

Manual of Community Soil-Fertilizer Management Center

(SOR.DOR.POR.CHOR.)



ASIAN SOIL
PARTNERSHIP



Preface

Department of Agricultural Extension realizes the importance of the work of soil and fertilizers, which is an important basic factor in producing plants to have good yields with qualities by having been promoting the use of fertilizer use technologies according to soil analysis values and tailor-made fertilizers in order to reduce costs of production since the end of 2014 until the present. Moreover, the Department also has a group of farmers provide services to the community regarding soil analysis, giving advice and passing on technologies of tailor-made fertilizer use and fertilizer use according to soil analysis values, and provide services regarding production factors. The Department does this by establishing Community Soil-Fertilizer Management Center (Sor.Dor.Por.Chor) to be used as an operating agency in the area managed by farmers.

In 2014, there were 94 prototype community soil-fertilizer management centers in 76 provinces. Since 2015, the number of the centers has been expanded. At present, there are 882 community soil-fertilizer management centers. The objectives of having all of these centers are to use them as mechanism in driving the knowledge of correct soil management and fertilizer use and as service providers in analyzing soil for members and farmers in the community, to give advice regarding primary soil and fertilizer management and to pass on technologies of tailor-made fertilizer application and fertilizer use according to soil analysis values in order to reduce costs of production together with the use of organic fertilizers and biological fertilizers. Moreover, the objectives are also to increase the efficiency of using chemical fertilizers, to set up learning plots and demonstration points, to collect needs and to provide straight fertilizers for farmers to use according to the advice whereby there are officials responsible for soil-fertilizer work of Provincial Agricultural Extension Offices and District Agricultural Extension Offices to conduct coaching for community soil-fertilizer management centers (Sor.Dor.Por.Chor.). Later in 2016, community soil-fertilizer management centers were determined to be the network center handling specifically for soil-fertilizer of Agricultural Products Efficiency Learning Center (Sor.Por.Kor.). In the future, there will be connection to the production system of large plots. For the previous operations performances, 17,640 farmers who were the members of 882 community soil-fertilizer management centers were upgraded regarding knowledge of soil and fertilizers. From the 2017 data, technologies were implemented in areas accounting for 140,304.75 rai and costs of fertilizer application could be reduced for 27.5% on average, accounting for the value of 43 million Baht. Moreover, yields could be increased for 10.3% on average when this was compared with the farmers' methods of practices.

The manual of community soil-fertilizer management centers has been prepared to be used as guidelines of operation for officials involved so that they can drive community soil-fertilizer management centers (Sor.Dor.Por.Chor) to be the mechanism of scaling up fertilizer use in order to truly reduce costs of production with the efficiency to achieve the set objectives. As a result, farmers will live happily and comfortably, including being able to conserve soil resources for agriculture sustainably.

Definition

Community Soil-Fertilizer Management Center (Sor.Dor.Por.Chor) refers to the network supporting the operation of Department of Agricultural Extension. It functions as the network for Agricultural Productivity Efficiency Learning Center (Sor.Por.Kor.) regarding soil and fertilizers managed by farmers. It is a learning source of soil management and fertilizer use in reducing costs of production and increasing productivity. It provides services for soil analysis and gives advice regarding primary soil management and fertilizer use, including collecting needs and providing straight fertilizers so that farmers can use them according to the advice.

Soil analysis refers to taking samples of soil in cultivated areas to be analyzed for the amount of plant nutrients in the soil. The amount of primary nutrients (N, P and K) are mostly analyzed in order to acknowledge the advice for soil management and fertilizer use in the specific area.

Fertilizer use for reducing costs of production refers to the technology that helps farmers use correct formulas and correct rates according to the soil fertility and the need of plant nutrients. It is the accurate fertilizer use with specific areas whereby soil analysis must be conducted before cropping or before fertilizer application in order to know the amount of plant nutrients especially for the primary nutrients which are N P K in the soil so that fertilizers can be applied correctly, meeting the need-not too much or not too little. For example, if there are enough nutrients in the soil, little amount of fertilizers is required. If there are not enough nutrients, much amount of fertilizers is required. This is regarded as using fertilizers efficiently. As a result, the costs of chemical fertilizers of farmers have been reduced. On the other hand, in certain cases, the costs have been increased. This is due to the fact that there are few nutrients in the soil, therefore more fertilizers are required to use. The costs which farmers used have been increased but yields will increase. This is regarded as reduction of costs per production unit. The advice to mix straight fertilizers by themselves also helps reduce the cost of chemical fertilizers and fertilizers with qualities and standards will be obtained without adding previous substances. Regarding using fertilizers to reduce costs of production, besides helping reduce costs of production due to using chemical fertilizers, plants become strong, resulting in the reduction of using pesticides. Moreover, the adverse effects on farmers' health and the environment will also be reduced. The technologies which are used are tailor-made fertilizers and the technology of using chemical fertilizers according to the value of soil analysis with the following differences:

1. Tailor-made fertilizer technology is taking the values of analyzing primary nutrients (N, P and K) in the current soil to be considered together with the data of soil series in determining the advice for using fertilizers. The advice is derived from the mathematical program taking other data to jointly process apart from soil series data, namely plant varieties, sunlight, moisture. Therefore, the advice has more area-specific accuracy so-called "tailor-made fertilizer". It can be seen that in the soil with different soil series, although the values of analyzing main nutrients are the same, the advice for fertilizer use will be different. **Currently, the advice for using tailor-made fertilizers is specifically available for paddy fields, corn used for feeding animals and sugar cane grown in the northeastern region of Thailand only.**

2. Technology of using fertilizers based on soil analysis is taking the analysis values of main nutrients - nitrogen(N), phosphorus(P) and potassium (K) in the current soil to determine the advice for fertilizer use (types or fertilizer formulas and appropriate use rates)

Moreover, using fertilizers to reduce costs of production also includes other technologies or innovation used together with chemical fertilizers in order to enhance the efficiency of fertilizer use, namely stubble incorporation, organic fertilizer use, biological fertilizer use and the use of efficient soil conditioners.

Mixing chemical fertilizers for one's own use or mixing one's own fertilizers refers to bringing fertilizer with popular formulas, namely 46-0-0 fertilizer containing nitrogen (N), 18-46-0 fertilizer containing phosphorus (P) and also nitrogen (N) and 0-0-60 primary fertilizer containing Potassium (K) at the rate of the advice to mix together thoroughly without necessarily adding the previous substances. This will reduce costs of using chemical fertilizers from buying ready- made fertilizers. Moreover, the problems of fake fertilizers, inferior fertilizers will be eliminated due to the fact that straight fertilizers are fertilizers with qualities, hard to falsify and contain high concentration of nutrients. If you have only 3 kinds of fertilizers, you can mix them to create fertilizers for any formulas as you wish.

Integrated fertilizer use refers to using chemical fertilizers together with organic fertilizers and/or biological fertilizers appropriately which meets the requirement of soils and plants, resulting in optimal efficiency to plants.

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การฟื้นฟูดอกกลีบ
เพื่อส่งเสริมการอนุรักษ์

งานให้บริการวิชาการและการตรวจวิเคราะห์ดิน
ภายใต้โครงการศูนย์เรียนรู้การเพิ่มประสิทธิภาพ
การผลิตสินค้าเกษตร (ศพก) ปี ๒๕๖๑

ศูนย์เรียนรู้การเพิ่มประสิทธิภาพการผลิตสินค้าเกษตร (ศพก) ปี ๒๕๖๑

Chapter

1

Introduction

1. Background

Soil and fertilizer are basic factors of producing important agricultural products. In the past, Thailand faced the problems regarding agricultural areas which had low amount of organic matters, high costs of producing agricultural products especially for chemical fertilizers and most farmers lacked the knowledge of soil management and correct fertilizer use. Department of Agricultural Extension realized the mentioned problems. Therefore, it assigned Plant Protection Promotion and Soil-Fertilizer Management Division to conduct the project of promoting efficient chemical fertilizer use in order to reduce costs of production, starting from 2014. The Director-General of Department of Agricultural Extension approved this and gave the policy to the officials of District Agricultural Promotion and Development Office for every district and Provincial Agriculture Office for every province to hold a seminar regarding the project of promoting efficient chemical fertilizer use to reduce costs of production on 4 July 2014 at the meeting Room No. 7 on the 5th floor, Building 1 of Department of Agricultural Extension and a workshop symposium of the project of promoting efficient chemical fertilizer use in order to reduce costs of production of the year 2014-2015 from 15-16 July 2015 at TK Palace Hotel, Bangkok whereby there were provincial representatives and farmer groups attending the symposium. The objective was to promote efficient chemical fertilizer use in order to reduce costs of production by using the tailor-made technology and fertilizers based on soil analysis. Farmer groups were assigned to provide services to the community for soil analysis, giving advice and passing on technologies of using tailor-made fertilizers and fertilizers based on soil analysis. This was done by establishing community soil-fertilizer management centers in order to function as the network supporting the operation of Department of Agricultural Extension regarding soil and fertilizers. In 2014, there were 94 prototype community soil-fertilizer management centers in 76 provinces, extending to be 882 centers in 77 provinces in 2015 in order to act as mechanism in driving the knowledge of soil management and correct fertilizer use along with promoting farmers to produce organic fertilizers for their own use. The objectives were to upgrade the knowledge of soil and fertilizers to farmers, to help farmers able to manage soil and use fertilizers correctly in order to reduce costs of production and to increase yields, and to conserve soil resources sustainably.

2. Objectives of establishing community soil-fertilizer management centers

2.1 To function as the network supporting the operation of Department of Agricultural Extension regarding soil and fertilizers managed by farmers

2.2 To be a learning source of soil management and using fertilizers of the community

2.3 To bring about scaling up fertilizer use resulting in reducing costs of production to the community



Chapter 2

Community Soil-Fertilizer Management Center (Sor.Dor.Por.Chor)

1. Roles and tasks of community soil-fertilizer centers

1.1 Providing services for soil analysis by using N P K & pH Soil Test Kits for a quick check

1.2 Academic services regarding soil and fertilizers

1.2.1 Giving advice regarding soil management and correct fertilizer application by using the tailor-made fertilizer technology or fertilizer application based on soil analysis in order to reduce costs of production, including other soil-fertilizer technologies which are appropriate

1.2.2 Arranging learning process regarding soil and fertilizers

1.2.3 Preparing learning plots and demonstration plots for scaling up fertilizer use in order to reduce costs of production

1.3 Services for collecting needs and providing primary fertilizers for members to use according to the advice

2. Components of community soil-fertilizer management centers

2.1 Locations of the centers and necessary equipment and materials for conducting activities

Location of the centers

- should be located in the town or at areas with convenient communication
- having signs showing the names of community soil-fertilizer management centers



Tag of community soil-fertilizer management centers



Sample of the tag of community soil-fertilizer management center

- having enough space to conduct activities such as soil analysis, arranging the learning process of mixing fertilizers



A sample of community soil-fertilizer management center having areas for conducting activities

2.1.2 The equipment which is necessary to be used in conducting activities of community soil-fertilizer management centers consists of Soil Test Kits, medias of soil and fertilizer knowledge and maps of soil series.

2.1.2.1 For Soil Test Kit, Use a Quick Soil Test Kit for to assess N-P-K and pH values in the soil from government agencies or educational institutions following the advice of the Soil Test Kit such as Soil Test kit of Kasetsart University (KU Soil Test Kit), Soil Test Kit of Land Development Department (LDD Soil Test Kit). Department of Agricultural Extension supports community soil-fertilizer management centers in using a Soil Test Kit of Kasetsart University (KU soil Test Kit).



