

# SITE SPECIFIC FERTILIZER RECOMMENDATION (SSFR) USING SOIL TEST KIT



Food and Agriculture  
Organization of the  
United Nations



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**SITE SPECIFIC FERTILIZER  
RECOMMENDATION (SSFR) USING  
SOIL TEST KIT**

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Development of Site Specific Fertilizer Recommendation (SSFR)  
for Sustainable Food Crop Production  
(FAO- TCP/SRL /3606)

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# 1. Introduction

Fertile soil is essential to obtain a better harvest from food crops. Rain and crop production remove large quantities of elements from soil and make soil unfertile. It also causes a decline in soil pH and makes nutrients unavailable to plants. On the other hand, accumulation of some elements brought about by indiscriminate use of agrochemicals and fertilizer enhances nutrient accumulation and causes difficulty in absorbing certain nutrients by plants. Deficiency in plant nutrients result in weak and stunted plants. Therefore, proper management of soil nutrients is necessary to grow crops faster, stronger and to produce greater yields. Nitrogen, the most important nutrient, is responsible for leaf growth and green leaves. Phosphorus (P) the second important nutrient is the major constituent of plant genes/nuclear material and is important for seed development. Potassium (K) the third important nutrient strengthens the plant. The level of pH controls how well plants utilize the above nutrients available in the soil. So, the management of these three major nutrients along with soil pH is an essential part of sustainable crop production. When these nutrients are not at the required level for plant growth, they can be given through fertilizers to get healthy plants and optimum production. Application of fertilizer at quantities greater than or lesser than the required level is a wastage. As such, to determine the amount of fertilizer required for healthy plants and optimum production, soils should be tested for the level of plant nutrients before crop establishment

The soil test based fertilizer recommendation programme for food crops in Sri Lanka was introduced by the Department of Agriculture (DOA) in 1993. Application of fertilizer based on soil test results, prevents the accumulation of P and K in the cultivated fields and minimizes the cost of production and ground water pollutions. Under this programme any farmer can get his soil sample analyzed and a site specific P and K fertilizer recommendation be obtained for rice, maize and vegetables at a nominal fee of approximately Rs. 290 (US\$ 2). Although farmers can save a substantial amount of money spent on to fertilizer through this method, still few farmers get their soils tested under this programme due to the following reasons.

i). Soil samples collected from farmers' field have to be transported to soil testing laboratories situated in far -away places

ii). Twelve soil testing laboratories established island wide do not have enough manpower and capacity to analyse samples from all farmers in Sri Lanka within a season,

iii). Farmers have to wait for 3 to 4 weeks to get the soil test results.

To overcome the above constraints and to encourage farmers to test their soils before application of fertilizer, an easy and quick method to test soil samples at the field level should be introduced. Use of Soil testing kits, which are used to test soils in the field by other countries, is a better alternative to time consuming lab testing. So, if soil testing kits can be used to read the level of soil fertility *in-situ*, it will be helpful for Sri Lankan farmers to decide the level of lime, P and K needed to be applied before they start their cultivation.

Numbers of soil and plant testing kits are available in the world. Therefore, it is necessary to find out the most suitable test kit that can be used to test different soils found in Sri Lanka and for different crops cultivated by the farmers. To find the most suitable test kit, several soil test kits used in South Asian countries were evaluated over 12 months at Gannoruwa, Batalagoda, Mahailuppallama, Bandarawela, Makandura, Sitaeliya, Bombuwala Angunakolepelessa, Thirunnaweli and Kalpitiya research stations for different soils and for different crops. According to the results of the above experiments, the test kit branded Transchem was identified as the most suitable test kit for Sri Lankan soils and for food crops grown in Sri Lanka (Figure 1).



Figure 1. Transchem Soil Testing Kit

## 2. Use of Transchem soil testing kit to test the fertility condition in the soil

Collection of soil samples, methods of analysis and estimation of lime and fertilizer requirement based on the above soil test kit results are given below.

