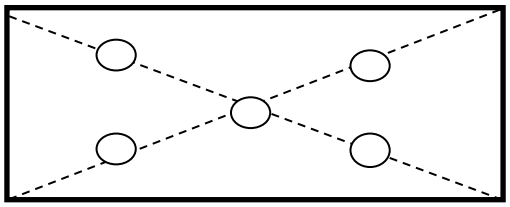
Reference 5

Methods of collecting samples for measuring radioactivity concentration in the soil

The National Institute for Agro-Environmental Sciences

1. Soil sampling points

Select five sampling points in each survey agricultural field to obtain the average radioactivity concentration of the soil down to a depth of 30 cm. The locations of these selected points shall be identified using GPS and marked on a map to allow sampling near the same points (but a point some distance apart from the point sampled in the preceding year to avoid any disturbance from it) in the next year and so on. When GPS is not available, the latitude and longitude shall be estimated using topographical maps, mapping services provided by the Geospatial Information Authority of Japan or other types of maps.



A sketch of sampling points

1) General agricultural fields (Basic fields)

Sampling points shall be determined with consideration of variations in soil conditions, etc.

2) Agricultural fields with deeply cultivated and/or disturbed areas

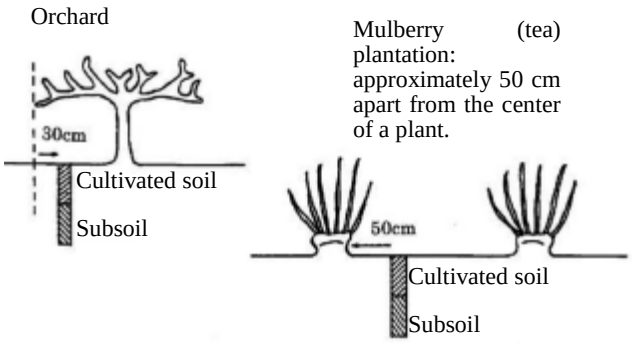
The area that has been partially deeply cultivated or contains disturbances (e.g. drains under paddy fields, deeply cultivated burdock fields, fertilization trenches in orchards, etc.) should be avoided for sampling points. When the entire field is cultivated deeply or disturbed, the sampling points shall be selected according to the same way as the basic field.

3) Agricultural fields with cut and filled soil

Agricultural fields on a slope are generally made flat by cutting or filling the soil. For this type of field, the cut and filled area should be included in sampling of the surveyed field.

4) Orchards and others

For orchards, mulberry plantations and tea plantations, sampling points shall be selected based on the figure below.

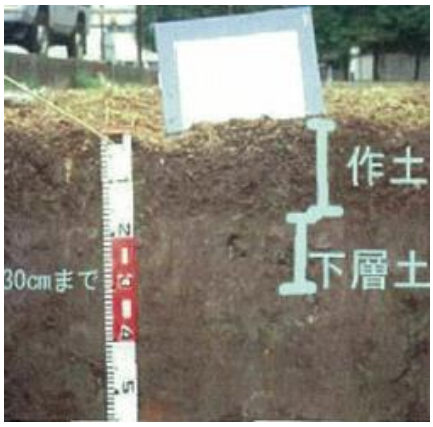


Sampling points at orchards

2. Sampling methods

1) Field with cultivated soil layer

(1) Without ridges: Take samples from the cultivated soil layer and the layer up to the depth of 30 cm from the ground surface (subsoil) (Base case). Record the depth of the cultivated soil layer. When undecomposed organic matter such as fallen leaves, branches and compost are observed on the surface and are to be mixed with the soil by plowing, take samples of the mixture of these. When these materials are to be removed from the field, take soil samples only. When taking a sample right after plowing, step on the soil lightly to pack it before taking the samples.



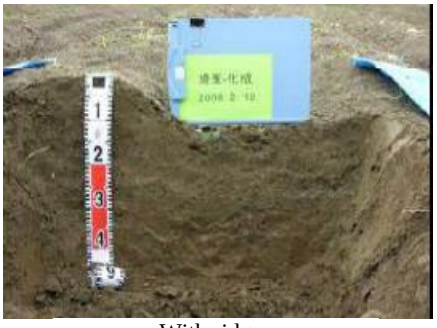
Without ridges

(2) With ridges: Flatten (plow) the ridges and take samples s as the same way as the above. For the subsoil, in the same way as the case without ridges.

(a) Destroy a part of the ridge to flatten the cultivated soil to the average thickness of the ridges and furrows by moderately leveling the soil with the hands or feet

(b) Measure the thickness of the cultivated soil.

(c) Take samples from the formed cultivated soil.

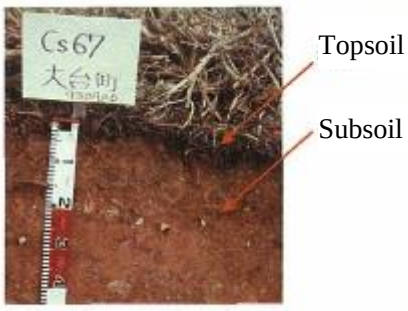


With ridges

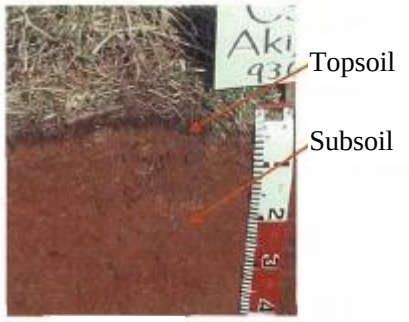
Note: When it is difficult to flatten a ridge because crops have not yet been harvested, samples can be taken from the shoulder of the ridge. In this case, the thickness of the cultivated soil should be assumed to be that when the ridges were flattened.