Soil Test Kit of Kasetsart University (KU Soil Test Kit)

2.1.2.2 Medias regarding soil and fertilizer knowledge

To learn about soil and fertilizers of the members of Sor.Dor Por.Chor to bring about knowledge and understanding. Department of Agricultural Extension has prepared medias regarding soil and fertilizer knowledge for types to support officials and farmers as follows:



Soil and fertilizer booklets



Documents for dissemination about managing soil and fertilizers efficiently



Brochures



Rotating chart for mixing fertilizers to be used privately



Videos for community soil and fertilizer management centers



Posters



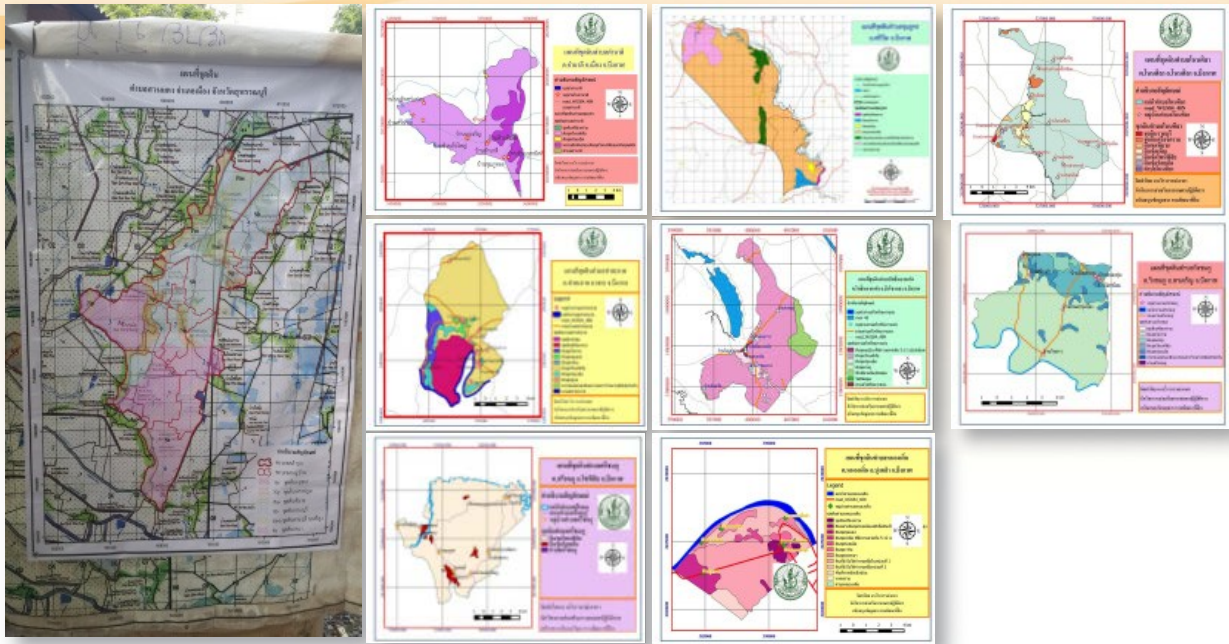
Key cards

Note The information of soil and fertilizers can be studied further in the appendix and can be searched from related documents and websites

2.1.2.3 Sub-district soil series maps for members of Sor.Dor.Por.Chor learners will know what soil series in the cultivated areas in the sub-district consist of and for supporting the advice regarding tailor-made fertilizers for 3 types of plants

Soil series are a level of classification which is the lowest of the system based on characteristics and physical, chemical properties important to land use and soil management. Land Development Department has prepared soil series maps for the benefits of giving advice, examining soil characteristics, land use and appropriate soil management to farmers and general public. Thailand has conducted research and named over 300 soil series based on the place where the soil was found for the first time. The classification of soil is based on soil properties which are difficult to change, namely soil texture, soil colors, depth, acidity-alkalinity etc. Due to the fact that the data of soil series are difficult to change. The data of soil series are also taken into consideration in giving advice of using tailor-made fertilizers for 3 types of plants, namely rice, corn for feeding animals and sugarcane grown in the northeastern region.

If certain areas do not have sub-district soil series maps, maps of soil series groups, the unit of soil maps developed by Land Development Department, are used. Checking is done to see which soil series in the soil series group are specified in the advice. Then, choose soil series which have the most similar properties. If there are not any available or you are not sure, use the fertilizer advice based on soil analysis values.



Samples of sub-district soil series map

2.2 Regarding members of community soil–fertilizer management centers, there are guidelines for selecting members to establish as community soil-fertilizer management centers (Sor.Dor.Por.Chor).

2.2.1 Being a strong group of farmers or grouping farmers for at least 20 people who are interested in joining the project and ready to establish as Sor.Dor.Por.Chor.

2.2.2 Member farmers have high costs of using chemical fertilizers.

2.2.3 Having capitals circulating in the group in order to be able to provide straight fertilizers to the members for use according to the advice.

2.2.4 Receiving or being able to provide sources supporting additional budgets from other agencies such as local administrative organizations in conducting the activities of Sor.Dor.Por.Chor in order to scale up to farmers in the community who are not member of Sor.Dor Por.Chor.

2.3 Board managing community soil–fertilizer management centers. Member farmers jointly select the Board managing Sor.Dor.Por.Chor in order to drive and manage Sor.Dor.Por.Chor in accordance with the objectives and the roles and tasks as designated. The team selected from the nomination of the members of Sor.Dor.Por.Chor consists of a president, a vice president, a secretary, a treasurer, a public relations officer, directors and members etc. This is a written appointment. Roles, duties and responsibilities are determined clearly, including determining committees of sectors. For example, Soil and Fertilizer Service Committee provides soil analysis, collects needs and provides straight fertilizers to deliver to members. There is a also Sor.Dor.Por.Chor Revolving Fund Management Committee.

2.4 Operation team stationed at the center. An operation team stationed at the center should be designated whereby duties are divided into following aspects: soil analysis and giving advice regarding primary soil management and fertilizer use; public relations regarding training courses and activities of Sor.Dor Por.Chor.; collaboration with agencies involved in terms of financial sources and academic aspects; data entry and collection of soil analysis results, advice for fertilizer use to reduce costs and for yields obtained from practices in the field of member farmers; and preparing learning plots by selecting farmer lecturers of each aspect of technologies.

2.5 Learning plots, demonstration points regarding soil management and fertilizer use

Community soil-fertilizer management centers must set up learning plots to be used as sources for learning and passing on technologies of soil and fertilizers to member farmers and make public the operational performance to farmers and the general public. Whether to have demonstration points or not is optional, depending on suitability.

2.5.1 Learning plots refer to plots which have been set up to be used as places for studying , learning, practicing and passing on technologies and knowledge regarding soil and fertilizer management to members and farmers in the community whereby there must be components of setting up learning plots as follows:

2.5.1.1 Location must be conspicuous for farmers and communities or conveniently accessible for people to come for learning,

2.5.1.2 There are signs showing the information of setting up learning plots thoroughly,

2.5.1.3 Owners of learning plots who can be farmer lecturers in passing on technologies,

2.5.1.4 There is taking notes of the operation and operational performances according to the learning plot report form (Appendix) in order to take operation results to be analyzed in terms of costs, yields, soil fertility compared with farmers' methods,

2.5.1.5 Make a summary for making public the used technologies and the results that came out to general farmers to acknowledge so that they can accept them and implement them.



Sample pictures of signs of learning plots

2.5.2 **Demonstration points** refer to the area where the act of showing someone how to do something or doing something as a model takes place regarding soil and fertilizer work such as demonstration points of soil analysis, demonstration points of mixing fertilizers for private use, demonstration points of making compost etc. Demonstration points are points which disseminate, pass on and make public soil and fertilizer work to member farmers and farmers in the community.



2.6 **Revolving funds** are the fund obtained from the support of agencies to be used in conducting activities of Sor.Dor.Por.Chor, money obtained from providing services such as soil analysis, straight fertilizers distribution, areas used for mixing fertilizers or electricity used in mixing straight fertilizers based on the advice, including money from taking shares of the members. These funds are managed to circulate in Sor.Dor.Por.Chor to be used to conduct sustainable activities.

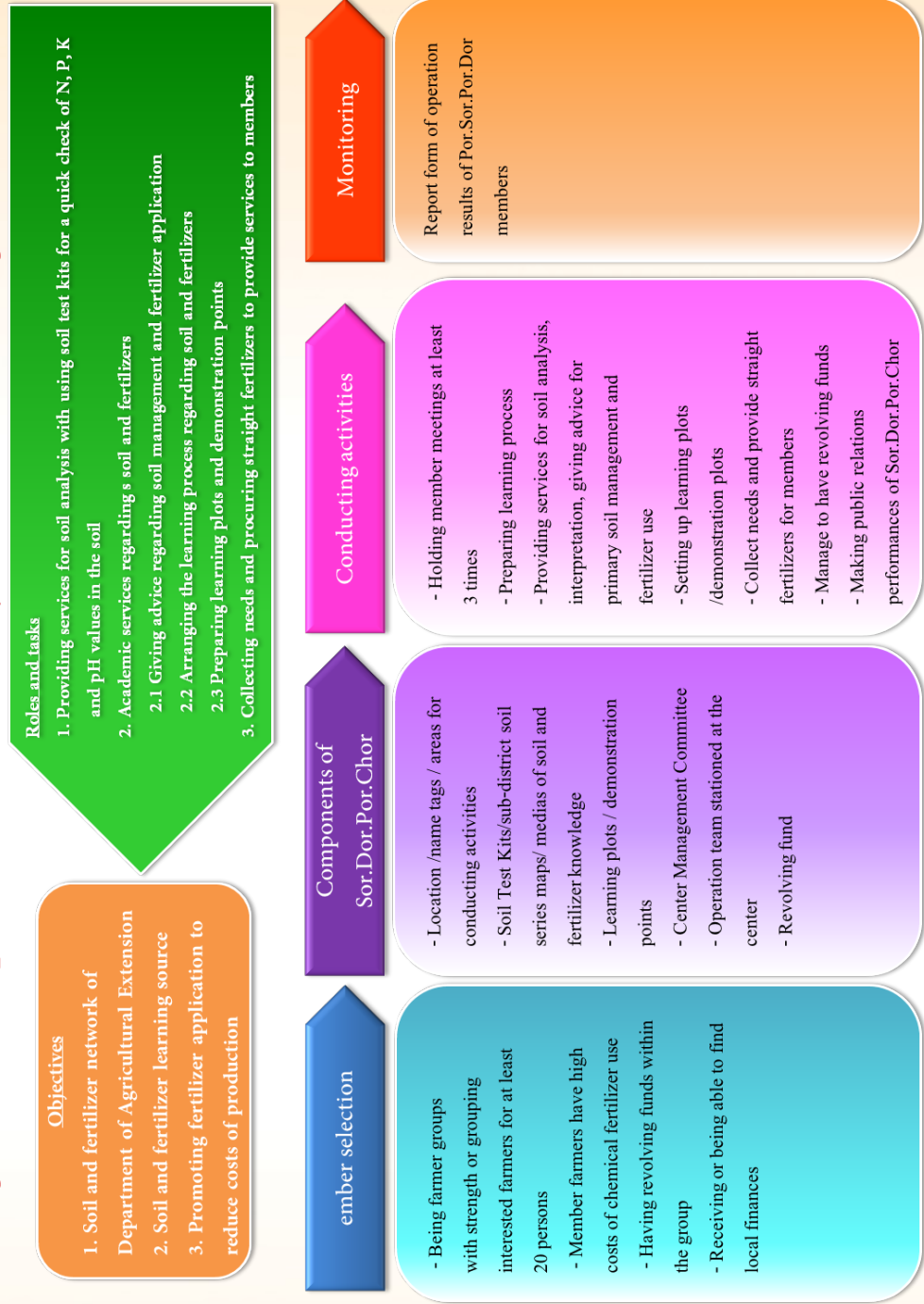
3. Expected benefits to obtain from establishing community soil–fertilizer management centers which will happen to farmers/communities /the environment:

- 3.1 Farmers have knowledge and understanding in managing soil and using fertilizers correctly and efficiently in order to reduce costs of production.;
- 3.2 Farmers can reduce costs of using chemical fertilizers.;
- 3.3 There will be the integration of related agencies in the area in order to jointly develop production and living of the community.;
- 3.4 Soil resources are conserved and maintained so that they can produce quality crops sustainably.
- 3.5 Correct soil and fertilizer management helps plants become strong, resulting in the reduction of using chemical pesticides having an impact on the environment, farmers' health and consumers, and reduce the chemical fertilizer use.

