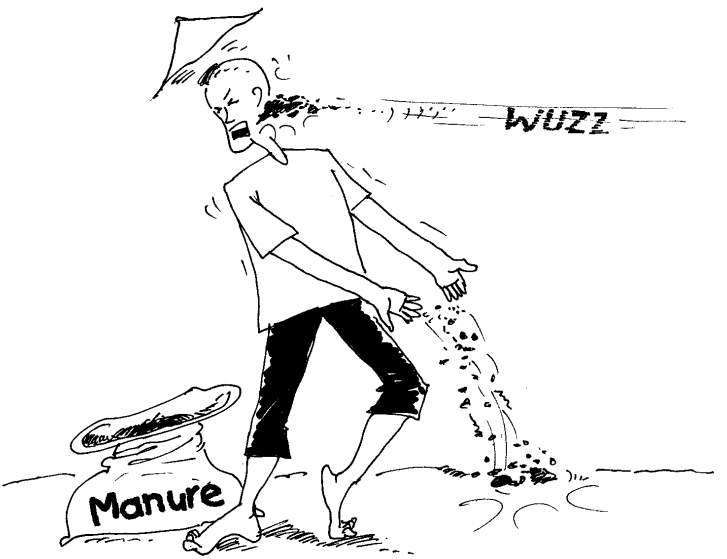
15 Fertilization

Background

Before inorganic fertilizers such as urea, TSP and KCl were available, farmers used farm manure to fertilize their soils. Organic manure is an important source of nutrients. It contains all the nutrients that are needed by the plant. In addition, it improves the structure of the soil by adding organic matter, and hence results in better and more efficient nutrient and water availability for plants.



Nowadays, farmers, however, rarely use organic manure in their fields. Some reasons for this often mentioned by farmers are, because:

- They do not keep livestock, because it is a burden.
- Those having livestock often do not have enough labor to bring the manure to the field.
- They are of the opinion that inorganic fertilizers are more practical and more effective.

Apparently, in many places where inorganic fertilizers have been used for decades, soil fertility deteriorated. This happened particularly in areas where unbalanced applications of inorganic fertilizer types were used, and mostly only nitrogen and phosphate were supplied to the soil. These soils have become exhausted and can only be made fertile again by using organic fertilizers, such as farm manure, compost or green manure.

Besides reducing soil fertility, the use of inorganic fertilizers which are becoming more and more expensive is often inefficient, because application methods are inappropriate. Studies have shown that rice crops in wet paddy fields absorb only about 40% of the nitrogen contained in the urea applied by farmers. The remaining 60% is lost through evaporation, washing-off, leaching or adsorption to soil particles. The mineral nutrients not absorbed by the crop are left in the environment and can pollute both ground and surface water.

In order to achieve a balance in sweetpotato cultivation, both from an ecological and an economic perspective, plant nutrition and fertilization are equally important aspects to take into consideration. Therefore, we should seek fertilization methods that result in optimum yields at minimum cost and leaving maximum environmental health.

Objective

After conducting this activity the participants should:

- Understand the factors that determine fertilization needs and practices.
- Be able to apply fertilizers properly, with regard to type, dose, time and method of application.

Materials

- Samples of urea, TSP and KCl (two tea spoons full of each type).
- Small plastic bags (six per subgroup).
- Rubber bands to tie the labels on the jars.
- Urea and KCl according to the dose needed for the FFS field.

- Newsprint paper.
- Felt-tip markers.

Preparation

The amounts of urea and KCl needed for the second fertilizer application on the FFS field should be calculated and prepared prior to this FFS session. For calculating the amount the following formula can be used:

Amount of fertilizer (gram) = dose (kg/1,000 m^2 x field area (m^2)

The recommended fertilizer dose for the FFS field used in intensive production areas in Indonesia, where yields of 40 tons/ha can be expected and a basal application of organic manure is applied, is 5 kg of KCl and 10 kg of urea per 1,000 m^2 (see Part III, section 2.6.2). Appropriate doses will have to be determined in other areas and/or at different yield levels. In case the FFS participants conduct a fertilization experiment on the FFS field, fertilizer application rates should be adjusted to the treatments tested.

Activity steps

This topic is related to the topics discussed in Field Guide 2 (Healthy soil) and Field Guide 7 (Healthy crop). The participants should be reminded of what was discussed previously.

A *The behavior of inorganic fertilizers*

A.1 The participants are divided into small groups. Each group is given small samples of three types of fertilizer: urea, TSP and KCl (or other N, P and K-containing, mineral fertilizers available), and six small plastic bags.

A.2 The facilitator explains the purpose of this activity, i.e. to discover how inorganic fertilizers behave in water and soil, and hence what the consequences of fertilizer application are.

A.3 The participants are invited to observe the following characteristics of the three fertilizer types and note down the results:

→ Look at the color of each of them.
→ Feel their structures.
→ Smell their aromas.

A.4 Each group fills three plastic bags with water and three others with soil. Each bag with water is given one tea spoon full of one type of fertilizer. The same is done with the bags with soil. The fertilizer is mixed well with the water or the soil. The participants should observe the following characteristic of the mixtures:
→ Color.
→ Smell.
→ Solubility.

A.5 The plastic bags with water/soil and fertilizer are kept until the end of the meeting to be observed again, and any changes with regard to the characteristics described above must be noted down.

A.6 In the meantime, the facilitator initiates a discussion about the composition of each fertilizer, and probes for, or explains, the nutrient contents of each type.

A.7 A comparison could be made between the price of organic manure versus inorganic fertilizers, calculated on a basis of price per kg of nutrient content (see example Part III, Section 2.6.1).

A.8 The following questions can be posed by the facilitator to stimulate the discussion:
→ Why should we incorporate inorganic fertilizers, particularly urea and KCl, in the soil?
→ Why should we give TSP and manure as a basal application?
→ What are the advantages of organic manure as compared to inorganic fertilizers?
→ What are the advantages and disadvantages of the different types of fertilizers?

B *Input = output*

B.1 The facilitator explains the purpose of this activity, i.e. to understand the need for the application of appropriate fertilizer doses.

B.2 The participants are asked for their opinion about the actual objective of fertilization. Building on their statements, the facilitator reaches the conclusion that, through fertilizer application, the same types and amount of nutrients should be returned to the soil as have been absorbed by the crop and will be removed from the field at harvest time.

B.3 An inventory is made together of the fertilizer regimes applied by several participants on their previous sweetpotato crop, and the harvest they obtained. The fertilizer rates and yields are converted into standard units (kg/ha or m^2) and compared. Did the highest dose give the best yield? The participants are asked for their opinions on the strengths and weaknesses of the fertilization practices reported.

B.4 The facilitator elaborates on the recommended application rates of manure, urea, TSP and KCl for the FFS field. It should be emphasized that there is no fixed recommendation, but only some flexible guidelines that have to be adapted according to local conditions (soil fertility, expected yields, availability of nutrients from natural sources, availability of fertilizers). The facilitator could remind the participants about the way to do a reliable experiment to determine appropriate fertilizer rates.

C *Fertilizer application on the FFS field*

C.1 The participants are invited to apply the second urea and KCl applications to the FFS field by evenly distributing the appropriate amounts on the side of the ridges before hilling up.

C.2 The fertilizer is covered by hilling up the ridges.

For more information see:

- Plant nutrition (Part III, Section 2.6)

Notes