Reference 5-3

28 September 2011

Methods of collecting samples for measuring radioactivity concentration in the soil

The National Institute for Agro-Environmental Sciences

1. Tools to be prepared

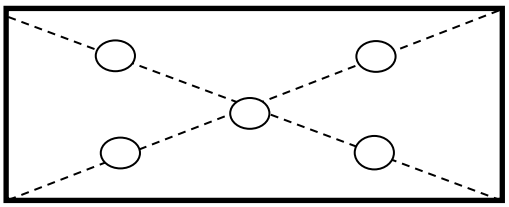
- GPS, digital cameras
- Scintillation survey meters
- Soil sampler with a liner (30 cm in depth)
- Liners, plastic (adhesive) tape
- Soil augers, weighing scales
- Shovels, scissors, cutter knives
- Paper pads for recording data
- Pens or pencils

2. Selection of sampling locations

Survey agricultural fields shall be selected by the prefectural governments. Take photos of the overall area of each survey agricultural field and attach the photos on the back side of the survey form.

3. 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 at or near the same points in the future. When GPS is not available, the latitude and longitude shall be estimated using topographical maps, mapping services on the internet provided by the Geospatial Information Authority of Japan or other types of maps.



A sketch of sampling points
○: selected sampling points

1) General agricultural field (Basic technology)

Sampling points shall be determined with consideration for variations in soil conditions.

2) Deeply ploughed and disturbed agricultural field

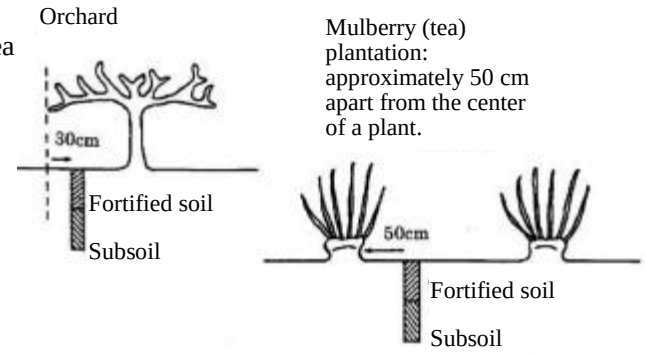
Agricultural field that has been partially deep plowed and disturbed (i.e. drains under the paddy fields, deeply cultivated burdock fields, fertilization trenches in orchards, etc.) should be avoided when selecting sampling points. When the soil of the whole agricultural field is cultivated deeply and disturbed, the sampling points shall be selected in the same way as the basic technology.

3) Agricultural field with cut and filled soil

Agricultural fields on a slope are generally made flat by cutting and filling the soil. For this type of field, the cut and filled area should be selected as one of sampling points.

4) Orchards

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



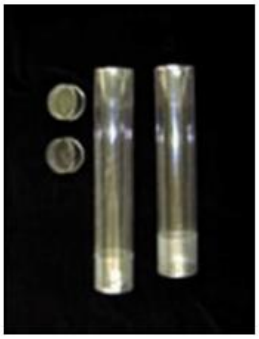
Sampling point of orchards

4. Sampling methods (with a soil sampler)

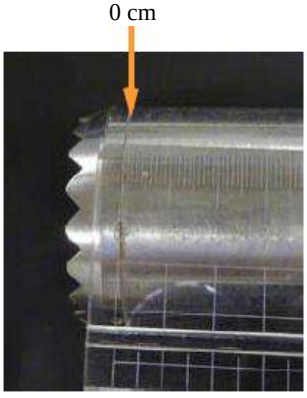
1) Soil sampler with a liner (for soil samples down to 30 cm depth)

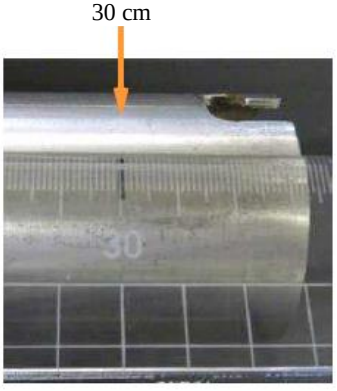
The sampler collects soil of 30 cm in depth with two types of blade edges; angle and bit type. The appropriate edge can be selected depending on the soil properties and the amount of plant roots.