Management form of community soil-fertilizer management center



Diagram of the Operation of Community Soil-Fertilizer Management Centers



Chapter 3

Conducting activities of community soil-fertilizer management centers

In order to make the community soil-fertilizer management centers operate according to the objectives, there are guidelines to conduct activities as follows:

1. Holding member meetings

Community soil-fertilizer management centers should hold member meetings regularly for at least 3 times a year so that members have a chance to get together to assign operation in the center, to review, exchange knowledge and experiences regarding soil and fertilizers, to plan the operation and the development of soil and fertilizer work, to determine courses and learning plans regarding soil and fertilizers. For each meeting, agendas should be determined and there should be taking the minutes.

2. Arranging the learning process

Learning process refers to arranging situations or activities in order to bring about learning in people, thinking development, resulting in changes of behaviors and capabilities in learners. There are procedures as follows:

2.1 Hold member meetings to jointly consider topics and issues which members are interested in so that objectives and subject matters brought to arrange the learning process can be determined,

2.2 Determine courses or contents to be in line with the objectives based on considering members' foundation of knowledge and the lecturers who will come to pass on knowledge,



Arranging the learning process

2.3 Planning the conduction of arranging the learning process to be in line with situations such as soil analysis. The conduction should be before plant cultivation or fertilizer application to bring about learning starting from the step of soil sampling. There should also be coordination with lecturers in determining the operation plan.

2.4 Provincial/district agriculture offices conduct the arrangement of the learning process regarding soil and fertilizers for member farmers of Sor.Dor.Por.Chor based on the following guidelines:

First time: Pass on knowledge of how to collect soil samples correctly. Practice soil sampling, soil analysis and learn the benefit of fertilizer use based on soil analysis values/tailor-made fertilizers and make an appointment of when to bring soil samples to be collected in the field for soil analysis in the learning platform of the second time

Second time: For the day of soil analysis, (can be upgraded to be an exhibition or an event for providing services for farmers who are not members of Sor.Dor.Por.Chor. also in case of being able to find a budget to support the event holding) prepare a platform for sharing and learning regarding soil, fertilizers and fertilizer application to reduce costs of production while farmers are waiting for the analysis result and receiving the advice fertilizer use for implementation.

Third time: Share and learn from experiences and the knowledge for taking advice of fertilizers based on soil analysis/tailor-made fertilizers to implement in their own field, and knowledge regarding soil and fertilizers in other aspects required by the members

3. Providing services soil analysis, interpretation and giving advice

3.1 Soil analysis services

For soil analysis to give out correct results, correct soil sampling is required in order to have best soil samples representing the plot. . Errors resulting from soil analysis is mostly due to incorrect soil sampling. Therefore, in this case, the advice for soil management and fertilizer use based on soil analysis can go wrong also. **Therefore, advising farmers to conduct soil sampling correctly is required.**

Taking soil sampling for analysis

1. Soil sampling can be conducted throughout the year. However, the best time is a little after yield harvesting or before the next cultivation in order to take the advice from soil analysis to be used for soil amendment in time for the next production season. If it is the area where fruit trees are grown, soil sampling can be conducted after harvesting. If it is the area where there is plowing up and over stubbles or growing green manure crops, collect soil samples after finishing plowing up and over for 2 weeks in order to have decomposition of organic matters. If the appointment for soil analysis is made at the same time, make allowance for the time to prepare the soil readily (dry soil and the soil is digested thoroughly) before bringing the soil sample for soil analysis. If the soil sample is sent to the laboratory, soil sampling should be conducted to send the soil sample 2 months before the next cultivation.

2. For the area to conduct soil sampling, the soil should have little moisture in order to dig and collect it easily.

3. Soil sampling should be conducted away from residential buildings, stalls and the area with fertilizer residues.

4. The equipment used in soil sampling must be clean, not be contaminated with soil, fertilizers and chemicals.

5. Take notes of the details regarding each soil sample clearly for the benefit of giving advice.

Equipment for collecting soil samples

Equipment used to collect soil samples has blades such as hoes, shovels, spades which farmers already have, tube types and auger types etc.



Hoe

spade

shovel

tube type

auger type

Samples of equipment used to collect soil samples

Moreover, a bucket or a plastic can for putting soil in for each point, a plastic sheet for mixing soil and drying soil, and pieces of paper to take notes of soil samples must be available.



a plastic bucket



a plastic sheet

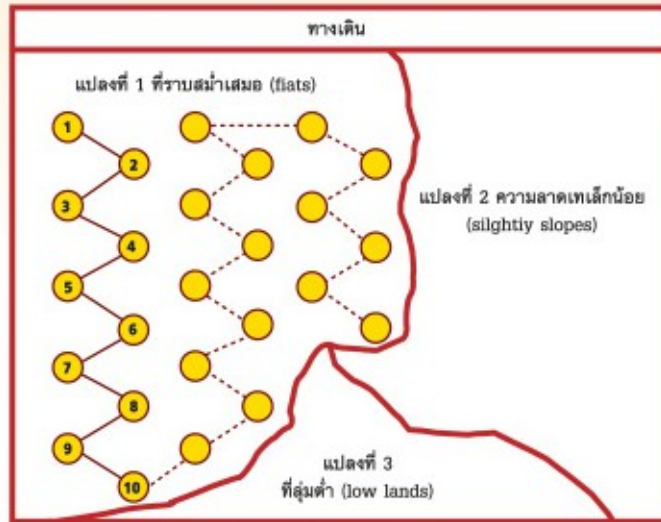


a plastic bag for putting soil in

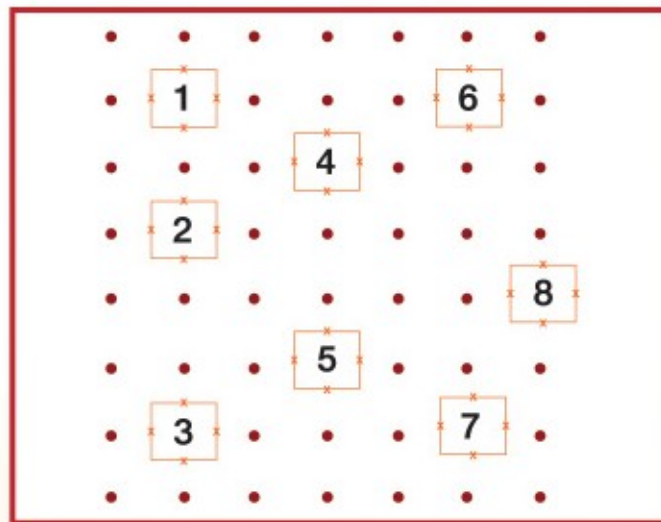
Area size and the number of points for collecting soil samples

The size of the plot where soil samples are collected is not exactly limited, depending on differences of the area (area consistency, slope, soil texture, soil color), types of plants grown and the previous soil management. The area for collecting one soil sample should not exceed 25 rai and points to collect soil samples should be determined of about 15-20 points. The more points to collect soil samples, the better they represent the area. There will be more accuracy of soil analysis results also.

- In case of the area for farm plants, fields, vegetables, perennial plants (such as para rubber, palm oil) or areas with no cultivation, walk all over the plot to collect soil samples for about 15-20 points per plot.
- In case of fruit trees plantation, collect soil samples at the canopy area for 4 points per tree (4 directions), accounting for 10-15 % of the number of trees available in the plot.



Sample of dividing the area in collecting soil samples based on the terrain, soil types, type and age of plants, fertilizer and lime application



- x Point of collecting soil samples
- Trees

Sample of collecting soil samples from fruit tree plantation (collect 4 points per tree)

Depth for collecting soil samples

Depth (cm)

0-5

0-10

0-15

0-30

cultivated plants

grass

paddy

farm plants, vegetables

fruit trees, perennial plants

Methods of collecting soil samples

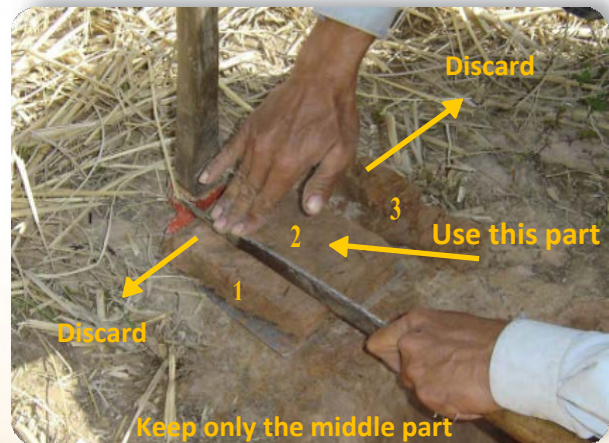
Clean up the soil surface at the designated area. If a tube for drilling soil, an auger for drilling soil or a tube-shaped auger is used, the instrument must be set up perpendicular to the soil surface. Then, press it at the desired depth level. If a shovel or a spade is used, drill the soil into a V shape and then discard the V part. Use the shovel to shovel in at the edge of one side of the v shape to get the thickness of 2-3 centimeters by pressing the shovel deeply to the bottom of the hole based on the desired depth. Then, lever the soil and divide it into 3 parts. Discard the soil at both sides of the spade. Take the remaining soil at the middle and put it in the plastic bucket. Keep doing this until every designated point is completed. There are things to take precautions of which are: The soil from every point which was collected to put together in the plastic bucket must have the same amount. Then mix the soil in the bucket thoroughly. After that, pour the soil into a pile on the plastic sheet. Then mix it thoroughly once again. Composite samples will be obtained in order to be used as one soil sample representing the soil in the plot. Dry the soil in the shade (Do not dry in the sun)



Removing grass and sweeping plant scraps or materials on the soil surface off



Shovel in the soil to get a 2-3 cm. plate



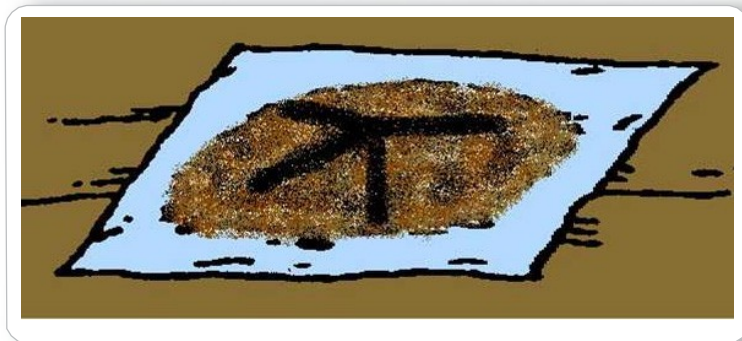
Keep only the middle part

Soil sampling

After mixing the soil sample thoroughly, make a pile of soil into a shape of a cone-shaped cover and make a cross sign (+) on the top of the pile of soil in order to divide the pile into 4 parts. Take the soil for one part and repeat the same step until a soil sample is obtained for about 0.5-1 kg. Put this divided part of the soil into a plastic bag. Take notes of the soil sample such as the name of the sample sender, location of sampling and sampling depth, types of cultivated plants on the side of the bag clearly. Then, tie the opening part of the bag tightly. Bring it to soil analysis or send it to the laboratory to have it analyzed further.