### 2.1. Collection and preparation of soil samples

Since soil samples should represent the whole growing area, samples should be collected as shown in the Figure 2. For every 1 to 3-acre plot, it is

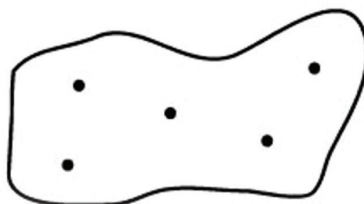


Figure 2. Collection of soil samples

recommended that 10 to 30 samples of soil should be collected. Procedure to collect representative soil samples is given below.

- Plant residue from the ground.
- Make a vertical core or thin slice down to the depth that will be ploughed, which is typically about 6 inches, using a shovel, a garden spade, or a soil probe.
- Place sample in a clean bucket and mix well. Soil should not be excessively wet and a clean bucket without lime, fertilizer, or pesticide residue should be used otherwise it will provide skewed results.
- Prepare about 500g of sub sample from the above samples. Air dry the sample and remove larger particles. Sub sample can be used to determine soil fertility characters by soil testing kit.

## 2.2. Determination of soil pH suitable for food crops using Transchem soil testing kit

Procedure to determine soil pH is given below. Procedure is diagrammatically shown in the Figure 3

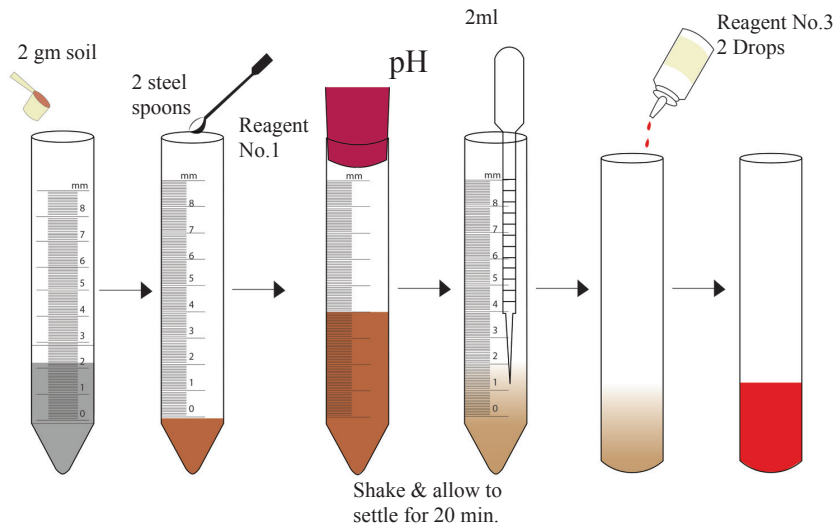


Figure 3. Schematics diagram for testing soils for pH using Transchem soil testing kit.

1. Take 5 ml distilled water in glass graduated test tube and add 2 grams (one small spoon) of the soil sample.
2. Add 2 level steel spoons of powder from bottle No 1 and mix thoroughly. The test tube is then left to stand with occasional shaking for a maximum of 20 minutes, until a clear solution is obtained in the upper half of the test tube.
3. Transfer 2 ml of this clear solution into another small plain glass tube. Add 2 -3 drops of reagent from bottle No 3 and mix gently. Compare the colour with the following chart



Figure 4. Colour Variation for different levels of soil PH

## 2.3 Determination of phosphorous availability soils using Transchem soil testing kit

Procedure to determine the available P content in the soil is given below. Procedure is diagrammatically shown in the Figure 4.