2) Field without cultivated soil layer

Take samples from the topsoil (0 – 5 cm layer) and the layer up to the depth of 30 cm from below the topsoil. When there are fallen leaves and branches (layer L), crop residues such as rice straw or a root mat layer on the surface, take samples together with them when they are mixed with soil. When these materials are to be removed from the field, take samples from the mineral soil layer underneath these materials.



Tea plantation



Grass land

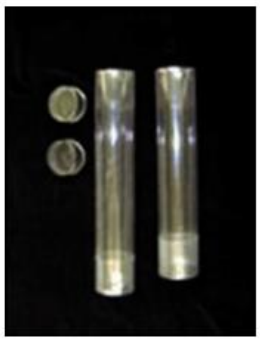
Examples of fields without cultivated soil

3. Sampling of soil with a soil sampler

1) Tools

The tools include a soil sampler with a liner (30 cm in depth), shovels, weighing scales, cutter knives, scissors, plastic adhesive tape, marker pens, plastic labels, etc.

The sampler collects soil to 30 cm in depth with two types of blade edges: angle and bit type. The appropriate edge can be selected depending on the soil properties and the amount of plant roots.



Clear vinyl chloride cylindrical shaped liner

2) Soil sampling points

Follow the instructions of section 1. However, when the cultivated soil is raised and soft, take samples after lightly treading on the soil to pack it.

3) Sampling method

Sampling using a 30 cm sampler

Place the sampler vertically and push it into the soil by turning the handle while applying a force from the top

Remove the handle and take out the cylindrical liner

Attach a cap on the cylindrical liner and put a label with the sample name, etc.

An example of a paddy field sample of gray lowland soil (Clay content: 33%, LiC).

Rotation speed or downward force needs to be controlled depending on the properties and water content of the soil.

Samples should be classified into cultivated soil (or A layer) and subsoil depending on the density and appearance characteristics such as color.

The volume should be calculated from the diameter (50 mm) and thickness of the cylindrical liner.

In the case of the sample in the photo on the left, the zone in the range of 0-13 cm is defined as the first layer and the zone in the range of 13-30 cm is defined as the second layer.

For the first layer,

Volume (cm^3) = 13 x π x 2.5^2

For the second layer

Volume (cm^3) = 17 x π x 2.5^2

Note: When the sampler cannot reach to 30 cm in depth due to gravel and hardpan, take samples at the depth possible and record the depth. When a 30 cm long sample cannot be collected at one time, the cultivated soil and subsoil may be sampled separately. In this case, the subsoil should be sampled by changing the cylindrical liner while the soil sampler remains inserted into the soil.

4) Preparation of samples to measure the specific gravity and radioactivity concentration (See the flowchart)

The cylindrical liner samples are divided into cultivated soil (or top soil) and subsoil. Specific weight of each sample should be determined from its total weight, fractioned quantity, absolute dry weight of the fractioned sample and absolute dry weight of gravel in the fractioned sample.

Flowchart of the soil sampling method

Take soil samples up to 30 cm in depth.

Take five samples at a representative point of an agricultural field.

Separate the soil layer from the surface up to 30 cm in depth into cultivated soil (or topsoil) and subsoil; Measure the specific weight and radioactivity concentration of each layer

Measure the depth of each layer and determine the volume — B

Measure the total weight of samples of each layer — A

Total weight of samples in each layer = A
Volume of each layer = B
Measured weight = C

Separate gravel

Gravel

Soil

Measure radioactivity concentration

Sample portion

E Measure weight

Measure weight — C

Dry at 105 deg C, 12 h

D Measure weight

Specific weight = {(D-E) x (A/C)}/B

4. How to record information on location

1) Numbering

Specify location numbers for this survey.

H0001 (five alphanumerics): Record the number of the fixed survey points when the locations are the same as those used for the fixed point survey in the project to study carbon in the soil.

2) Input of data

Files for location information data of the survey points

- Enter latitudes and longitudes in degrees, minutes and seconds or decimal degrees. Degrees, minutes and seconds are automatically converted to the decimal degrees.
- Use the World Geodetic Systems (WGS84, Japan Geodetic System 2000) for GPS geodetic reference system. Add notes in remarks when the older Japan Geodetic System is used for positioning.
- Input measurements results of ambient dose rates or surface contamination if any.
- Input soil series according to the "Classification of Cultivated Soils in Japan, Third Approximation" for the soil names.

Information on the survey locations

Pref. Code	Location #	Fixed point survey	Address	Latitude			Longitude			Sampling date and time
2 digits	5 digits	5 digits	Letters	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds	
08	H0001	T0003	Tsukuba	138	40	36	35	50	17	2011/05/24/13:30

Dose Rate (1cm)	Surface Contamination	Farmer name (optional)	Land category	Crop	National soil series	Recorded by
μSv//h	cpm	Letters	Letters		Letters	Letters
		Ichiro Taniyama	Rice field	Paddy rice (Koshihikari)	Fine-grained gray lowland soil	Hiroshi Ohara

3) Recording information on soil liner samples

Write the prefecture code, sampling location number, sampling date and time, and person's name who collected the sample on the plastic bags into which soil samples are put.