Mix the soil before take it to be dried in the shade

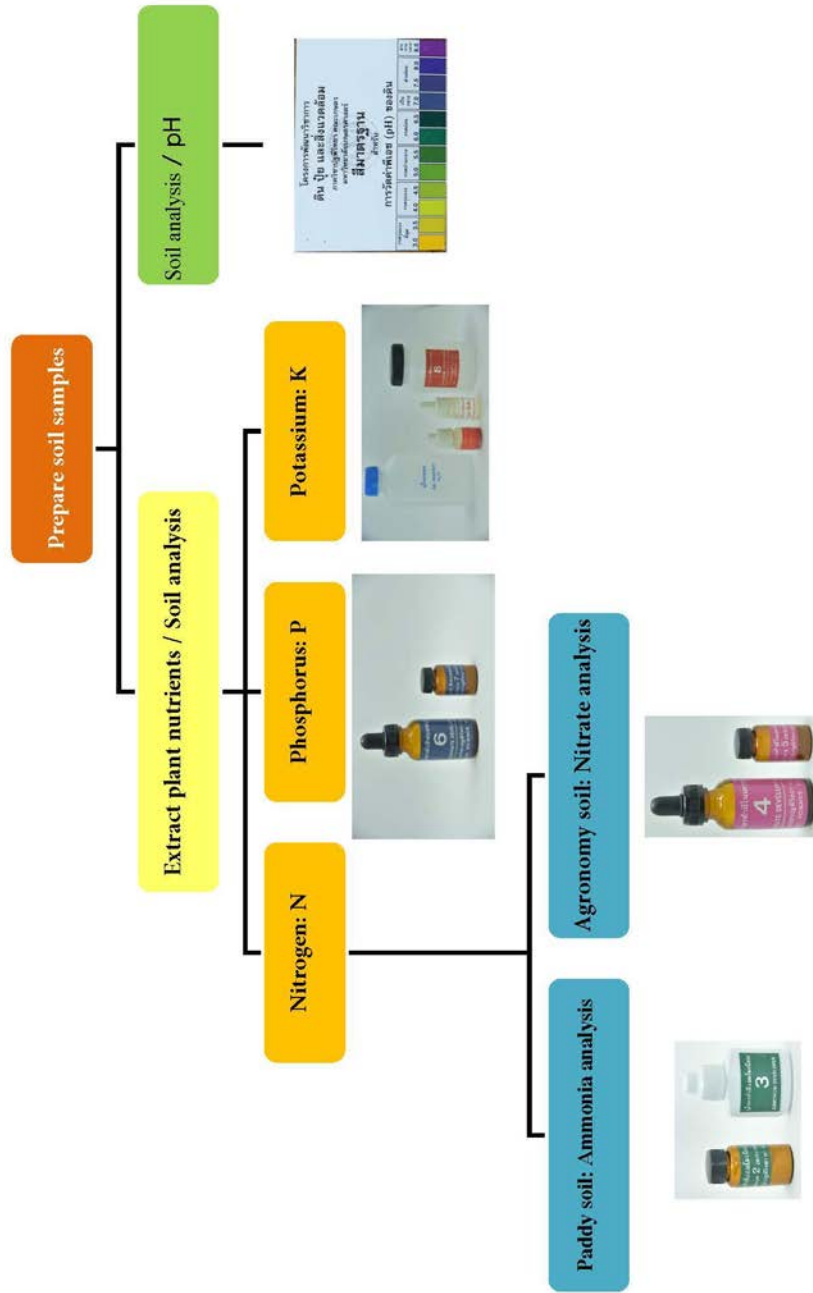


Divide the soil into 4 parts



A pile of soil with a shape of a cone -shaped cover and the pile is divided into 4 parts. Take the soil for one part and repeat the same step until a soil sample is obtained for about 0.5-1 kg in order to take it to be analyzed or to be sent to the laboratory for analysis

Steps of soil analysis



Soil analysis

By using Quick Soil Test Kits such as Quick N P K Soil Test Kit and Quick Test Kit For Soil pH. (The result will be known in 30 minutes) of Kasetsart University (KU Soil Test Kit). There are steps to proceed as follows:

1. Extracting plant nutrients in the soil

1.1 Measure the soil for one measuring spoon (gently tap it 3 times). Pour it into a soil extraction bottle



1.2 Fill in the No.1 solution for 20 milliliters. Close the lid. Then, shake the bottle continually for 5 minutes.

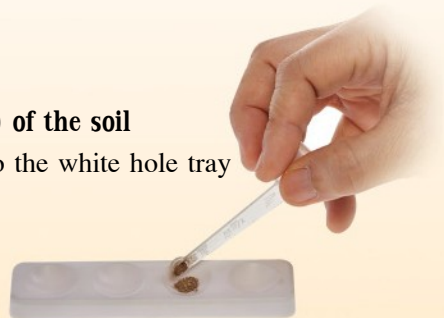


1.3 Pour the soil extract into the receiving bottle through the filter paper



2. Measure acidity-alkalinity (pH) of the soil

2.1 Scoop the soil and put it into the white hole tray for half a hole.



2.2 Gradually drop the Solution No.10 until the soil is saturated with the solution. Then, put in two more drops.



2.3 Keep tilting from side to side. Leave it for 1 minute. Then, compare the color with Standard Color Chart

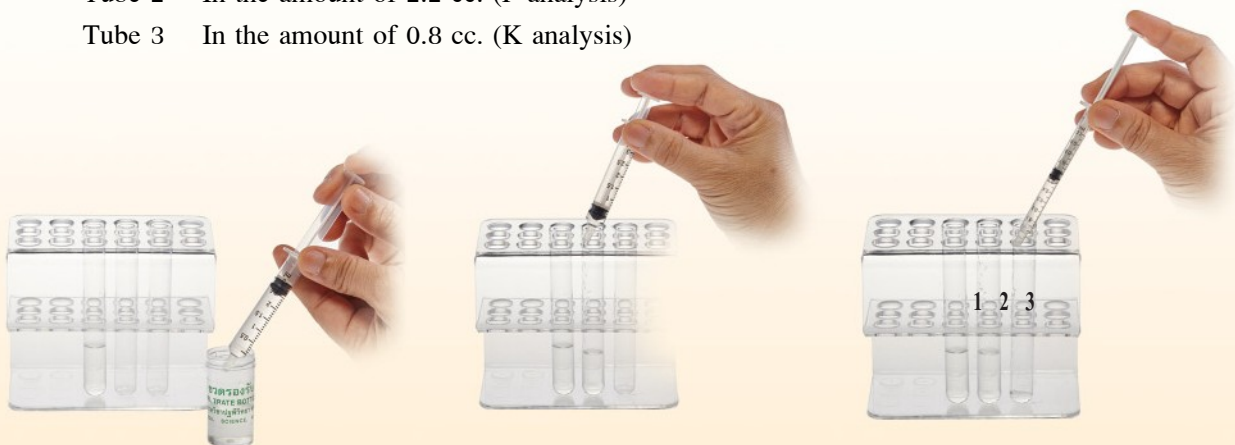


3. Suck the soil extract from the receiving bottle and put the liquid into 3 glass tubes.

Tube 1 In the amount of 2.5 cc. (N analysis)

Tube 2 In the amount of 2.2 cc. (P analysis)

Tube 3 In the amount of 0.8 cc. (K analysis)



4. Tube 1 (N analysis)

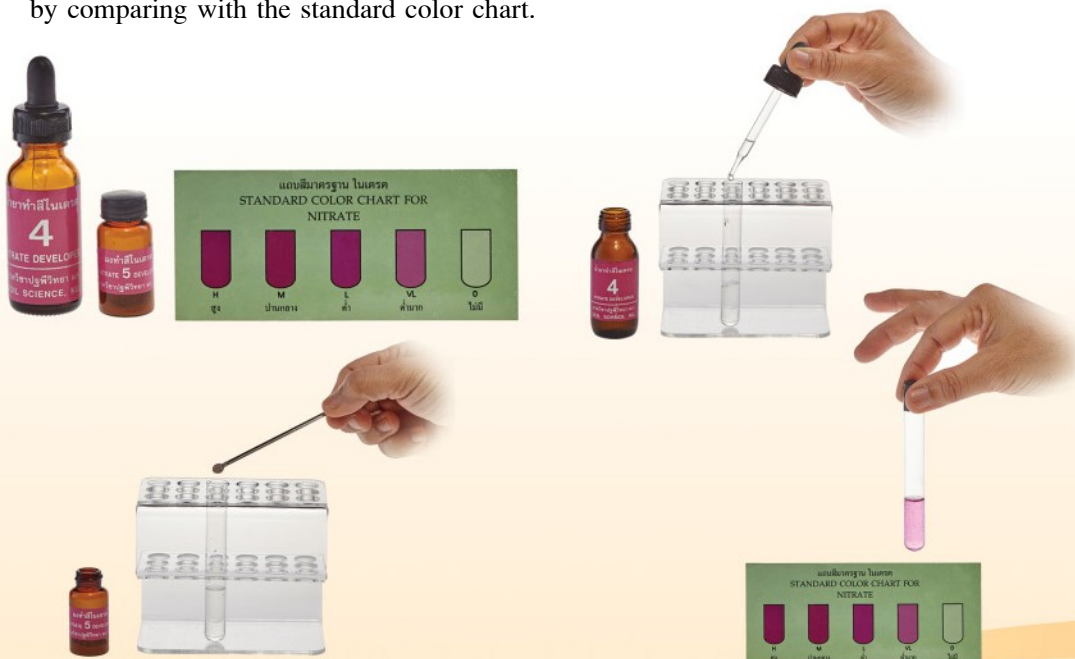
Paddy soil (Ammonium analysis)

- Add Powder No. 2 in the amount of 1 small spoon into the soil extract in the tube.
 - Add Solution No. 3 for 5 drops
 - Close the closure and **shake the mixture well for incorporation. Leave it for 5 minutes.**
- Then, read the value by comparing with the standard color chart.



Agronomy soil (Nitrate analysis)

- Add Solution No. 4 in the amount of 0.5 milliliters in the tube filled with the soil extract.
- Add Powder No. 5 in the amount of 1 small spoon.
- Close the tube closure and shake the mixture well for incorporation. Then, read the value by comparing with the standard color chart.



