Soil Survey Using Grid System on Study of Land Resource Potency for Agriculture Development

Muhamad KUNDARTO and Sari VIRGAWATI, Indonesia

Key words: Survey, grid method, land unit, sample site

SUMMARY

The potency of land resource for agricultural development in a region can be observed through soil survey activity. One of the survey method commonly used is grid system with topographic map as a base-map. Some problems occur when the site to be observed is very steep, in the middle of a building, in water body, or the survey budget is limited, etc. In some cases it is need to reduce the number of sample site by modifying the grid system without reducing the accuracy of data.

In modifying grid system should consider some factors, for instance the pedogenesis, water body, slope, land use, degree of difficulties, research objectives, research budget, etc. By combining those factors, the number of sample site may be reduced but still give sufficient data.

The reduction may vary for different step of survey, for example, when putting grid on base-map, the number of sampling site may reduce 50% after sorting the slope. When checking the field, the number of sampling site after first elimination may reduce 20% with some reasons the site meet a housing area, or building or water body. It can be reduced again about 15% after composite some soil samples to be analyzed at the laboratory. Though the number of soil sample is cutting down, with careful treatment it will not affect significantly to the accuracy of soil data.

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1. INTRODUCTION

Soil survey is commonly used when conducting a research, especially when it associates with a certain area in a region. The aim of survey is to obtain the description comprehensively of the research area situation and condition, and as a consideration in selecting some sample sites.

In determining the methodology and the technique of soil survey, it must be carried out carefully and accurately. The precision in selecting the location or sample site depend how the soil survey has been conducted. The soil survey also affects the calculation of time, manpower, and the budget available in a research.

Soil survey plays an important role in a research of land resource potency, especially for agriculture development. Soil, as a main media for cultivation, need to be surveyed thoroughly, in order to be used as its natural potency. For processing the soil survey data, the Geographic Information System (GIS) can be applied.

The GIS may be applied to assist on spatial problem solving, therefore it can be used as a tool for planning the land management and its resources potency.

Land, as the place for all human activity, reflects the intensity of the society advancement by the pattern of land using. The facts of using land in a certain area may be a reference for the activity in planning or developing the region. It can be shown from the land use map that contents the information of the activity in its region.

2. MATERIAL AND METHOD

2.1 Material

The material for soil survey are basic or work-map, secondary data, and survey tools/kit. For working map the topographic map scale 1:25.000 produced by *Bakosurtanal* is used for Java Island or scale 1:50.000 for outer Java Island, and the administration map published by the local government. The working map will be more beneficial if supported with the geology map, soil map and agroclimatic map.

Secondary data used commonly are data from the *Statistical Bureau* or *Regency in Number*. Those data are used as tentative reference for interpreting the condition of the area will be surveyed.

The survey tools/kit consists of the soil test kit, vehicle, base-camp, etc. The supported tools usually are needed, depend on the complexity level of the survey area. The survey area in Java Island typically reachable by motorbike, unless to the mountain peak or swamp area.

2.2 Method

The method in soil survey commonly used is Grid system that is the easiest and familiar for public. However, this grid system sometimes need modification depend on the time, budget and manpower in the research as mentioned above.

3. IMPLEMENTATION

The orders of conducting the survey are :

3.1 Working Map Preparation

The working maps should be collected in a month before the survey. The overlay from several basic maps gives better information for interpreting the landform in order to point out the site for observation.

3.2 Determining the Observation Site

The factors that are affecting in reducing the number of sampling site on a survey with grid system are:

- The research objectives
  The objective of research will be the main reason for a researcher to reduce the sample sites
- The habitation
  The sample sites near the residence will be eliminated since the objective of the research is for agriculture development. The occupancy of land for residential is assumed impracticable to be converted as conventional agriculture.
- Water body
  The sample site which is precisely locates in a water body will be moved with some certain distance. If the reposition is too far (>250 m for grid distance 500m), the sample point will be deleted.
- The slope
  The number of sample sites locate on a plane area is less than the slope land or hilly area.
- Pedogenesis
  The points in the same height (parallel with the contour) in a slope of hill is assumed that its have relatively the same characteristic of pedogenesis or the age of soil development, hence the number of sample sites maybe reduced. For example, from 4 rows become 2 rows of survey trail.
- The budget

The research budget usually becomes a fundamental reason in determining the number of sample sites or represent samples which will be observed in the laboratory. Sometime without considering the landform variation.

