

## Rapid Soil Diagnosis Kit “Midori-kun”

This kit was developed for rapid diagnosis of soil using the soil test paper of ETS Company, USA as a base by the soil science laboratory of Tokyo University of Agriculture. Soil pH(H<sub>2</sub>O) and soil nitrate nitrogen can be checked by “Midori-kun N” test paper, and water soluble phosphate and potassium by “Midori-kun PK” test paper. It is a product of Fujihira Co. Ltd, Tokyo, Japan.

By this kit, following items can be determined:

1. Soil pH and soil nitrate-N concentration,
2. Water soluble phosphate and potassium in soil,
3. Nitrate concentration in leaf stem of tomato, cucumber as a plant nutrition diagnosis kit,
4. Nitrate concentration in spinach and Brassica campestris as a food analysis kit,
5. N, P, K concentration in the nutrient substrate solution as a nutrient solution analysis kit,
6. Nitrate concentration in the ground water as an aquatic quality analysis kit.

How to use “Midori-kun” kit for soil diagnosis

1. Dig a trench or a soil-pit with around 15 cm depth, then insert a soil collection syringe in the central portion of the wall.
2. 5 cc (mL) of soil is collected from 5–10 cm depth.
3. Collected soil (5 cc) is pushed into a plastic bottle (100 mL).
4. Pure water (distilled water or de-ionized water) is added to the 50 mL level of the bottle. The bottle is capped tightly and shaken for 1 minute vigorously.
5. Dip the test paper (“Midori-kun N” and “Midori-kun PK”) into the soil emulsion for three seconds, take out and wait 1 minute for completing the reaction.
6. See the test paper from the backside and compare the developed color with the color chart on the test paper container.

How to use “Midori-kun” for nitrate measurement in plant

1. Cut the leaf stem to small pieces by scissors.
2. Squeeze the leaf stem pieces and collect the squeezed liquid into any appropriate

bottle.

3. Take 0.5 mL of the squeezed solution with a small (1 mL) plastic syringe.
4. Transfer 0.5 mL of the squeezed solution into a plastic bottle.
5. Add pure water to the 50 mL level of the bottle and mix well.
6. Dip the “Midori-kun N” test paper tip for nitrate concentration into the diluted solution for 3 seconds. “Midori-kun PK” test paper should be dipped for 10 seconds.
7. After reacting for 1 minute, compare the color of test paper with the color chart.
8. Multiply 100 to the obtained value to get the original concentration in the leaf stem.

### How to read the color chart of “Midori-kun N”

1. pH(H<sub>2</sub>O) value is applicable only to soil pH. The pH value of water or nutrient solution cannot be determined.
2. Nitrate-N remaining in soil (kg N/10a) can be read directly from the color chart.
3. Nitrate concentration in solution can be read in two modes: NO<sub>3</sub>-N mg/L and NO<sub>3</sub> mg/L.

### Soil diagnosis using the checked value

#### 1. pH(H<sub>2</sub>O)

Optimum pH for plant growth is usually between 6.0 and 6.5. If soil pH is lower than 6, soil-acidity should be corrected by liming. As a liming agent, dolomite (calcium magnesium carbonate) is recommended. Lime requirement cannot be obtained by this rapid method. Please follow the calibration curve method to obtain the lime requirement value. For the purpose of gardening, 100–200 g of dolomite should be applied to 1 m<sup>2</sup> of soil and mixed well.

#### 2. Nitrate nitrogen

Though nitrogen is the most important nutrient for plant, it also causes damage at too high concentration and brings about high soil EC value. Appropriate nitrate-N concentration may differ by plants, but it is around 5 kg/10a. Whether additional application of nitrogen fertilizer is necessary or not can be judged by referring to this value. In the case of greenhouse culture soil nitrate-N often reaches 10–15 kg/10a. In such case, additional nitrogen fertilizer application should be refrained from.

#### 3. Water soluble phosphate

Water-soluble phosphate is the form readily available to plants. However, low

phosphate level (lower than 5 kg/10a) can not be determined by this kit. This kit is recommended for the crop field or greenhouse field where high phosphate concentration is expected. The phosphate concentration higher than 10kg/10a means the excess in phosphate. In such case, decrease in phosphate fertilizer application or no application of phosphate should be considered. Excess in phosphate will cause root knot disease in Brassica vegetable or scam disease in potato.

