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Fertilizer synergist - Regulations of efficiency experiment and assessment

肥料增效剂 效果试验和评价要求

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Fertilizer synergist - Regulations of efficiency experiment and assessment

1 Scope

This standard specifies the relevant terms, experiment requirements and contents, effect assessment, report writing and other requirements for the efficiency experiment of the fertilizer synergist.

This standard applies to the assessment of the experiment results of urease inhibitors and nitrification inhibitors.

2 Terms and definitions

The following terms and definitions apply to this document.

2.1

Fertilizer synergist

The general term of urease inhibitors and nitrification inhibitors.

2.2

Urease inhibitors

A certain amount of material added to the urea. It reduces soil's urease activity and inhibits the urea's hydrolysis process, to reduce of ammonia volatilization loss of the amide nitrogen, thereby improving the fertilizer use efficiency.

2.3

Nitrification inhibitors

A certain amount of material added to the ammonium nitrogen fertilizer. It reduces the activity of soil's nitrite bacteria, inhibits the process of conversion of ammonium nitrogen to nitrate nitrogen, so as to reduce the loss of fertilizer nitrogen, thereby improving the fertilizer use efficiency.

2.4

Urease-inhibition rate

The experiment treatment shall be designed according to the type of fertilizer synergist, it shall also fully consider the factors such as the type of nitrogen fertilizer, the amount of application and the uniformity of application of different synergists.

3.3.1 The experiment shall be provided with at least 4 treatments.

- Blank control.
- Conventional fertilization.
- Fertilizers with fertilizer synergist which has iso-nutrient with the conventional fertilization.
- Fertilizers with fertilizer synergist which has iso-nutrient with the conventional fertilization reduced by 10%.

Note: The type of nitrogen fertilizer in conventional fertilization shall be the same as that in the fertilizer synergist applied; the demonstration experiment may not have a blank control.

3.3.2 If necessary, it may increase other experiment treatments.

- Fertilizers with fertilizer synergist which has iso-nutrient as the conventional fertilization reduced by 20% (or higher).
- Recommended fertilizer with the best fertilizer synergist.
- The recommended best application amount of the fertilizer synergist and the conventional fertilizer.

3.3.3 Except for the blank control, other experiment treatments shall specify the time and method of fertilization, including the application rate of base fertilizer, the application rate of top-dressing, the number of applications.

Note: Fertilization methods can be divided into spreading application, hole application, strip application, spraying application, seed soaking, root irrigation, root dipping, and so on.

3.3.4 Each treatment of plot experiment shall be arranged in a random block; the number of repetitions shall not be less than 3.

3.4 Preparation for experiment

3.4.1 Selection of experiment site.

- It shall select an experiment sites with flat terrain, neat shape and relatively uniform soil fertility level.

the plot for densely planted crops (such as rice, wheat, millet, etc.) should be 20 m^2 ~ 30 m^2; the area of the plot for cultivated crops (such as corn, sorghum, cotton, tobacco, etc.) should be 40 m^2 ~ 50 m^2; the area of the plot for fruit trees should be 50 m^2 ~ 200 m^2.

Note: If it is highly treated, the area of the plot should be smaller; if it is less treated, the area of the plot should be larger. The area of the plot should be relatively smaller in hills, mountains, and slopes; whilst the area of the plot should be relatively larger in plains and flat land.

4.4 Requirements for plot shape

The shape of the plot shall generally be rectangular. When the area of the plot is large, the aspect ratio is preferably (3 ~ 5) : 1; when the area of the plot is small, the aspect ratio is preferably (2 ~ 3) : 1.

4.5 Requirements for experiment result

- Each plot shall be harvested separately to calculate yield.
- According to the statistical fertilizer & labor-saving conditions of the plot, calculate the net income and output/input ratio.
- When analyzing the crop quality, it shall take sample in accordance with the requirements for experiment method.

5 Demonstration experiment

5.1 Experiment content

The demonstration experiment is an effect experiment conducted on a widely representative area of farmland, to demonstrate and assess the results of the plot experiment.

5.2 Requirements for demonstration area

- The demonstration area for economic crop shall be not less than 3000 m^2; the demonstration area for control shall be not less than 500 m^2.
- The demonstration area for field crop shall be not less than 10000 m^2; the demonstration area for control shall be not less than 1000 m^2.
- For the demonstration experiments such as flowers, seedlings and lawns, it shall consider their particularity, the experiment area shall be not less than that of economic crops.

5.3 Requirements for experiment result

Appendix A

(Normative)

Fertilizer synergist - Requirements for conditional culture experiment

A.1 Experiment content

Use the conditional culture experiments to evaluate the inhibitory effects of urease inhibitors and nitrification inhibitors on soil's nitrogen transformation. The soil water content is maintained within the range of 65% ~ 80% of the field water holding capacity, the temperature of the constant temperature incubator is (25 ± 2) °C.