- Inaccessible site
  The observation area that is technically hard to access or may bring danger to the surveyor should be eliminated, unless the location is the main object of the research.

3.3 Pre Survey

The pre survey should be conducted to check field orientation, inventory general information about the landform, and set up the base-camp for the surveyor.

3.4 Main Survey

The main survey effectively takes time about 1-2 weeks, depend on the area of the research. The wider the area, the more surveyors needed. It is not advised to take more time, to avoid the tiredness of the surveyors. Generally a group of surveyor complete 10 sample sites per day with the distance between sites is 0.5 – 1 km, or 8 sites/day for hilly area and 13 sites/day for plane area (not include swamp).

The scale of working map usually is bigger than the scale of the outcome thematic map, in order to get more detail information. It is to avoid the errors and to ease the crosscheck.

If the surveyor found a new occurrence on site that not shown in the map, it was necessary to carry out a particular survey to find out whether the phenomena would affect to the main purpose of the research.

From the field description the data may be grouped to some land units. The next work is making delineation of land units on the working map. Each land units should be represented at least one sample site.

3.5 Soil Laboratory Analysis

Lab analysis should be done to soil, water and crop samples. The form and method of analysis should match with the objective of the research. More complete the analysis, more accurate the outcome data, but it expenses more costly.

3.6 Data Analysis

The secondary data such as statistical data, climate data, will be compiled with the result of field description, interview, and lab analysis.

3.7 Map Composition

The GIS tools will ease the process in data analysis and mapping. The thematic map is composed from the working map combined with the selected results data as the attributes. The thematic map is the main reference for the discussion and conclusion of the research.

3.8 Research Report

The research summary usually should be report in 3 parts, Preliminary Report, Draft of Final Report, and Final Report.

4. SOIL SURVEY USING MODIFIED GRID SYSTEM

The Soil Science Department had conducted many soil surveys. Some of its were collaboration with the local governments such as the regency of Rembang (2002), Magelang (2002) and Bantul (2003). The projects were about classification of soil fertility and the recommendation for the amount of fertilizers.

The soil survey using modified grid system. The number of sample sites has been reduced after eliminating some location with consideration not affects to the accuracy data. Table 1 shows the percentage of the sample sites reduction number.

The soil sampling for each sample sites need several group of surveyor depend on the area size and the level of difficulties in accessing to the location. As an education institution, the group of surveyor contents 2-3 scholars. In every group there is a local agent as field informant and assistant, and they use motorbike as transportation to the location.

Table 1: Percentage of reduction number of samples by modified grid system

Research location	Survey area (Ha)	Number of spot (pure grid) (a)	Number of spot (modified grid) (b)	Number of sample sites (c)	Number of analyzed soil sample
Rembang (2 dsitrict)	15,727.144	629	173 (27.5% from a)	43 (6.8% from a) (24.9% from b)	43 (6.8% from a) (24.9% from b) (100% from c)
Magelang (5 district)	26,140.110	1098	823 (74.9% from a)	248 (22.6% from a) (30.1% from b)	121 (11% from a) (14.7% from b) (48.8% from c)
Bantul (7 district)	26,733.000	829	452 (54.5% from a)	390 (47.1% from a) (86.3% from b)	43 (13.5% from a) (24.8% from b) (28.7% from c)

5. CONCLUSION

Soil survey with the modified grid system often applied on the research for land resource potency study for agricultural development.

The selection of sample site depends on the objective of the research, the land use (habitation, water body, etc.), slope, pedogenesis, the budget and the accessibility to the location.

The number of soil sample to be analyzed using modified grid system reduced 15% from the original grid system, it is decrease the expenses as well.

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CONTACTS

Muhamad Kundarto and Sari Virgawati
Soil Science Department – Faculty of Agriculture
UPN "Veteran" Yogyakarta
Jl. SWK 104 Lingkar Utara Condongcatur – Yogyakarta
INDONESIA
Email: maskund@yahoo.com, virgawati@hotmail.com