#### 4. Water soluble K

Water-soluble K is the form readily available to plants. However, K level lower than 5 kg/10a can not be determined by this kit. This kit is recommended for the crop field or greenhouse field where high K concentration is expected. The K concentration higher than 10kg/10a means the excess in K. In such case, decrease in K fertilizer application is recommended.

### Cautions in using “Midori-kun”

1. “Midori-kun” is the rapid soil diagnosis kit. It should be used as a supplemental method for the original and conventional soil diagnosis analysis.
2. Nutrient concentration displayed on the upper column of color chart can be used when soil-water ratio is 1:10 as written in the manual. When the ratio is different from this ratio nutrient concentration in the lower column should be read and multiplied by the adopted soil-water ratio.
3. When the pH of soil-water emulsion is determined both by a glass-electrode pH meter and pH-test paper, two values will not coincide. In “Midori-kun”, the color of the color chart is calibrated so that it will coincide with the reading by the pH meter. Therefore, pH of the solution can not be determined correctly by “Midori-kun”.
4. The only necessary maintenance for “Midori-kun” is the proper preservation of test paper tips. After taking out tips from the container, it should be capped tightly again immediately to keep the remaining tips.

Translated by K. Tsutsuki from the manual of “Midori-kun” for the Group Training Program of JICA on “Environment-oriented Agriculture for Increase of Food Production FY 2011”

## Schedule

### August 18 (Thursday)

- 9:00 Self-introduction
- 9:10 Lecture on soil diagnosis and soil analysis
- 10:30 Practice on soil sampling in the experiment field using a sampling apparatus.  
Collect soil sample using a syringe for rapid soil diagnosis procedure.  
Start drying soil samples
- 12:00 Lunch break
- 13:00 Sieving dried soil samples.
- 13:30 Start sample preparation and shaking for pH and EC  
Weigh soil samples, add water or 1 mol/L KCl.  
Start shaking, continue shaking for 30 min.
- 14:00 Determination of pH(H<sub>2</sub>O), NO<sub>3</sub>-N, water soluble P<sub>2</sub>O<sub>5</sub>, water soluble K<sub>2</sub>O  
using a rapid soil diagnosis kit "Midori-kun"
- 15:00 Measurement of pH(H<sub>2</sub>O) using pH meter
- 15:30 Measurement of pH(KCl)
- 16:00 end

### August 19 (Friday)

- 9:00 Lecture on available phosphate determination
- 9:30 Laboratory practice on Bray No.2 method for available phosphate  
Weigh soil samples. Add extractant. Shake the mixture.  
Filtrate.  
Develop blue color by adding coloring reagents in a 50 mL volumetric flask.  
Prepare also standard mixture for a calibration curve.
- 11:30 Spectrophotometric determination of available phosphate
- 12:00 Lunch break
- 13:00 Determination of electric conductivity (EC).
- 14:00 Practice on calculation of available phosphate.
- 15:00 Summary and comparison of obtained data.
- 16:00 Summary discussion

Data sheet

Sample (plot name):

Rapid soil diagnosis by “Midori-kun”

pH(H<sub>2</sub>O) :

nitrate-N: kg/10a mg/L

water soluble P<sub>2</sub>O<sub>5</sub> : kg/10a mg/L

water soluble K<sub>2</sub>O: kg/10a mg/L

pH(H<sub>2</sub>O) by pH meter:

pH(KCl) by pH meter:

EC(Electric conductivity):  $\mu$  S/cm

Available phosphate (Bray No.2 modified method)

Volume of extractant taken into a volumetric flask:

Absorbance of standard and sample solutions:

Amount of P <sub>2</sub> O <sub>5</sub> ( $\mu$ g)	Absorbance at 710nm
0	
20	
40	
60	
80	
100	
Sample number and name	Absorbance at 710 nm
1:	
2:	
3:	
4:	
5:	
6:	
7:	
8:	