To make it easy to know the correct depth of the soil, a mark may be made at 30 cm on the outside of the sampler using a marker pen. As the tip of the blade and the bottom end of the liner do not fit closely to each other, the location of the mark (30 cm) should be measured from the bottom end of the liner.



Clear vinyl chloride cylindrical shaped liner





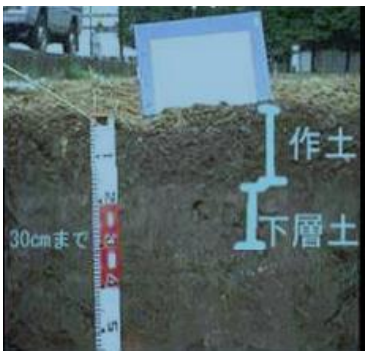
Marking at 30 cm

Preparation of a soil sampler

2) Sampling points

(1) Fortified soil:

(a) Without ridges: When fallen leaves, branches and undecomposed organic matter such as fertilizer on the surface are mixed with soils by plowing, take samples of the mixture of these. When these materials are 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 samples.



Without ridges

(b) With ridges: Flatten (plow) the ridges and take samples in the same way as the above. When it is difficult to flatten a ridge, samples can be taken from the top of the ridge.

With ridges

(2) Unfortified soil:

When the agricultural field is not fortified soil such as in orchards and has a cover of fallen leaves and branches (layer L), or crop residues such as rice straw on the surface or a root mat layer, take sampled of them if they will be mixed with the soil in the future. When these materials are removed from the field, take samples from the mineral layer underneath these materials.

Unfortified soil layer (i.e. tea plantation)

3) Sampling method

(1) Insert a cylindrical liner into a soil sampler and attach the handle.
(2) Place the sampler vertically and push it into the soil by turning the handle while applying a downward force.
(3) Once the sampler reaches the specified point, pull the sampler out from the soil by turning the handle.
(4) Remove the handle and take out the liner. For soil with high viscosity, it is easier when the fingers are used to push the soil out at the blade edge.
(5) For the soil remained beyond the length of the liner to the blade edge, slice it off using a small shovel.
(6) Put a cap on the liner and fit it tight with plastic (adhesive) tape.
(7) Write the sample number, sampling date and time, and the depth on the surface of the liner at a point lower than 15 cm from the top using a marker pen.

Samples are usually taken from the surface soil layer down to 30 cm in depth. However, when the sampler cannot reach to that depth due to gravel and the hardpan, take samples at the depth possible. The depth for these samples are determined by the distance between the 30 cm mark on the sampler and the ground surface (d) and the value (30-d) cm is recorded on the liner and on the survey form.

Place the sampler vertically and push it into the soil by turning the handle while applying force from the top (2)

Remove the handle and take out the cylindrical liner (4)

Boundary between the blade and liner

When the soil remains beyond the length of the liner to the blade edge, slice it off (5)

Place a cap on the liner and write the sample name and the other information (6)

Examples of labeled samples of lowland soil (clay content 33%, Lic) from a paddy field (7)

4) Transportation of samples

Samples taken from a roughly plowed layer at a depth shallower than 30 cm may collapse inside the liner due to vibration during transportation. In order to avoid these collapses and mixing of the samples, the liners containing the soil samples should be kept vertically in a container or a carton box with padding materials while being transported. The soil part should be placed at the top (the cap should be at the bottom).

5) Preparation of samples for measuring radioactivity concentration

(1) Grouping of samples

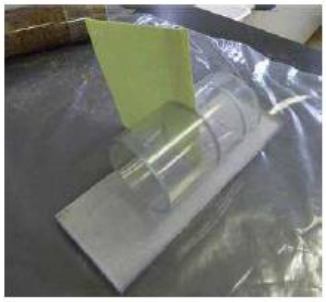
Sampled soil specimens should be grouped by depth to use for measuring radioactivity concentration. They should be divided into two groups: 0-15 cm and other depths.

(2) Methods of cutting, mixing and making sample batches (non-specific samples)

Samples together with the liner should be cut into two parts: 0-15 cm and the rest. For samples where the soil in the liner is tending to collapse, a thin plastic board (for example, a clear plastic file folder or other materials cut into 10 cm squares) should be inserted to the place where the sample is cut to prevent mixing of the soil from the two different depths.