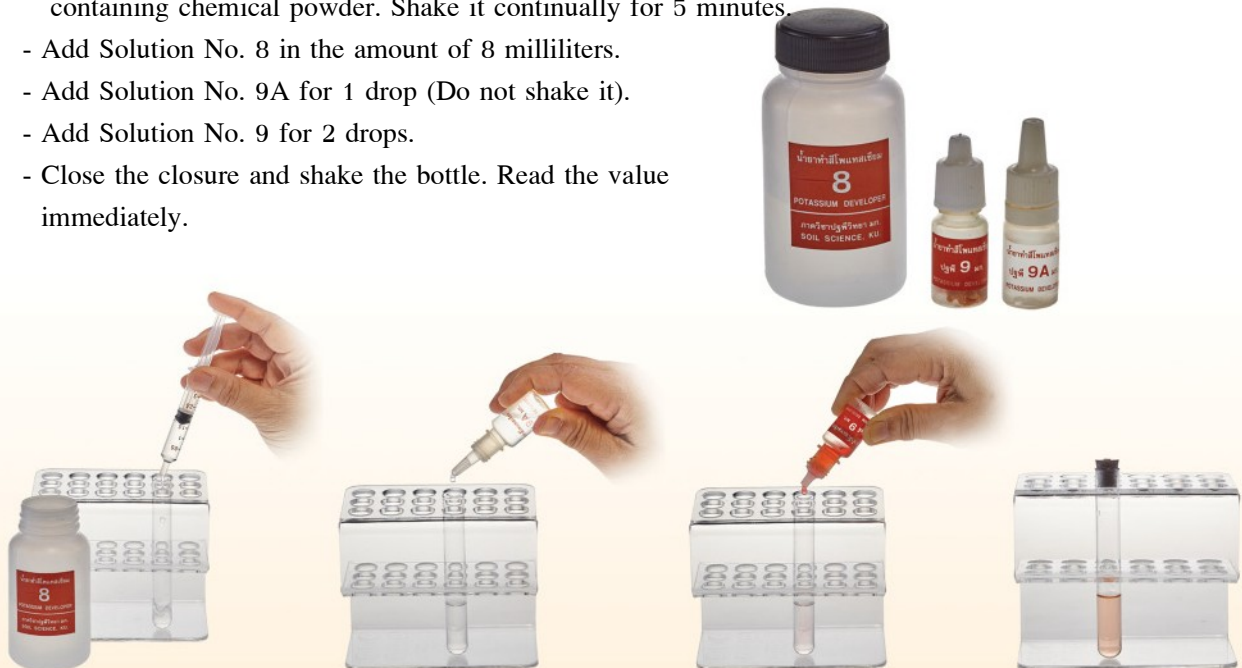
5. Tube 2 (P analysis)

- Add No. 6 solution in the amount of 0.5 milliliters in the tube filled with the soil extract.
- Add no. 7 powder in the amount of ½ small spoon.
- Close the tube closure and shake the mixture well for incorporation. Set aside for 5 min. Then, read the value by comparing with the standard color chart.



6. Tube 3 (K analysis)

- Prepare Solution No. 9 by sucking the filtrate in the amount of 3 milliliters into Bottle No. 9 containing chemical powder. Shake it continually for 5 minutes.
- Add Solution No. 8 in the amount of 8 milliliters.
- Add Solution No. 9A for 1 drop (Do not shake it).
- Add Solution No. 9 for 2 drops.
- Close the closure and shake the bottle. Read the value immediately.



Note Sor.Dor.Por.Chor. can collect soil samples and send them to the laboratory whereby the analysis results are more meticulous than the ones from the usage of Quick Soil Test Kits. Moreover, it also gives advice regarding soil amendment and fertilizer application; however, to obtain the analysis result and the advice may be delayed.

3.2 Interpretation and giving advice about soil management and fertilizer use

3.2.1 Giving advice about soil management

From soil analysis results, consider acidity-alkalinity (pH) of the soil. If the analysis result shows that the pH value is mildly acidic or mildly alkaline (pH: 5.5-7.5), there is no need for improvement. However, if the pH value falls below or higher than the value in the mentioned range, give advice about soil management as follows:

1) In case of acidic soil (in the paddy: $\text{pH} < 4$; in other plants: $\text{pH} < 5$), the advice is to use lime for soil amendment in order to increase soil pH to be suitable. The objective is to make plant nutrients which are limited due to inappropriate pH values dissolve into the soil so that plants can absorb them for use more. However, plants are capable of growing in the soil with different pH values. Certain plants can resist soil acidity well. Most plants grow well in the soil with mild acidity to mild alkalinity (pH 5.5 -7.5). For the advice of using lime, study further in the Appendix.

2) In case of alkaline soil ($\text{pH} > 7.5$), the advice is to improve the soil (Study further in the Appendix)

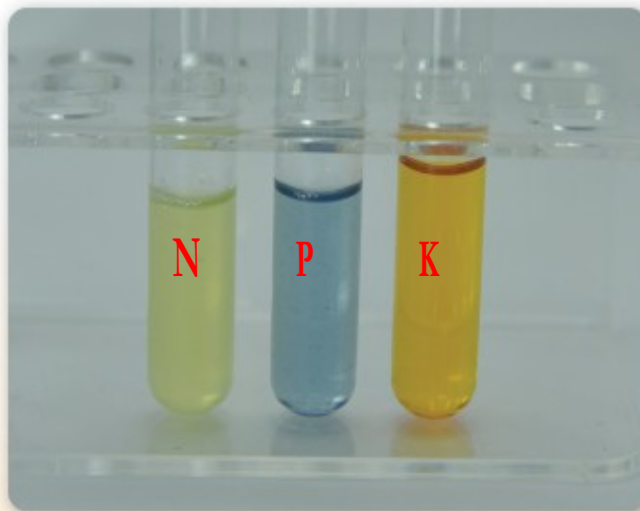
3.2.2 Giving advice about fertilizer use

3.2.2.1 Using tailor-made fertilizers

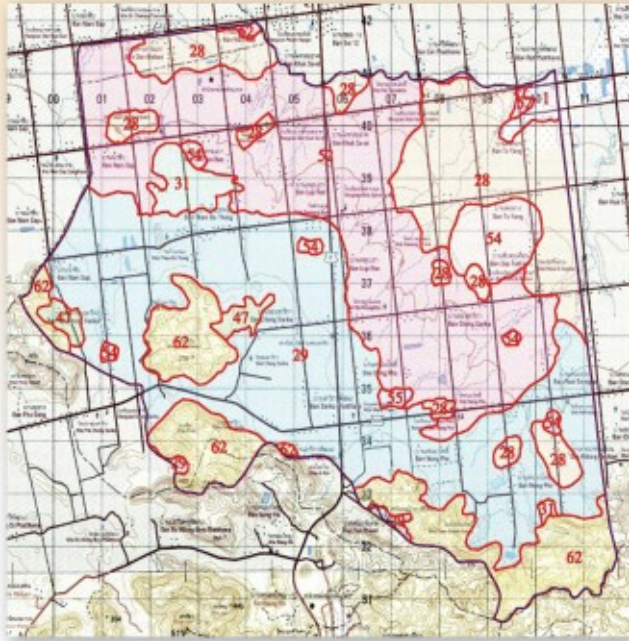
Interpretation for giving advice is based on taking into consideration soil analysis values together with soil series data at the sub-district level (recommendation about using tailor-made fertilizers in 3 types of plants only, namely rice, corn for feeding animals and sugar cane in the northeastern region).

Sample 1

Farmers collected soil samples from the plot of cultivated rice in Sawaeng-Ha district, Ang Thong province. Examined from the soil series map, the soil sample was Nakhon Pathom soil series. The rice grown was a non light-sensitive variety. The values obtained for soil analysis of N-P-K were at low-medium-low levels, respectively. The mentioned values were taken to be considered together with soil series data. Then the advice was given regarding the usage of "tailor-made fertilizers for growing rice of Ang Thong province".



Picture of the solution showing the analysis values of N-P-K levels: low-medium-low



Soil series map



Handbook for Advice

ชุดดิน		ต่ำมาก	ต่ำ	ปานกลาง	สูง	ผลผลิตที่คาดหวัง
ชัยบุรี (Tan)	เอิน	8	4	0		1,005 กก./ไร่
	พี		5	4	2	
	เค		6	3	0	
นครปฐม (Np)	เอิน	8	4	2		773 กก./ไร่
	พี		5	4	2	
	เค		4	2	0	
นครพนม (Nn)	เอิน	8	4	2		1,024 กก./ไร่
	พี		5	4	2	
	เค		4	2	1	
น่าน (Na)	เอิน	8	6	2		898 กก./ไร่
	พี		5	4	2	
	เค		4	2	0	
น้ำกระจาย (Ni)	เอิน	8	4	2		702 กก./ไร่
	พี		3	2	1	
	เค		4	2	0	

เอิน-พี-เค	ใส่ปุ๋ยครั้งที่ 1 (กก./ไร่)				ใส่ปุ๋ยครั้งที่ 2 (กก./ไร่)			
	ปุ๋ยสูตร	อัตรา	ปุ๋ยสูตร	อัตรา	ปุ๋ยสูตร	อัตรา	ปุ๋ยสูตร	อัตรา
4-1-4	0-0-60	7	18-46-0	3	46-0-0	4	46-0-0	5
4-2-4	0-0-60	7	18-46-0	5	46-0-0	3	46-0-0	5
4-3-4	0-0-60	7	18-46-0	7	46-0-0	2	46-0-0	5
4-4-4	0-0-60	7	18-46-0	10	46-0-0	1	46-0-0	5
4-1-5	0-0-60	9	18-46-0	3	46-0-0	4	46-0-0	5
4-2-5	0-0-60	9	18-46-0	5	46-0-0	3	46-0-0	5
4-3-5	0-0-60	9	18-46-0	7	46-0-0	2	46-0-0	5
4-4-5	0-0-60	9	18-46-0	10	46-0-0	1	46-0-0	5
4-1-6	0-0-60	10	18-46-0	3	46-0-0	4	46-0-0	5

Recommendation

Look in Nakhon Pathom soil series in Ang Thong province. From the reading of N-P-K analysis which was low-medium-low, one set of number was obtained which was 4-4-4. Use the number obtained to check for finding the advice about fertilizer application. The advice is to apply fertilizers twice as follows:

- First time 46-0-0 straight fertilizer with the rate of 1 kilogram per rai
- 18-46-0 straight fertilizer with the rate of 9 kilograms per rai
- 0-0-60 straight fertilizer with the rate of 7 kilograms per rai
- Second time 46-0-0 straight fertilizer with the rate of 5 kilograms per rai

Sample 2

Farmers collected soil samples for the plot growing corn for feeding animals in Uthai Thani province. Checking with the soil series map revealed that the soil samples belonged to Lam Sonthi soil series. For the values obtained from soil analysis, the values of N-P-K were medium-medium-medium. After that, the mentioned values were considered together with soil series data. Then, advice was given for using "tailor-made fertilizers" for growing feeding animals of Uthai Thani province.

Soil series		Very low	Low	Medium	High	Expected yields
Korat (Kt)	N	20	15	10		1,056.0 kg./rai
	P		4	3	2	
	K		9	7	4	
Lam Sonthi (Ls)	N	20	8	2		991.0 kg./rai
	P		7	3	0	
	K		14	10	4	
Li (Li)	N	15	10	8		713.0 kg./rai
	P		7	3	0	
	K		10	6	2	

Look at Lam Sonthi soil series. The reading of N-P-K analysis was medium-medium-medium whereby 1 set of numbers, namely 2-3-10 was obtained. Taking the obtained numbers to check for advice about fertilizer application revealed that there was not any set of numbers as mentioned in the advice about fertilizer application, If a case like this happens, consider numbers with values close to the set of numbers obtained from soil analysis at the most. For this time, the advice about fertilizer application of the set of figures "4-3-10" instead of "2-3-10" is used resulting in the advice about fertilizer application as follows:

First time

- 46-0-0 fertilizer with the rate of 2 kilograms per rai
- 18-46-0 fertilizer with the rate of 7 kilograms per rai
- 0-0-60 fertilizer with the rate of 17 kilogram per rai

