

## Measurement of soil organic matter problems and its countermeasures

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**Abstract:** Soil is the necessary material base for crops to grow, and the fertility of soil determines the growth and harvest of crops. Therefore, there is a "Crops a flower, all by the fat of the home" this saying. This also shows the importance of soil fertility for crop growth. The Ancients recognized in ancient times the effect of soil fertility on crops, and recognized the importance of four factors in addition to the need for light, temperature, water, and fertility, soil fertility has the greatest impact on crops, and if the soil lacks organic matter, it will affect the final crop yield, poor growth. How to determine soil organic matter is one of the focuses of many agricultural technologists. In order to improve the accuracy and efficiency of the determination of soil organic matter, this paper discusses the methods and techniques of soil organic matter determination.

### 1. Introduction

In recent years, with the continuous development of our country's social economy and the increasing population, the per capita demand for food in our country has greatly increased, and the soil fertility is lacking, or there is a problem of pollution, it directly affects the grain planting and development of our country, even threatens the normal development of our society's agriculture, and brings no small influence to the stable grain supply of our country. The determination of soil organic matter can understand the soil fertility in time, and put forward some feasible countermeasures to solve the related soil problems, and improve the problems such as too much or too little soil organic matter, etc. , this is very linear. The traditional method of soil determination is not applicable now, and it has not got a relatively accurate determination result, which is not conducive to soil determination, because, traditional measurement methods often result in the mismatch between measurement results and policy data. During the process of soil organic matter determination, it is affected by operation, sample selection and so on. We should pay attention to some common problems existing in the process of soil determination, and make a reasonable soil determination method according to the actual needs, so as to improve the effect and accuracy of soil determination, and further improve the efficiency of soil organic matter determination, saving more manpower, material resources and energy. Therefore, it is very important to further improve the method of soil measurement. In the process of soil measurement, some soil measurement personnel do not pay attention to the process and method of soil measurement, which leads to inaccurate results. Therefore, the determination and study of soil organic matter is of great practical significance and value.

### 2. Effects of soil organic matter on crop growth

Soil organic matter has a great influence on the growth of crops, studies have shown that: "Throughout the growth and development of n ginseng, more than 95% of the nutrients from the soil, only about 5% of the nutrients from fertilizer." The influence of organic matter in soil on crops is self-evident. We can find that the main source of nutrients in soil is a few ingredients, which is also the main reason why many people choose organic fertilizer, the ultimate goal is to enhance the organic matter content of the soil. The organic matter in the soil has a great influence on the growth of plants. It can reduce the stickiness of the soil, make the soil softer and more conducive to the production of crops and the absorption of water and nutrients, providing the

necessary infrastructure for crop production and reducing damage to crops and plants can effectively mitigate the adverse effects of pollution and thus contribute to a more balanced soil ecology.

### **3. Strengthen the importance of soil organic matter determination**

#### **3.1 To provide more necessary basis for the treatment of soil problems**

With the continuous development of social economy and the increasing of industrial production capacity, the problems of land become more and more prominent. At present, there are many soil problems, which have a great impact on the natural growth of crops, such as: Soil Desertification, soil salinization, soil erosion, soil pollution and soil degradation. The appearance of such problems usually leads to the deterioration and rapid decline of the soil quality of agricultural cultivated land, and the serious insufficiency of the comprehensive production capacity of agriculture, which directly threatens and affects the safe production of food in our country, it seriously restricts the sustainable development of agricultural economy. The quality improvement of land has become a lot of problems to be solved in land use and consolidation. It is very important to strengthen the determination of soil organic matter for improving soil and making a series of improvement plans, at the same time, it also helps to realize the transformation of land efficient use and land consolidation from a focus on quantity to a focus on both quantity, quality and ecological conservation, and to improve and further enhance the comprehensive benefits of land use, so as to effectively promote the efficient development of land use work<sup>[3]</sup>. In 1997, American soil scientist Deibert proposed that the quality of soil can be judged by the number of earthworms<sup>[4]</sup>. This method is a good method, but it can not really determine the exact content of soil organic matter, but it is an intuitive and simple method to determine soil fertility. Of course, using earthworm counts to determine the quality of the soil can also be used to determine the degree of relaxation of the underlying soil, which, as explained above, helps crops absorb moisture and nutrients. In order to accurately determine the organic matter in soil, it is necessary to use some equipment, instruments to determine. From the view of natural ecological environment and modern agricultural development, it is very important to strengthen the research of soil organic matter determination, it is one of the long-term concerns of global agricultural technology research institutions, organizations and researchers in the future.