A.1.1 Urease inhibitor experiment: Through measuring the amount of $NH_4^+—N$ in the soil at different time points, calculate the difference between each treatment.

Note: Urease inhibitors inhibit soil's urease activity for a period of time, delaying the hydrolysis of urea in the soil; it has a higher content of amide nitrogen as compared with the control, and a lower content of $NH_4^+—N$.

A.1.2 Nitrification inhibitor experiment: Through measuring the amount of $NO_3^-—N$ in the soil at different time points, calculate the difference between each treatment.

Note: Nitrification inhibitors inhibit the activity of nitrite bacteria for a period of time, delaying the conversion of $NH_4^+—N$ to $NO_3^-—N$; it has a higher content of $NH_4^+—N$ as compared with the control, and a lower content of $NO_3^-—N$ as compared with the control.

A.2 Treatment for experiment

A.2.1 The experiment shall have at least the following three treatments.

- Blank control.

- Iso-nutrient fertilizers.

- Iso-nutrient fertilizers, which are added with nutrient synergist.

A.2.2 If necessary, it may add other experiment treatments and control treatment.

- Iso-nutrient fertilizer, which is added with different amounts of fertilizer synergist.

A.5.4 Implementation steps

According to the experiment design requirements, determine the addition amount of material required for the experiment treatment. Respectively weigh 40.0 g of soil and the corresponding experiment materials in a 500 mL beaker, mix it uniformly, transfer them all into a 100 mL beaker, weigh them in turn and mix them uniformly. According to the moisture content of soil, calculate the amount of water to be added to each beaker, uniformly add it into the soil. After using the sealing film to seal it, use a needle to puncture uniformly 5 vents, place it in an incubator at 25 °C for culture, during which it shall timely with and supplement soil moisture. According to the sampling interval requirements, remove the beaker, pour all soils into a 500 mL beaker to mix it uniformly, determine the content of NH_4^+—N or NO_3^-—N as well as the moisture content of soil.

Note: It shall, according to the moisture content of the experimented soil, respectively calculate the mass of the beaker that meets the moisture requirements of the conditional culture, respectively supplement in time the soil moisture according to the quality requirements (the moisture content of the experimented material is considered same as the soil moisture content); the soil sample and the experimented material may be diluted stepwise to mix it uniformly.

A.5.5 Expression of results

A.5.5.1 Urease-inhibition rate is calculated based on mass fraction X_1, the value is expressed as a percentage, calculated according to formula (A.1).

$$X_1 = \frac{c_1 - c_2}{c_1} \times 100\% \quad \cdots\cdots (A.1)$$

Where:

c_1 - The amount of soil NH_4^+—N (calculated by dry soil) treated with iso-nutrient fertilizer, in milligrams per kilogram (mg/kg);

c_2 - The amount of soil NH_4^+—N (calculated by dry soil) treated with iso-nutrient fertilizer which is added with urease inhibitor, in milligrams per kilogram (mg/kg).

A.5.5.2 Nitrification-inhibition rate is calculated by mass fraction X_2, the value is expressed as a percentage, calculated according to formula (A.2).

Appendix B

(Normative)

Fertilizer synergist - Requirements for pot experiment

B.1 Experiment content

The pot experiment is suitable for small-plot experiments, so as to more-accurately assess the effect experiment of fertilizer synergists on inhibiting soil ammonia transformation.

- By artificially controlling the experiment treatment and environmental conditions, to ensure the experiment management consistency of soil temperature, moisture, uniformity of experimented soil's conditioner, crop planting in the experiment vessel.

- The experimented soil in the pot experiment is an unnaturally structured soil, some soil traits may change.

B.2 Experiment requirements

The experiment shall meet the following requirements, the others are implemented in accordance with the requirements of 3.

B.2.1 Collection and preparation of experimented soil

- Determination of collection sites and number of sampling points of soil shall consider the representativeness of the farming area; the sampling depth is generally 0 cm ~ 20 cm. The collection and preparation processes of soil shall avoid contamination.

- Make the collected soil pass through a 5 mm aperture sieve, mix it uniformly.

- For the prepared soil under experiment, indicate the soil name, collection site, collection time, and main soil traits.

B.2.2 Selection of pot

- Pots may be glass pots, enamel iron pots, clay pots and plastic pots.

- The pot size may be selected from 20 cm x 20 cm, 25 cm x 25 cm, 30 cm x 30 cm.

B.2.3 Each treatment shall be randomly arranged, the number of repetition is not less than 4.

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