Second time

- 46-0-0 fertilizer with the rate of 5 kilograms per rai

เส้น-พี-เค	ปุ๋ยครั้งที่ 1						ปุ๋ยครั้งที่ 2	
	ปุ๋ยสูตร	อัตรา	ปุ๋ยสูตร	อัตรา	ปุ๋ยสูตร	อัตรา	ปุ๋ยสูตร	อัตรา
3-0-0					46-0-0	4	46-0-0	4
3-0-3	0-0-60	5			46-0-0	4	46-0-0	4
3-0-7	0-0-60	12			46-0-0	4	46-0-0	4
3-2-0			18-46-0	5	46-0-0	2	46-0-0	4
3-2-3	0-0-60	5	18-46-0	5	46-0-0	2	46-0-0	4
3-2-6	0-0-60	10	18-46-0	5	46-0-0	2	46-0-0	4
3-3-0			18-46-0	7	46-0-0	1	46-0-0	4
3-3-3	0-0-60	5	18-46-0	7	46-0-0	1	46-0-0	4
3-3-6	0-0-60	10	18-46-0	7	46-0-0	1	46-0-0	4
3-3-7	0-0-60	12	18-46-0	7	46-0-0	1	46-0-0	4
3-4-0			18-46-0	9			46-0-0	4
3-4-3	0-0-60	5	18-46-0	9			46-0-0	4
3-4-6	0-0-60	10	18-46-0	9			46-0-0	4
3-6-0			18-46-0	14			46-0-0	4
3-6-3	0-0-60	5	18-46-0	14			46-0-0	4
3-6-7	0-0-60	12	18-46-0	14			46-0-0	4
4-0-0					46-0-0	5	46-0-0	5
4-0-4	0-0-60	7			46-0-0	5	46-0-0	5
4-0-8	0-0-60	14			46-0-0	5	46-0-0	5
4-1-2	0-0-60	4	18-46-0	3	46-0-0	4	46-0-0	5
4-1-4	0-0-60	7	18-46-0	3	46-0-0	4	46-0-0	5
4-1-7	0-0-60	12	18-46-0	3	46-0-0	4	46-0-0	5
4-2-1	0-0-60	2	18-46-0	5	46-0-0	3	46-0-0	5
4-2-2	0-0-60	4	18-46-0	5	46-0-0	3	46-0-0	5
4-2-3	0-0-60	5	18-46-0	5	46-0-0	3	46-0-0	5
4-2-4	0-0-60	7	18-46-0	5	46-0-0	3	46-0-0	5
4-2-7	0-0-60	12	18-46-0	5	46-0-0	3	46-0-0	5
4-2-8	0-0-60	14	18-46-0	5	46-0-0	3	46-0-0	5
4-2-10	0-0-60	17	18-46-0	5	46-0-0	3	46-0-0	5
4-2-17	0-0-60	29	18-46-0	5	46-0-0	3	46-0-0	5
4-3-0			18-46-0	7	46-0-0	2	46-0-0	5
4-3-1	0-0-60	2	18-46-0	7	46-0-0	2	46-0-0	5
4-3-2	0-0-60	4	18-46-0	7	46-0-0	2	46-0-0	5
4-3-3	0-0-60	5	18-46-0	7	46-0-0	2	46-0-0	5
4-3-4	0-0-60	7	18-46-0	7	46-0-0	2	46-0-0	5
4-3-7	0-0-60	12	18-46-0	7	46-0-0	2	46-0-0	5
4-3-8	0-0-60	14	18-46-0	7	46-0-0	2	46-0-0	5
4-3-10	0-0-60	17	18-46-0	7	46-0-0	2	46-0-0	5
4-3-17	0-0-60	29	18-46-0	7	46-0-0	2	46-0-0	5

3.2.2.2 Fertilizer use based on soil analysis is taking the updated analysis value of N P K in the soil to be determined for the advice about fertilizer application so that it will be in line with nutrient needs of plants. Use the advice of the given book with Soil Test Kit (KU Soil Test Kit)

Sample

Conducting soil analysis from the soil samples collected from the plot growing cassava

- Interpreting and the values of N-P-K from soil analysis were read at the level: very low-medium-low

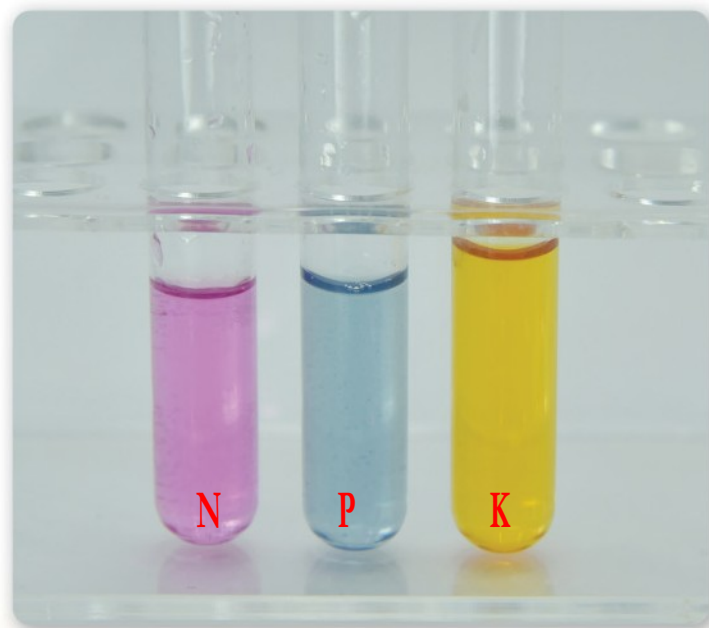
- Giving advice about fertilizer use according to the recommendation document about fertilizer use based on soil analysis (no advice for tailor-made fertilizers) by using straight fertilizers with formulas to mix fertilizers for private use as follows:

46-0-0 straight fertilizer with the rate of 32 kilogram per rai

18-46-0 straight fertilizer with the rate of 9 kilograms per rai

0-0-60 straight fertilizer with the rate of 27 kilograms per rai

After 1-3 month cultivation, apply the fertilizer one time. After fertilizer application, cover up the fertilizer.



Picture of solution colors showing soil analysis of N-P-K at the level of very low-medium-low

คำแนะนำ
การใช้ปุ๋ยตามค่าวิเคราะห์ดิน
พืชไร่ พืชผัก ไม้ผล และไม้ยืนต้น



ชุดตรวจสอบดินแบบรวดเร็ว
(KU Soil Test Kit)
วัดค่า เอ็น-พี-เค และกรด-ด่างของดิน

- 1 ชุดวิเคราะห์ดินได้ 50 ตัวอย่าง
(ดิน 1 ตัวอย่าง เก็บ 15-20 จุดจากพื้นที่ 25 ไร่)
- ราคาพร้อมอุปกรณ์ ชุดละ 4,745 บาท
- ราคาขายยาเคมี ชุดละ 3,675 บาท
- ชุดเล็ก (15 ตัวอย่าง) ชุดละ 2,605 บาท

ย้าย “ห้องแล็บ” ลง “กล่อง”
ถูกต้อง - ประหยัด - รวดเร็ว
เกษตรกรทำได้ด้วยตนเอง
สั่งซื้อ : สุรโชติ 083-189-3255
e-mail : surachoti@yahoo.com

Handbook of Recommendation

Type	Soil analysis values			Recommendation for fertilizer application (kg./rai)		
	N	P	K	46-0-0	18-46-0	0-0-60
1	Low	Low	Low	28	18	27
2	Low	Low	Medium	28	18	20
3	Low	Low	High	28	18	7
4	Low	Medium	Low	32	9	27
5	Low	Medium	Medium	32	9	20
6	Low	Medium	High	32	9	7
7	Low	High	Low	35	0	27
8	Low	High	Medium	35	0	20
9	Low	High	High	35	0	7
10	Medium	Low	Low	11	18	27
11	Medium	Low	Medium	11	18	20
12	Medium	Low	High	11	18	7
13	Medium	Medium	Low	14	9	27
14	Medium	Medium	Medium	14	9	20
15	Medium	Medium	High	14	9	7
16	Medium	High	Low	18	0	27
17	Medium	High	Medium	18	0	20
18	Medium	High	High	18	0	7

Note 1. Apply the fertilizers only once after cultivation for 1-3 months or after getting rid of weeds at first by apply the fertilizer at both sides of cassava trees when the soil has appropriate moisture. Then, the fertilizer must be covered also.

Showing Recommendation

Sample of issuing and recommendation invoice to farmers who bring soil to have it analyzed

Order ...15....

Advice for using tailor-made fertilizers/fertilizers based on soil analysis values

Member of Sor.Dor.Por.Chor

Non-Member of Sor.Dor.Por.Chor

Name of farmer ...Mr. Dham Kaokham.....House No.Village No. Sub-district.....District.....

Type of cultivated plants....rice.....Variety....not light-sensitive.....Area of cultivation.....30...rai

Information supporting giving advice about soil management and fertilizers

1. Name of soil series ...Nakhon Pathom.....
2. Analysis results regarding acidity-alkalinity of the soil (pH)...5....Advice for lime application.....no application....
3. The results of analyzing nutrient levels in the soil for: N....low...; P.....medium.....; K.....low.....
4. Amount of main nutrients to put in for N - P -K4-4-4.....
5. Advice for using fertilizer per rai

5.1 First time (Age of rice at 20-25 days) Formula: 18-46-0; Rate: ...9....kgs./rai ; in the amount ofBaht/rai
 Formula: 46-0-0; Rate: ...1....kg./rai ; in the amount ofBaht/rai
 Formula: 0-0-60; Rate: ...7....kgs./rai ; in the amount ofBaht/rai

5.2 Second time (Age of rice at 50 days) Formula: 46-0-0; Rate: ...5....kgs./rai ; in the amount ofBaht/rai

Total amount of straight fertilizers usedkgs./rai Total.....Baht/rai

Note: In case of no straw burning, N fertilizer use of the second time (46-0-0 fertilizer) can be reduced for 2 kilograms/rai

คำแนะนำการใช้ปุ๋ยสังคัง (นาข้าว) ลำดับที่.....

โครงการส่งเสริมการใช้เทคโนโลยีปุ๋ยสังคังสำหรับนาข้าวจังหวัดขอนแก่น ปี 2557

กลุ่มนำร่อง (จบ อปท.) กลุ่มดำเนินการเอง

ชื่อ นาย ด.ช. ธรรม ใจดี บ้านเลขที่ 186 หมู่ที่ 4 ตำบล หนองโพธิ์ อำเภอ แวงใหญ่

ท่านปี 2557 จำนวน 3 ไร่ เป็นข้าวเหนียว กข. 6 จำนวน 3 ไร่ เป็นข้าวขาวดอกมะลิ จำนวน - ไร่

ข้อมูลประกอบคำแนะนำการใช้ปุ๋ย มีสี 98/76 3 ก.บ. 2100 ม
95 82 ๓.๕๕ (4%)

๑.) ชื่อชุดดิน ๗๑

๒.) ผลการตรวจวิเคราะห์ดิน ธาตุ เอ็น-พี-เค ระดับ กลาง-สูง-สูง ต้องใส่ธาตุอาหาร 2-2-5 PH ๖.๕

๓.) คำแนะนำการใช้ปุ๋ยต่อไร่

๓.๑ ปุ๋ยครั้งที่ ๑ ใช้ปุ๋ย ในโตรเจน (N) 46-0-0 จำนวน <u>1</u> ก.ก. เป็นเงิน <u>15 = 15</u> บาท (ใส่หลังจากวัน ๒๐ วันต้นกล้า)
ใช้ปุ๋ย ฟอสฟอรัส (P) 18-46-0 จำนวน <u>4</u> ก.ก. เป็นเงิน <u>22 = 88</u> บาท (ต้นกล้าใส่หลังปักดำ ๗ วัน)
ใช้ปุ๋ย โพแทสเซียม (K) 0-0-60 จำนวน <u>9</u> ก.ก. เป็นเงิน <u>18 = 162</u> บาท
๓.๒ ปุ๋ยครั้งที่ ๒ ใช้ปุ๋ย ในโตรเจน (N) 46-0-0 จำนวน <u>3</u> ก.ก. เป็นเงิน <u>15 = 45</u> บาท (ใส่ประมาณวันที่ ๒๕ วันชาวน ต้องมีน้ำ)
รวมจำนวนแม่ปุ๋ยที่ได้ <u>19</u> กิโลกรัม เป็นเงินรวม <u>310</u> บาท/ไร่ รวม <u>375</u> เป็นเงิน <u>930</u>

Sample of issuing advice about using tailor-made fertilizers to farmers

คู่มือศูนย์จัดการดินปุ๋ยชุมชน (ศดป.ช.)