#### **3.2 Understand the fertility of the soil**

Soil is not only the foundation of human reproduction and survival, but also a vital part of the food chain, and one of the important foundations of traditional and modern agricultural production systems. In addition, soil is not only an important medium for crop growth, but also maintains crop productivity and affects the quality of the environment and the health of animals, plants and even human beings<sup>[1]</sup>. How the soil organic matter content determines to a great extent the growth of crops, but also determines the final harvest. Therefore, many agricultural technologists pay great attention to the determination of soil organic matter, has been developed, for our understanding of the soil fertility and physical and chemical status is very important indicators. How to measure the content of organic matter in soil accurately by scientific method is one of the important problems related to the development of modern and future agricultural production. Technical experts and related personnel through soil testing formula fertilization and other black soil research projects are impossible without the technical testing of soil organic matter<sup>[2]</sup>. The determination of soil organic matter refers to the use of modern agricultural technology, equipment and instruments to determine the organic content of soil, that is, to determine the carbon content in the soil, so, soil organic matter content is an important measure of soil fertility. When the ancients cultivated wasteland, they used primitive methods such as cutting down trees, cutting grass and burning it to increase soil fertility so as to better grow various crops and crops. Long ago, the ancients understood that the fertility of the soil directly affects the growth of crops and harvests. Modern research has also proved this through scientific experiments. Soil organic matter content determines soil health. In the process of

carrying out environmental protection research projects, soil measurement is one of the tasks that can not be bypassed.

#### **4. Overview of determination methods**

Soil organic matter determination usually refers to the determination of animal and plant remains in the soil or microorganisms and their life activities in the process of organic matter. The determination of soil organic matter is based on the results of soil organic carbon multiplied by conversion coefficients to continue the calculation. At present, the more common methods of measuring organic matter usually include two methods. One is to measure the total amount of carbon dioxide released by combustion after the organic carbon in the soil is oxidized at high temperature, the method involves measuring the carbon content in the soil in the form of carbonates and in the form of elements. The second is through the use of oxidants to determine, mainly to determine the total content of organic carbon consumption of oxidants, and then converted into organic carbon. Currently, the potassium dichromate capacity method is a method commonly used for soil organic matter determination. This method is simple, easy to operate, and has high accuracy. Therefore, many soil technical researchers often apply this method to soil determination to improve the accuracy and efficiency of measurement. At present, potassium dichromate volumetric method is commonly used to determine soil organic matter. The method is simple, easy to operate and accurate. Therefore, many researchers of soil technology often use the method in soil measurement to improve the accuracy and efficiency. The potassium dichromate is used as the sulfuric acid solution in the determination, and a number of different solutions are used to concentrate the determination to serve as a control, prepare some test tubes, alcohol lamps, stand thermometers, flasks, oil pans. Place a stent in the tube during the measurement, then add 0.05-0.5 g of soil to the tube, then add about 10 ml of potassium dichromate sulfuric acid solution to the oil pan, it is then heated with an alcohol lamp until the solution is completely boiling, the coolant is allowed to stand still, then placed in a flask, and then a certain indicator is added, to determine the amount of organic matter in the soil.