Five 0-15 cm samples collected at five sampling points are emptied into a tray and mixed well. After removing all gravel and plant roots of 2 cm or more, the soil samples are placed in a pre-weighed plastic bag and weighed. The sample weight (difference of the two weights) is recorded in the survey file. The sample number and time/date/month of each sample should be written on each bag and the bagged samples are sent by pay on delivery to a designated organization for analysis.

Five samples collected deeper than 15 cm are kept in their liner, covered with a double plastic sheet over the top using plastic (adhesive) tape to fit the sheet in place and then placed in a padded box and sent by pay on delivery to the National Institute for Agro-Environmental Sciences.



Sample cutting tool

Cut together with a liner into a sample thickness

A thin plastic board is inserted between the cut surfaces when a soil sample can collapse easily

(3) Method of cutting, mixing and making sample batches (samples from designated paddy fields: Fukushima Prefecture only)

Five samples collected at five sampling points at a depth of 0-15cm are emptied into a tray and mixed thoroughly. After removing gravel and plant roots of 2 cm or more, samples should be divided into two amounts with a size ratio of approximately 1:2, placed into two pre-weighed plastic bags and weighed. The sample weight (difference of the two weights) is recorded in the survey file. Sample numbers and time/month/date of sampling are written on each bag. According to the size ratio of the soil sample, the sample bags are sent by pay on delivery to different designated organizations.

5. Record of survey data

The attached survey form is used. The main survey data should be recorded as below:

1) Sample number

New numbers should be allocated for each survey.

xxR0001 (7 letters): xx - prefectural code, R - budget classification code, 4 digits that follow - serial numbers for the prefecture. When surveying at the same place for March /April, the name of the survey location for these months is added after the code.

2) Latitude/longitude

Latitude and longitude are recorded in degrees, minutes and seconds. When indicating decimals, they are recorded in the remarks column. The world geodetic system (WG84, JGD2000) should be used. Positional measurements in the old Japanese geodetic system are recorded in the remarks column. Latitude/longitude is measured using GPS at actual sampling points to the practical as possible extent. When this is not possible, the position should be confirmed using web maps or other maps and recorded on the survey form. Recording the address only should be avoided as the position cannot be precisely determined.

3) Land category and planted items

Land category is selected from five categories; paddy field, common crop field, pasture, orchard or land for agricultural facilities. When growing wheat in paddy fields, the land category is “paddy field” and “wheat” is written in the “plants grown now” entry. For converted fields, the land category and planted items are recorded in the same way. Permanent grass land updated after March has a land category of “pasture” and the name of the grass (i.e., mixed seeding) is recorded in the “plants grown now” entry. Annual pasture (e.g. Italian rye glass) is categorized as common crop field. Fields with fruit trees, tea or mulberry bushes are in the “orchard” land category.

4) Shielding objects around the agricultural field

The deposition of radioactive materials is affected by the topography and buildings. When there are cliffs and large buildings around the soil sampling points, the direction of and distance to the cliffs and buildings should be recorded.

5) Thickness of the fortified soil layer

Determine the thickness of the fortified soil layer by examining the soil structure by inserting a soil auger to a depth of 30 cm. In orchards or grass land where the fortified soil layer is not discernable, record as N/A.

6) Soil classification

Based on the above determination, the type of soil should be recorded according to the soil series grouping of the “Application of Cultivated Soils in Japan, Third Division” as much as possible. If this is not possible, the soil subgroup names (the Third Approximation) or the soil series group names (or the soil subgroup names) of the “Secondary Division” should be recorded.

7) Measurement of radiation dose

Since the distribution map of radioactivity concentrations is to be created referring to a radiation dose map, the relationship between the radiation dose and the radioactivity concentration of the soil at survey points should be

clearly stated. Using a scintillation survey meter, the ambient dose rate should be measured at the survey points. The radiation dose is measured five times at the heights of 1m and 1 cm from the surface of agricultural field at each soil sampling point.