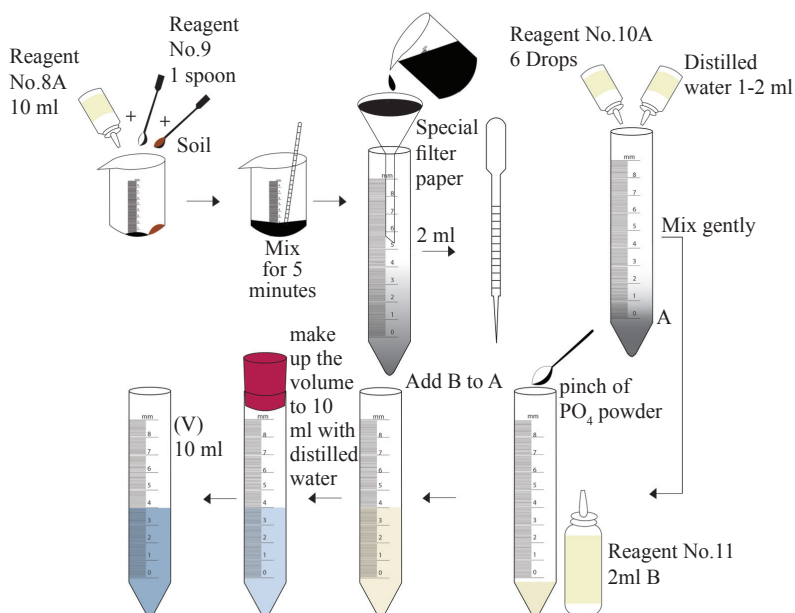


Figure 5. Schematics diagram for testing soils for P using Transchem soil testing kit.

1. Take 10 ml reagent from bottle No 8A in a plastic beaker and add 1 level steel spoon of powder from bottle No 9.
2. Add 2 steel spoon of soil sample to the above, mix thoroughly for 5 minutes and filter through special filter paper provided with the kit.
3. In a graduated glass test tube take 2 ml filtered solution and add 6 drops of reagent from bottle 10A and add 1 -2 ml distilled water and mix gently.
4. Take 2 ml of reagent from bottle No 11 in another graduated glass tube.
5. Add a pinch of powder to that with the help of the white needle spoon from bottle containing  $\text{PO}_4$  powder and mix properly till it gets dissolved.
6. Add the reagent prepared in step 4 into step 3 test tube and make the volume to 10 ml mark with distilled water.

7. Close mouth of the test tube with rubber cork and mix gently.
8. After 10 minutes compare the colour developed using the following chart:



Figure 6. Colour variation for different levels of soil phosphorous

## 2.4 Determination of available potassium (K) availability in the soils using Transchem soil testing kit

Procedure to determine the exchangeable K content in the soil is given below. Procedure is diagrammatically shown in the Figure 5

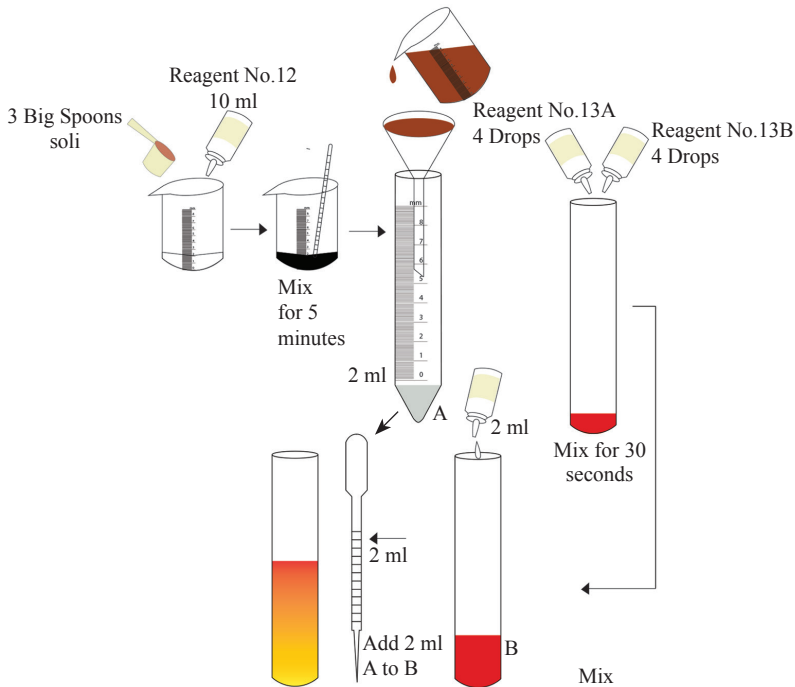


Figure 7. Schematics diagram for testing soils for K using Transchem soil testing kit.