#### **5. Problems in determination of soil organic matter content**

##### **5.1 The control of the sample size is not accurate and the heating condition is not well controlled**

(1) At present, too much or too little weighing of soil organic matter results in inaccurate weighing of soil organic matter, which affects the determination of soil organic matter. If the scale is too large, the oxidation of the solution will be incomplete. For example, the oxidation of the solution after cooking is incomplete, which leads to the green of the solution after cooking. In some cases, the operators cannot control the soil for quantity, so that they cannot accurately measure the organic matter content in the soil. Then again, there is a lack of test steps, that is, before the test, the sample is not tested first, and then, the sample is weighed again, but only for a one-time determination.

(2) In the process of soil organic matter determination, the external heating conditions can not be well controlled, which leads to inaccurate determination of soil organic matter. As we all know, in the process of soil organic matter determination, the external heating conditions should be strictly controlled, if the determination time is too long, or the measured temperature is too high, it will also directly affect the determination of organic matter in soil, resulting in inaccurate determination of organic matter content. Some operators, because of neglect of temperature control, or not strictly according to the heating temperature to cook, resulting in inaccurate soil organic matter measurement, a waste of time and energy, need to be re-measured.

## **5.2 Lack of refinement**

In the process of soil organic matter determination, some operators, in order to save trouble or avoid trouble, just wash the determined sample into a triangle bottle, however, the residue from the tube wall and the bottom of the tube was not washed into the triangle flask, thus, the determination value was not accurate enough to reflect accurately the organic matter composition in the soil, result in distortion of the final result of the measurement. In addition, some operators do not pay attention to the amount of iron(2+) sulfate (anhydrous) in the process of titration, which leads to inaccurate titration test data, resulting in large errors in the measurement results.

## **5.3 No attention was paid to the presence of impurities in the test sample**

In the process of determining soil organic matter, the operator, in his eagerness to determine the organic content of the soil, did not notice the presence or absence of impurities in the soil, such as: in the process of selecting the sample did not pay attention to the water content of the sample, or the existence of other reducing impurities, and so on, resulting in the determination of the sample data distortion, a relatively large error, this can eventually affect the measurements, such as when the samples react with a potassium dichromate sulfuric acid solution, resulting in too much data to accurately determine the organic content of the soil. In addition, the purity of the solution itself, then will affect the final determination results, such as: if the potassium dichromate solution with crystallization, will lead to a decrease in solution concentration, this will lead to the final determination of the result is not accurate.

## **6. Determination of organic matter content in the determination of the solution to the problem**

### **6.1 Strictly control the sample size and control the external heating conditions**

#### **(1) Strictly control the sample quantity**

In the process of determining soil organic matter, if the soil organic matter content can not be determined, the test sample may be determined first, and then, in the calculation of the next batch of samples of organic matter content, only accurate determination of soil organic matter content, can be accurately determined. In practice, the normal weight of soil is 0.2 g, when the organic content is more than 50 g/KG, then the appropriate reduction of 0.1 G. Practice has proved that if the soil if the weighing is too large, it will lead to inaccurate sample measurements. The final weighing value can be accurately determined by the method of reduction weighing to 0.0001 g, that is, the sum weight of the sample and the paper is weighed first, and then the weight of the paper after the soil sample is taken is weighed, subtracting between the two gives the difference between the values. If the oxidation is not complete, the sample size should be reduced appropriately, and then the measurement should be repeated. For example, the operator should be aware that the volume of the iron(2+) sulfate (anhydrous) solution is too small for the measurement of soil organic matter, that is, less than 1/3 of the normal volume, then there is incomplete oxidation, at this time to reduce the soil weighing.

#### **(2) Control the external heating conditions**

Control of external heating conditions with the continuous improvement of soil determination methods, some researchers have introduced and improved heating methods to improve the efficiency and accuracy of soil organic matter determination, more and more heating methods have been applied in soil measurement, including microwave oven, digestion oven and constant temperature oven. Although these methods are becoming more common and more accurate, whatever method is used requires strict control of the temperature and time of cooking. If the potassium dichromate solution is too hot, it will decompose. For example, during oil bath heating, the preheating temperature is usually controlled between 185 ° C and 190 ° C during cooking, the temperature can be controlled from 170 ° C to 180 ° C during the cooking process<sup>[5]</sup>. If the temperature and time of heating and cooking are too long, it will cause the solution to decompose.