Sample of a registration form recording the result of soil analysis and giving recommendation about soil management and fertilizer use

No.	Name	Location of farm			Soil series	pH	Advice for lime application	Results of soil analysis			Recommended nutrients			Advice for fertilizer use			
		Village No.	Sub-district	District				N	P	K	N	P	K	First time		Second time	
														Formula	Kg./rai	Formula	Kg./rai
													18-46-0		46-0-0		
													46-0-0				
													0-0-60				
													18-46-0		46-0-0		
													46-0-0				
													0-0-60				
													18-46-0		46-0-0		
													46-0-0				
													0-0-60				
													18-46-0		46-0-0		
													46-0-0				
													0-0-60				

4. Preparing learning centers/demonstration plots

The objective is to have them as points passing on the technology of using fertilizers in order to reduce costs of production

4.1 Learning centers: There must be setting up learning plots to compare the plots using fertilizers to reduce costs of production with the plots which farmers operate as usual. The reason of doing this is to see differences of costs of production and productivities, including differences in other aspects such as strength, plants' resistance to diseases caused by insects etc. Both types of the plots must be operated similarly except for the fertilizer use which is different. The operation is as follows:

4.1.1 Select member farmers of Sor.Dor.Por.Chor who can be farmer lecturers in order to prepare learning plots, demonstration plots;

4.1.2 Procure equipment and necessary production factors in setting up learning centers/demonstration plots such as signs of learning plots, signs of demonstration points, seeds, breeder plants, chemical fertilizers etc.

4.1.3 For technologies applied in preparing learning plots to scale up fertilizer use in order to reduce costs of production, the plots using tailor-made fertilizers or fertilizers based on soil analysis values together with using organic fertilizers and/or biological fertilizers are set up to compare with the plots using farmers' methods. In any case, there are other practices which are similar but different in terms of fertilizer application. The plots should be adjacent to each other in order to compare the results clearly. However, there must be a barrier separating the two plots distinctly in order to prevent fertilizer application of one plot or one tree from affecting the other plot or another tree.

4.1.4 The size of the learning plot depends on types of main plants of Sor.Dor.Por.Chor. whereby there should be the minimum size of the area as follows:

- Rice for 1 rai
- Vegetables for 1 ngan
- Field crops for 1 rai
- Fruit trees for 1 rai

4.1.5 Sign of the learning plot Prepare signs showing information of setting up the learning plot thoroughly according to the learning plot signs model so that other farmers in the community can study, learn and follow up the occurring results for scaling up, which brings out acceptance and implementation.

4.1.6 Officers give advice to farmers regarding taking notes of the operation and the operation results in the information recording form of the learning plot and the plot based on farmers' methods. This is for the benefit of passing on techniques and scaling up to other farmers so that this can bring about acceptance and implementation (Appendix).

4.1.7 Make public and scale up the success of the technology by preparing signs of learning plots and/or hold an event for Technology Transfer Day by having farmers who are owners of the plots participate in passing on technologies and occurring success.

4.2 Demonstration points or learning bases for at least 1 point to pass on the technology regarding soil management and fertilizer application such as point of making compost or bio-extract, point of demonstrating soil analysis, point of mixing fertilizers for personal use.

Learning plot: Use of chemical fertilizers based on soil analysis values/tailor-made fertilizers to reduce costs of production of the Year 2018

The plot owner

Type of plantVarietyArearai

Results of soil analysis

Nitrogen(N) Phosphorus (P)..... Potassium (K).....Soil series

Advice for using chemical fertilizers based on soil analysis values/tailor-made fertilizers	
First fertilizer application	
46-0-0	in the amount of kgs./rai, accounting for Baht/rai
18-46-0	in the amount of kgs./rai, accounting for Baht/rai
0-0-60	in the amount of kgs./rai, accounting for Baht/rai
Second fertilizer application	
46-0-0	in the amount of Kgs./rai, accounting for Baht/rai
Total costs of chemical fertilizer (Baht/rai)	
Total costs of pesticide (Baht/rai)	
Yields (kgs./rai)	

Note: Information can be adjusted to be suitable with types of plants and practices.

5. Collecting demands for straight fertilizers of members

The Community Soil-Fertilizer Management Center (Sor.dor.Por.Chor.) represented by the assigned committee collects the information of the demand for using straight fertilizers according to the advice of each member and procure them to deliver or sell fertilizers to members. Moreover, it allows members to use the place, rent and borrow equipment used in mixing fertilizers for the purpose of labor-saving and facilitation (further details in the Appendix).

6. Guidelines on the operation of Sor.Dor.Por.Chor. to bring about sustainability

Key Success Factors having an effect on making Sor.Dor.Por.Chor. useful to members and have sustainability as follows:

6.1 Qualities of the work team, The work team of Sor.Dor.Por.Chor. has leadership, volunteer-spirit, correct knowledge regarding soil and fertilizers. Moreover, it also has the committee with duties being assigned distinctly, the soil analysis operating team with good skills and the team making public relations of the performance of Sor.Dor.Por.Chor. so that it becomes evident in terms of benefits to the community.

6.2 For soil analysis services, Sor.Dor.Por.Chor. provides soil analysis services to members and the community continually.

6.3 For the number of members of Sor.Dor.Por.Chor, farmers have applied for membership more.

6.4 For primary nutrient fertilizers funds or revolving funds, Sor.Dor.Por.Chor should conduct management to bring about straight fertilizer funds or funds or revolving funds of Sor.Dor.Por.Chor. in order to use them in providing straight fertilizers to members to use according to advice and other related activities which are useful to members. Funds or revolving funds are established by the management of the group, obtained from the budget supported by Department of Agricultural Extension and/or other agencies with the management to bring returns to be used as funds or revolving funds of Sor.Dor.Por.Chor., including fundraising of member farmers. Moreover, there is distribution of reward from earnings.

6.5 Good management There is data entry to be used in giving advice about soil management and fertilizer application, including straight fertilizer procurement such as member data, soil data, fertilizer use data, demand for primary nutrient fertilizers, primary nutrient fertilizer stock, accounting and financial data etc.

6.6 Promoting the conduction of community business or community enterprise regarding soil and fertilizers

Business refers to activities which bring about production of goods and services. There are sales and purchase for exchanging. The objectives are to receive benefits, profits or yields from the activities.

Community Business is the gathering of people in the community in order to conduct business with mutual objectives and ideologies whereby the people are determined to build profits, develop people and the community. The people in the community are co-owners who mutually think, analyze, jointly own business, make plans, operate and receive benefits under participation and being in line with the community. They can start with owning small business with the form of production, services and management which are agile under small amount of capitals in operating the business. Moreover, incomes at the beginning may not be great.

6.6.1 Principle of managing community business

6.6.1.1 Beginning of community business

- Find market demands, demands of consumers of each community, what goods members want, the number of members in the community.

- Hold on to the principle of self-reliance, raw materials and labor force in the community.

- Hold on to sufficiency economy by starting from small business at first in order to meet the needs of the community. Then, start developing.

6.6.1.2 Management of production and production factors

- Land, establishment

- Labor force in the community. Start with volunteers. When success and self-reliance occur, more people will want to participate.

- Operations, management, methods of production, having knowledge or finding more knowledge

- Capitals, resources in the community, labor force and raw materials in the community

6.6.1.3 Marketing management, sell to whom?

- Building products, packages, can be transported far away, building brands to let people know that the products belong to the group

- How to determine prices so that the business can survive, having profits, the community being able to survive, analysis of production factors and raw materials as well. For the economic aspect, costs of labor force, the capital which is not cash but an opportunity cost, must be analyzed also. How to think to make the business survive, to make the community survive.

- For distribution channels, distribute products to members in the community so that in the future, they can be distributed to communities nearby. Development of finding channels for displaying merchandises, distribution through internet, LINE and Facebook.

- Marketing promotion, discounts for members, distribution of reward from earnings to members for distribution to outsiders in the community nearby in order to bring profits obtained to circulate, manage the community business so that it can survive sustainably and strike out on one's own

6.6.1.4 For management of finance and accounting, all costs must be recorded such as costs of equipment, costs of labor etc., which can be forgotten to calculate by requesting knowledge from Auditing Office, mentors of the group or finding people in the group who have potentials in finance, doing accounting and conducting the business.

6.6.1.5 Human resource management, Persons and human resources are precious things that will bring the group to succeed. There are 4 things to hold on to in managing people with the approach to have the chairman of the group to act as a leader not a commander. There should be equality, equivalence, and different roles and duties. Holding to the principle of one's ability and appropriateness- Which aspect is the person good at? likes to calculate, likes to do accounting or people who has ability to manage human resources. Division of roles, members receive compensation. There is security. Profits circulate so that the community can survive. Good governance is held on to in managing people with transparency, impartiality and giving justice to the group for sustainability.

6.6.2 Factors which determine success of the community business

6.6.2.1 Production - Products must have good qualities. People should have skills and abilities in production, know process and methods of production. Having true knowledge of things that are produced. Costs of production are not high. Small funds are raised in the community at first.

6.6.2.2 Marketing - There are definitely markets which support goods. People should have knowledge of marketing, find lecturers to fulfill the business or supplement it after having operated it for a certain degree. At first, production starts with the support for the demand of the community, which will then extend to other markets, including the access of information about marketing.

6.6.2.3 Finance - Fund raising in the group- shares, having ability to provide sources of investment funds with reliability regarding financial systems and accounting systems. The business must prepare accounts whereby it can connect these accounts in finding sources of investment funds with transparency and reliability.

6.6.2.4 Person - Members have specialized knowledge. Production, marketing and doing accounting are skills which can be learnt. Having a good leader is a factor which increases an opportunity for success. There should be sacrifice, expertise in aspects, participation of members in the group, exchanging ideas. Due to the fact that humans want to be praised, they realize their own importance. Participation is a factor which makes the group succeed.

6.6.3 Developing the business to be sustainable should focus on 3 components which are:

6.6.3.1 Sustainable economy, having profits, transparency and justice

6.6.3.2 For the society and the community to be sustainable, being a giver is required.

6.6.3.3 Sustainable environment. The business agency contributes to conserving the environment.

If all 3 components have balances, the business will become sustainable later.

7. Monitoring and Assessing Results

In order to assess the success of fertilize use promotion to reduce costs of production through mechanism, Sor.Dor.Por.Chor. has determined to have reporting operational performances and management at the Sor.Dor.Por.Chor level as follows:

7.1 Report form of operational performances through operating in the management system of community soil-fertilizer management centers "<http://fertilizerdoae.go.th/login>". Moreover, there is a storage form of the data of learning plots in the Appendix in order to store specific data of learning plots.

- Data Entry Form of the learning plot and the plot based on farmers' methods
- Report Form 1-4 (previous Report Form)
- Online Report form (input form)

7.2 Arranging the level of community soil-fertilizer management centers. Due to the fact that there is designation of goals in operating according to tasks and for the purpose of making the operation achieve the objectives, criteria of assessing development or driving community soil-fertilizer management centers has been prepared whereby there are points to be considered as follows:

7.2.1 There is location for centers which can be used to set up demonstration points or learning bases in conducting important activities such as soil analysis, arranging the process of learning about mixing straight fertilizers.

7.2.2 There are name tags of Sor.Dor.Por.Chor with the logo of Department of Agricultural Extension and the logo of supporting agencies according to the designated form.