1. Take 10 ml reagent from bottle No 12 in the small plastic beaker and add three spoons of soil using sample big plastic
2. Mix thoroughly for 5 minutes with glass rod and filter with filter paper.
3. Collect 2 ml filtrate in a graduated test tube
4. To a small glass test tube add 4 drops of reagent from bottle No 13 A and 4 drops of reagent from bottle No 13B and mix for 30 seconds
5. Add 2 ml of reagent from bottle No 14 to the test tube of step 3 and mix gently by inverting the tube once or twice.
6. Add this mixture to the 2 ml filtrate in the graduated glass tube. Turbidity will develop in the solution.
7. Transfer this solution to the small plain glass test tube and evaluate colour using the following colour chart.



Figure 8. Colour variation for different levels of soil K

### 3. Estimation of lime and fertilizer requirement for food crops using the results obtained from Transchem soil testing kit

Given below are the methods to estimate lime, phosphorous and potassium requirement for food crops grown in soils.

#### 3.1 Estimation of lime requirement for food crops using the information collected from Transchem soil testing kit.

Optimum soil pH range for most of the food crops is 5.5 – 7.0. After testing soils, low pH soils can be ameliorated by adding different sources of lime. Pulverized limestone is the most common and inexpensive acid neutralizer. If the soil pH is at lower level, it is recommended to add 1250 kg of lime per hectare and mix with soil before crop establishment.

#### 3.2 Estimation of P requirement for food crops using soil P levels determined by Transchem soil testing kit

Phosphorus fertilizer rates recommended for different crops based on the test kit results is given in the Table 1. It is important to apply all P fertilizers at the time of planting or before planting

Table 1. Phosphorous fertilizer requirement for rice, maize and vegetables based on soil P availability data collected from Transchem soil testing kit.

Soil P levels	Quantity of Triple super pospate (kg/ha)						
	Rice	Maize	Cabbage	Bean	Tomato	Bitter gourd	Potato
Low (< 5 mg/kg)	55	100	270	270	215	225	275
Medium (5 -20 mg/kg)	30	75	135	135	160	100	135
High (> 20 mg/kg)	0	50	70	70	85	50	70



### 3.3 Estimation of potassium requirement for food crops using soil K levels determined by Transchem soil testing kit.

Potassium fertilizer rates recommended for different crops based on the test kit results are given in the Tables 2 – 4. It is important to apply all Murate of Potash fertilizers at the time given in the tables.

Table2. Potassium fertilizer requirements for rice grown in different agro-ecological zones based on K availability data collected from Transchem soil testing kit.

Soil K levels	Age of the crop (week)	Quantity of Murate of Potash (kg/ha)			
		Dry zone		Wet zone	
		Irrigated paddy fields	Rain-fed paddy fields	Irrigated paddy fields	Rain-fed paddy fields
Low (< 100 ppm)	2	0	0	0	35
	4	25	25	25	45
	6	35	25	25	30
Medium (100 -200 ppm)	2	0	0	0	20
	4	20	20	20	30
	6	25	20	20	20

Table 3. Potassium fertilizer requirement for maize based on K availability data collected from Transchem soil testing kit.

Soil K levels	Time of application	Quantity of MOP (kg/ha)
Low (<100 mg/kg)	Basal	50
Medium (100 – 200 mg/kg)	Basal	35

Table 4. Potassium fertilizer requirement for vegetables based on K availability data collected from Transchem soil testing kit.

Soil K levels	Time of application	Quantity of MOP (kg/ha)				
		Cabbage	Bean	Tomato	Bitter gourd	Potato
Low ( $< 100$ mg/kg)	Basal	75	75	70	60	125
	3 weeks	0	75	0	0	0
	5 weeks	75	0	0	60	125
	6 weeks	0	0	70	0	0
	8 weeks	0	0	0	60	0
Medium (100- 200 mg/kg)	Basal	40	40	35	30	65
	3 weeks	0	40	0	0	0
	5 weeks	40	0	0	30	65
	6 weeks	0	0	35	0	0
	8 weeks	0	0	0	30	0

At the same time, use the LaMotte plant sap testing kit to determine the nutrient requirement of the crops during the growing period.

## 4.Reference

- Soil Testing Kit, Instruction Manual, Transchem AGRITECH Pvt Ltd.  
850/2, GIDC Estate, Makarpura, Vadodara, 390010, Gujarat, India
- Soil test based Fertilizer Recommendations of Department of Agriculture