What is the best time to set up a compost heap?**

A7. A compost heap should be set up when a lot of plant material is available. After the harvest of the main crop, the crop residues can be easily used. If the farm does not supply enough plant material, it may be collected from outside sources.

**Q8. What is an adequate size for a compost heap?**

A8. To allow sufficient aeration it should be maximum 2.5 metre wide and 1.5 metre high.









# THE DIFFERENT STEPS IN PREPARING A COMPOST HEAP

**Q1. What do you see in the picture?**

A1. The different activities to carry out when constructing a compost heap.

**Q2. What do Nicodemus and his wife Mama do first?**

A2. They build a base layer with material that is difficult to decompose, such as maize or cotton stalks, twigs or other dry material.

**Q3. Why do they have to raise the base at least 30 cm high?**

A3. 

- The base layer will stabilize the heap.
- It ensures good aeration and drainage for the compost heap.
- Material that is easy to decompose should not be put on bare soil.

**Q4. Why should they use a variety of crop residues?**

A4. The mixture of maize stalks and leguminous crop material ensures a good mixture of nitrogen and carbon sources, which ensures a high quality compost.

**Q5. What material do you think is in the wheel burrow?**

A5. Animal manure and old compost.

**Q6. What do they do with these additional materials?**

A6. They are piling up different layers of coarse material, such as stalks, roots or twigs, and material that decomposes quickly, such as cow dung, green leaves kitchen waste, manure and old compost. This allows the heat from the upper layers to facilitate decomposition of the harder material.

**Q7. Why is important to add a sprinkling of black soil to each layer?**

A7. It is important to sprinkle every layer with black soil in order to hold moisture and facilitate decomposition.

**Q8. What is the water in the bucket for?**

A8. The whole pile needs to be watered well before covering. At all times, the compost should be kept in moist condition, but not too wet. When pressing a handful of compost the material should stick together but no water should come out of it.



**Q9. What kind of material may be used to cover the compost heap?**

A9. The compost heap may be covered with a plastic sheet, polybags, banana leaves, or grass thatch to protect it against evaporation and heavy rain as this will wash away the nutrients.

**Q10. What are those long poles in the heap for?**

A10. These are cut bamboo canes to enable good air circulation in the heap.

**Q11. What next after the heap is set and well covered?**

A11. 

- Two to three weeks after building the compost heap, it will have decreased to about half its original size. This is the right time to turn it for the first time in order to accelerate the process; turn again after another 1-2 weeks for a second time and again for another 2 times. The heap needs to be covered again after each turning process.
- The compost should be ready for use after the 4<sup>th</sup> turning, approximately 2.5 – 3 months after it has been set up.
- The length of time usually depends on the amount of turning and if the heap has been watered sufficiently.