7.2.3 There are important data and equipment to be used in setting up learning bases and conducting activities such as Soil Test Kits, medias regarding knowledge of soil-fertilizer and fertilizer application to reduce costs of production and local soil series maps.

7.2.4 There are members not fewer than 20 people.

7.2.5 There are committees and division of duties and responsibilities.

7.2.6 There are holding meetings and reporting meetings.

7.2.7 There is arrangement for the learning process to pass on the knowledge about soil and fertilizers to members.

7.2.8 There is soil analysis, including giving advice to members.

7.2.9 There are demonstration points or learning bases such as production of organic fertilizers, mixing fertilizers for private use.

7.2.10 There are learning plots regarding fertilizer usage to reduce costs of production.

7.2.11 There are member farmers for at least 50% who use tailor-made fertilizers or fertilizers based on soil analysis values (Percentage increases according to the outcome of the project designated in each year).

7.2.12 Collect needs and provide straight fertilizers to members.

7.2.13 There is scaling up such as increasing the number of members, extending soil analysis services to non-member farmers.

7.2.14 There are funds or rotating funds or revolving funds.

There is arrangement for 4 levels which are A⁺ A B and C according to the following criteria:

- Sor.Dor.Por.Chor. A⁺ refers to passing the criteria completely for every item of 14 items (Item 1-14).
- Sor.Dor.Por.Chor. A refers to passing the criteria completely for every item of 12 items (Item 1-12).
- Sor.Dor.Por.Chor. B refers to passing the criteria completely for every item of 11 items (Item 1-11).
- Sor.Dor.Por.Chor. C refers to passing the criteria incompletely of 11 items (Item 1-11).

“Development Assessment Form” can make an assessment according to the development form of community soil-fertilizer management centers below:

Development Assessment Form of community soil-fertilizer management centers

Name of Sor.Dor.Por.Chor

District Province

A ⁺	
A	Scaling up <input type="checkbox"/> 14. Having fundsBaht <input type="checkbox"/> 13. Having scale-up <input type="checkbox"/> Number of members has increased <input type="checkbox"/> Extending soil analysis services to non-member
B	Services <input type="checkbox"/> 12. Collect needs and procure straight fertilizers to distribute to members
C	Passing of knowledge <input type="checkbox"/> 11. At least 50% of member farmers use fertilizers based on soil analysis values or tailor-made fertilizers. <input type="checkbox"/> 10. There are learning plots of chemical fertilizer use based on soil analysis values together organic fertilizers. <input type="checkbox"/> 9. There are demonstration points of organic fertilizer production. <input type="checkbox"/> 8. There is soil analysis available as well as giving advice to members. <input type="checkbox"/> 7. Providing training and giving fertilizer knowledge to members
Member	<input type="checkbox"/> 6. Holding meetings and preparing list of names of attendants. <input type="checkbox"/> 5. There are committees and division of duties. <input type="checkbox"/> 4. There are at least 20 members. <input type="checkbox"/> 3. There is important equipment used to conduct activities, namely <input type="checkbox"/> Soil Test Kits <input type="checkbox"/> medias about soil and fertilizer knowledge <input type="checkbox"/> local soil series maps
Place/Equipment	<input type="checkbox"/> 2. Having Sor.Dor.Por.Chor name tags with the logo of the supporting agency which can be seen distinctly. <input type="checkbox"/> 1. There is a location for the center which can be used to conduct activities such as soil analysis, setting up the learning process and mixing straight fertilizers etc.

Note: 1. Put the mark (√) in the bracket with the operation and specify the figure of money amount in Clause 14.

2. Fund refers to farmers' money of taking shares and/or support money of the government sector such as money from the fertilizer project to reduce costs of agricultural production, ,money from farmer profession development plan project according to the need of the community to mitigate drought

3. Criteria of Sor.Dor.Por.Chor classification

Sor.Dor.Por.Chor. A⁺ refers to passing the criteria completely for every item of 14 items (Item 1-14).

Sor.Dor.Por.Chor. A refers to passing the criteria completely for every item of 12 items (Item 1-12).

Sor.Dor.Por.Chor. B refers to passing the criteria completely for every item of 11 items (Item 1-11).

Sor.Dor.Por.Chor. C refers to passing the criteria incompletely of 11 items (Item 1-11).

In case of passing the criteria of Item 1-12 completely and either Item 13 or Item 14, this is regarded as Level A.

* Percentage increases according to the outcomes of the project in each year.

Chapter

4

Problems, Obstacles and Solution Guidelines

Problems and obstacles which can happen during conducting activities of community soil-fertilizer management centers are divided into 2 parts which are:

1. Problem of using technologies

1.1 Soil Test Kits. If users do not have skills, interpretation of soil analysis can be in error. As a result, the advice for fertilizer usage deviates from what should be. This tends to happen from procedures of operating as follows:

1.1.1 In case of nitrogen (N) analysis, if there is uncertainty which one to analyze between ammonia and nitrate

Solution guideline: -For farm soil, check ammonia

-For field soil, check nitrate

1.1.2 For phosphorus (P) analysis, there is error in comparing colors with the standard color plate

Solution guideline: Soil analysis should be conducted at the place where there is enough light.

1.1.3 For potassium (K) analysis, there is confusion about procedures and equipment such as

1.1.3.1 When Solution No. 8 is added. The volume does not correspond to the advice.

This is mostly due to the confusion in using the equipment (droppers)

Solution guideline: Choose the dropper suitable with the volume to be used- the volume between 2 milliliter and 0.2 milliliter.

1.1.3.2 Add the solution until all procedures are completed. Shake the tube and leave it for a while without reading the value immediately.

Solution guideline: Should read the value immediately to prevent precipitation, which can cause confusion in reading the value.

1.1.4 Testing pH values of the soil

1.1.4.1 Adding too much solution/too little

Solution guideline: Should add Test Solution No. 10 until the soil is saturated. Then, add 2 more drops.

1.1.4.2 Scoop the solution from the hole tray for comparing the color, which brings about an error in comparing the color with the standard color chart. As a result, the interpretation of the analysis value is deviated.

Solution guideline: Do not scoop the solution from the hole tray for color comparison.

The hole tray should be tilted back and forth and leave it for 1 minute. Then, compare the color from the hole tray with the standard color chart.

1.1.5 There is confusion and no confidence in interpretation and advice for fertilizer usage such as in rice. Understanding that the soil series seen in the advice is a province.

Solution guideline: The officer gives knowledge to farmers by telling him that the name of soil series is usually named after the place where the soil is found at first. For example, Nakhon Pathom soil series can be found in Kanchanaburi province and Suphan Buri province etc.

1.2 Being confused between fertilizer use based on soil analysis values and tailor-made fertilizers

Solution guideline: Study details regarding technologies. Characteristics of operating are similar. The difference is that for the technology of tailor-made fertilizers, the data of soil series are considered together with N P K analysis values in the current soil in determining advice for fertilizer use in order to increase higher accuracy in using chemical fertilizers with efficiency.

1.3 Chemical fertilizer use with only main nutrients can make plants lack minor nutrients and supplemental nutrients.

Solution guideline: -Promote use of organic fertilizer together with tailor-made fertilizers and use of chemical fertilizers based on soil analysis values

-Increase minor nutrients and supplemental nutrients if plants specially need them or show the symptom of lacking them

1.4 Production of compost with no qualities

Solution guideline -For advice regarding producing compost to have qualities, there are things to take into consideration as follows:

1.4.1 Materials to be used are very important because they are indicators of the qualities of the compost. If they are materials containing a lot of plant nutrients, fertilizers with good qualities will be obtained. Materials for making compost are simply categorized into 3 groups which are:

1. Easily biodegradable materials such as branches, leaves, vegetables, fruits, animal parts. They can be decomposed to be organic fertilizer within 1 month.

2. Moderately biodegradable materials such as dry grass, rice straw, corn plant and its leaves and small branches. It takes 1.5 -2 months to decompose them to be organic fertilizers.

3. Hardly-decomposable materials such as saw dust, corncobs, eucalyptus. It takes more than 2 months to decompose them to be organic fertilizers.

1.4.2 Microorganism Food Materials to be used will become food of microorganisms which help decompose them to be compost. Decomposition times vary, depending on the mentioned types of materials. If you want to accelerate microorganisms in decomposing the materials to be organic fertilizers faster, adding more nutrients to microorganisms is required such as dung, rice bran, soybean meal, fish meal, molasses, chemical fertilizers or use of Super LDD 1 Microbial Activator, which is a group of microbes with high efficiency in decomposing materials used to produce compost. In any case, for whatever substances to be used, choose substances which are cheap and easy to find.

1.4.3 Moisture Control This part is very important. Besides the fact that every types of microbe needs water, water is the factor which helps dissolve food also. Therefore, moisture of the material must be kept appropriately at about 50-60% by weight. Materials to cover the fertilizer pile such as old sacks or plastic to keep moisture are recommended.

1.4.4 Ventilation Oxygen should be added to the fertilizer pile by turning the pile every 7 days.

Methods of Production

1. Bring materials used for production to pile up on the flat area evenly for the height of 50 centimeters.

2. Bring food for microorganisms such as dung to scatter on the top part of the fertilizer pile. The amount to be used depends on the property of the materials used to produce organic fertilizers. In case of easily biodegradable materials, use the rate "Dung: Material = 1:10". For moderately biodegradable materials, use the rate of 1:5 and for hardly-decomposable materials, use the rate of 1:1. After that, water the pile thoroughly to get the overall moisture for about 50-60%. Step on the fertilizer pile to make it compact. After stepping on it, the pile should have the height of 50 centimeters. If it is flattened too much, add more materials.

3. Repeat Clause 1-2 until the height of 1 meter is obtained.

4. Bring a plastic sheet to cover the pile completely and turn the pile every 7 days. Take a look at the fertilizer pile, if the moisture is too little, water it. If there is too much moisture, open up the pile in order to let out moisture.

1.5 Take the pH value from the analysis to be used in giving recommendation

Solution guideline: For giving advice, the pH value must be taken into consideration also because the pH value has an effect on dissolution of plant nutrients in the soil. If the pH value is not suitable, adjust acidity and alkalinity of the soil to be suitable before cultivation or fertilizer application.

1.6 Fertilizer recommendation use does not cover every kind of plants

Solution guideline: If the plant does not have advice, use the advice in the plant with similar growth or consult the academic agency in the area.

1.7 Advice for fertilizer use on the frequency of fertilizer application which is not in line with the reality

Solution guideline: Based on the given advice, separate fertilizer application according to the suitability with the period of plant requirement

2. Problems from management

2.1 Straight fertilizers are difficult to find

Solution guideline: Collect needs of the members. Then, inform the fertilizer shop in the community to provide for distribution. Use the platform of Sor.dor.Por.Chor network at the provincial level in consulting about the management approach.

2.2 Farmers are not interested in and do not accept the technology of using fertilizers to reduce costs of production

Solution guideline: Pass on the technology and prepare learning plots, comparing fertilizer use to reduce costs of production with the method of fertilizer use of farmers, There are signs of learning plots. Make public about the method of operation and the occurring outcomes.

2.3 Lacking the budget for continual operation

Solution guideline: Provide revolving funds such as writing projects to request financial support from agencies in the area. Raise funds by taking shares from members. Show local agencies the benefits for the community in using fertilizers to reduce costs of production so that financial support can be obtained.




ศูนย์จัดการดินปุ๋ยชุมชนตำบลห้วยม้า
 หมู่ 1 ตำบลห้วยม้า อำเภอเมือง จังหวัดแพร่
 บริการ 1. ให้คำแนะนำการใช้ปุ๋ยตามค่าวิเคราะห์ดิน การจัดการดิน น้ำ ปุ๋ย
 2. บริการตรวจวิเคราะห์ดิน