During the operation, the time will be counted when the melt in the tube starts to boil, of course, it is important to note that only when the surface of the solution begins to boil is the true boiling of the solution, and the heating of the solution produced bubbles is not the true boiling, so this needs to be identified. Heating time is usually 5 minutes, and after digestion of the test-tube solution is mainly yellow solution, and with a layer of green.

### **6.2 Pay attention to fine operation, improve the accuracy of determination**

In the process of soil determination, we must pay attention to fine operation, strictly follow the relevant procedures, pay attention to the non-loss operation of the sample, and must transfer the sample residue in the test tube to the triangle bottle, in order to more accurately determine the composition of soil organic matter. It is important to note that cleaning does not result in loss of samples, so it is safe to do so while keeping the volume of solution in the flask between 50ml and 60ml. Operators must follow the relevant procedures when doing drip operation, not too much drip can not be too little, once more or less will lead to numerical measurement distortion, data is not accurate. In the process of intravenous drip, we need to pay attention to the changes in the solution. Usually, when the measurement solution from yellow to brown red gradually can be, because this color change is the final change in color. Because the process of drip is operated by manual, it is necessary to operate carefully in the process of drip, to reduce the error as much as possible, so as to improve the accuracy of soil organic matter determination, get the most accurate data.

### **6.3 Pay attention to whether there is too much water or impurities in the test sample, pay attention to the purity of the solution**

In the process of determining soil organic matter, it is important to note whether there is too much moisture in the sample. The operator can judge by the naked eye. If the naked eye can see that the sample is wet, the sample can be spread out and allowed to air dry for a while, and then the determination can be carried out. For the presence or absence of impurities in the test sample, sample screening can be carried out, and then, multiple batches of samples are determined to obtain the most accurate values, and then one of them is selected to determine the best data, identification of the components of the sample, and detection of the consumption of the solution can be, so that the sample can also identify the presence of other reducing substances. In the choice of solution, it must be noted that there is a lot of crystallization at the bottom of the solution, if too much crystallization should be replaced by a new solution to ensure the accuracy of the determination. Therefore, we should pay attention to the determination of the purity of the solution in the process of the test, to select the higher purity of the detection solution in advance, in order to better next for the accurate determination of soil organic matter to make full preparation, at the same time, it is necessary that the testing personnel must carry out the testing according to the related test requirements, and standardize the selection standard of the materials needed for the experiment, so that all kinds of testing standards can be carried out and implemented according to the established standards.

## **7. Conclusion**

The determination of soil organic matter has a lot of influence on various agricultural production and cultivation, and is more related to the growth and harvest of crops, so, in order to improve the accuracy of the determination of soil organic matter, it is necessary to guarantee the operational method and process of the determination and to control the time and temperature of the determination, as well as the purity of the determined samples and solutions, improve the efficiency of soil organic matter determination. Through the above-mentioned introduction and analysis, it is not difficult to see that soil organic matter in the determination process needs to be combined with the actual situation, determination requirements to carry out the determination, only to standardize the test method and behavior of test operators, etc. , can be more conducive to the determination of soil organic matter, reasonable to put forward some feasible measurement solutions. To sum up, in the determination of soil organic matter in the process of the choice of soil samples, a variety of

experimental equipment, instruments and testing methods, scientific, rigorous and reasonable to determine, it is necessary to strengthen the supervision of the operators so that the supervisors can carry out the measurement according to certain standards and improve the effect and efficiency of the measurement, especially to save more manpower, material resources and so on, improve the effect and quality of the test and improve the efficiency of the test.

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