8) Active aluminum (allophone) test

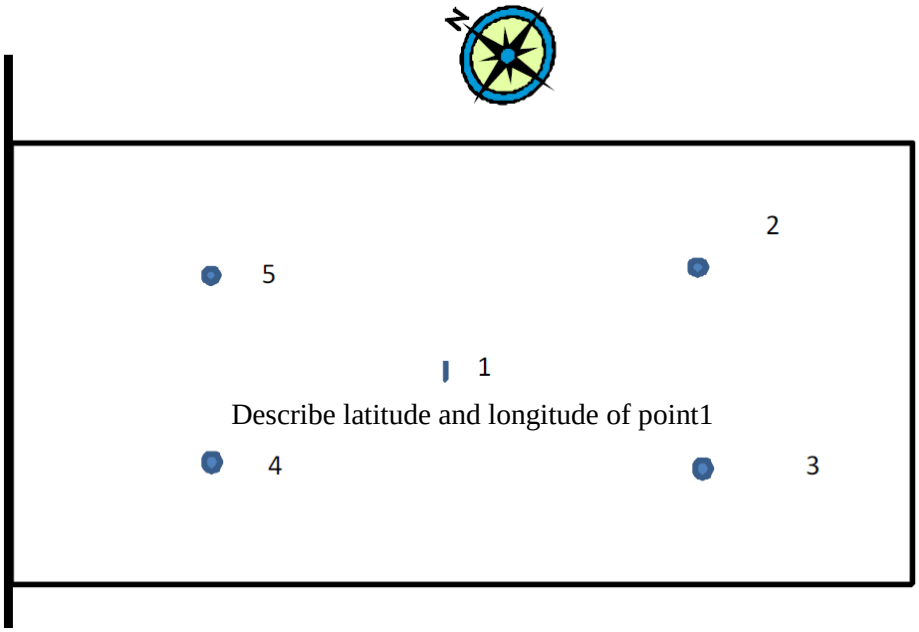
The test results should be recorded in the five steps according to the method shown in the handbook of soil investigation edited by a group of Japanese soil scientists (published by Hakuyusha Co.).

The survey data should be stored in an electronic file and sent to the National Institute for Agro-Environmental Sciences together with the completed survey form.

Survey on radioactive material contamination of agricultural soils Prefecture: Ibaraki						
Sample No.	08R0001 Tsukuba City		Sampling date/time		17 June 2011 at 15:00	
Names of collectors	Kamiyama, Ohara, Takada		Weather		Rain	
Location of the agricultural field	3-1-3 Kannondai, Tsukuba City, Ibaraki (3-1, Farm C of NIAES)					
Latitude and longitude (WGS84)	N	36°	15min	27.4sec	Altitude	20m
	E	140°	6min	24.5sec		
Shielding objects around the agricultural field	Hot houses 5m north of the agricultural field					
Category of land	Paddy field, [common agricultural field,] pasture, orchard, for facilities				Inclination	Flat
Current plants grown	Sunflowers		Planting date		28 May	
Previous plants grown	Wheat					
With/without plowing after 11 March (circle one)	[With]/ Without		Plowing date		26 May	
With/ without mulching (circle one)	With/ [Without]		Mulching date			
With/without straw or weeds (circle one)	[With]/ Without		Condition of straw and weeds		Straw removed	
Gravel down to 30 cm in depth	None					
Allophone test	++					
Classification of soil	Common humic Andosol					
Types of radiation exposure dosimeter			ALOKA TSC161			
Calibration constant			0.3-30=x1.0			
	Point 1	Point 2	Point 2	Point 3	Point 4	Point 5
Radiation dose (1cm)	0.34	0.29	0.31	0.33	0.32	μSv/h
Radiation dose (1m)	0.25	0.2	0.21	0.22	0.23	μSv/h
Depth of plowed soil	16	17	16	17	16	cm
Depth of the soil	30	30	30	29	30	cm

sampler						
Thickness of the soil inside the liner	30	30	30	29	30	cm

A sketch of the agricultural field to be surveyed/ sampling points/ remarks



Survey file (Partial)

				Date of sample collection			Time of sample collection				Latitude and longitude										
No	Prefecture	Sample number	Name(s) of sample collector(s)	Year	Month	Date	Hour	Minute	Weather	agricultural field address	Latitude	Latitude (Min)	Latitude (Sec)	Longitude	Longitude (Min)	Longitude (Sec)	Altitude	Shielding objects around the agricultural field	Inclin-ation of the land	Type of land	Plants grown now