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Research on Improvement of Experimental "Growth Sites of Roots"

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Abstract. The “Growth of Roots” is a teaching experiment of biology course in the middle school. The four parts of the apical root have no obvious demarcation in appearance, and the total length of the three parts of the elongation zone, the meristematic zone, and the root crown is only about 3-7 mm, which makes the experiment difficult to complete. Some changes were made to the materials and methods, then obvious results were achieved.

Introduction

"Growth site of root" is a teaching experiment in the middle school biology course. During the course of practice, some problems were encountered. During the process of solving the problem, the materials and methods of the experiment were partially modified and obvious effect. Roots are organs that adapt to land life as a result of long-term evolution of plants. It is derived from the radicle of the seed and constitutes the underground part of the plant. Roots are important for plants to absorb water and inorganic salts. In the root structure, the fastest growing part is the root tip, and the root tip refers to the root tip to the rooting hair part. It includes the root crown, meristem, elongation and mature areas.

The instruction of the textbook for the experiment was to take a red bean seedling about 2 cm in length and mark each part of the young root, measure the length, and compare it with the length measured after water was incubated for 24 hours. In practice, it has been found that red bean seedlings grown from water have poor visibility of root hairs and are not easily observed by students. The roots all contain a thin layer of waxy substance that is not easily marked and is not easily marked by washing with soap and water. After marking, the root tip is severely damaged, which is inconvenient for students to observe, which affects the smooth development of the experiment, and red beans are not easily obtained. Zhuang Feng [1] proposed to use measurement to cut the roots of different parts of the young roots in order to determine which part of the root tip grows fastest and can better solve the problem.

However, the operation is difficult (the four apical parts do not have a clear demarcation in appearance, and the total length of the three parts of the elongation zone, the meristematic zone, and the root cap is only about 3 to 7 mm, and it is difficult to remove it accurately.) Moreover, the integrity of the organism is damaged, and at the same time, the root damage will affect the growth of the root. The growth status of the roots of different parts of the apical roots may be different from the growth conditions of the intact roots, so as to determine which part of the root tip grows fastest, and the experimental results make the students questioned. Experimental teaching plays a very important role in biology teaching. The success or failure of the experiment directly affects the students' interest in this chapter. It may also affect the students' interest in this course. In the course of practice, the experimental materials and methods are as follows: Change to make the experiment more intuitive and vivid.

Materials Selection For Cultivation

Use larger, straighter roots (approximately 2 cm in length) as the material. After the seeds germinate (about 0.5 cm in root length), they are transferred to a beaker for cultivation. The culture method is as shown in (Fig. 1):

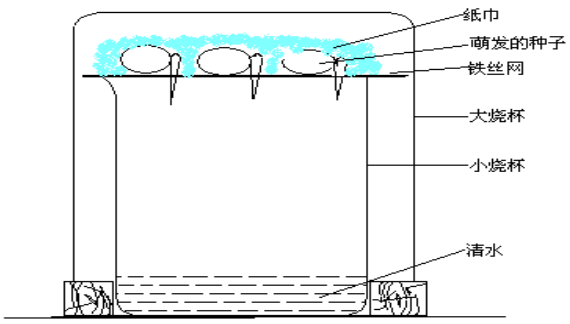

Figure 1. Finite Cultivation of seedlings

Place the germinated seeds on a barbed wire with the roots straight down and use paper towels to fix and moisturize them in the gaps. Add a small amount of water to the small beakers and cover them with a large beaker to keep the environment moist. In this way, it is not easy to take root in an object and it is not easy to take a root, so that the root tip is damaged, which is easy to cause death, and it prevents the excessive bending of the root[2]. The young roots that are produced are straighter, which is conducive to measurement, and there are no more smooth cuticles on the young roots to facilitate marking.

The Mark On the Root Tip

Most plants are about 3 cm long from the tip of the root, which is morphologically called the apex [3]. Observe the structure of the root tip and observe it with a simple method [4] (observe with the naked eye or a magnifying glass: the mature part is located in the upper part of the root tip, the white root hair is dense; it is a smooth and white part between the growth area and mature area. The area is about 2 to 5 mm long. The cells are significantly elongated in the long axis and are elongated. They are located in the cap-shaped root and are light or dark yellow. They are small in size. Most of them are wrapped by root irrigation and are about 1 to 1 in length. The 2 mm is the meristem; it is located at the very tip of the root, with a translucent, cap-shaped structure, and it is covered with a root crown on a yellowish growing point.) This method is very good, but for students of junior students, it is more vague and difficult to identify.

According to observations, there are no obvious boundaries on the root tips of the seedlings, of which only mature areas and root crowns can be identified, and the elongation area is not easily identified. Because the shape and the partition of the root were observed with a magnifying glass, the root crown of the slightly transparent portion of the root tip was cap-shaped. Most of the meristem area is covered by the root crown, and the upper part is connected with the extension area, and there is no obvious boundary between the appearance and the extension area. The top part of the apical root is the root hair area. The root hair is an extension of the outer wall of the epidermis. It is a unique structure of the roots of the plant. It is generally tubular, and the cuticle is very thin. It is not branched and is about 0.08 to 1.5 mm in length. It varies with plant species. A small section between it and the meristem is the elongation zone, which is generally about 2 to 5 mm long [5]. Therefore, the four parts of the apex are indistinguishable, and their division is only artificial. Therefore, in the observation of the "root structure" experiment, let students guess the function of each part, and ask what part of the root of the problem grows fastest? Discuss the experiment program briefly - After marking the measurement method, let students use the oily pen to do mark. The labeling method is as shown in (Fig. 2):

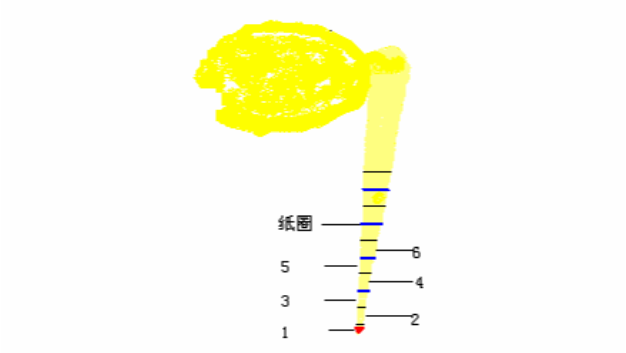

Figure 2. Finite Apical mark

The young roots were cultured to a length of approximately 2-3 cm and then removed. The fine line was drawn from the tip upwards (0.2 cm) and the "root crown" was only 0.1 cm (ie, 0.1 cm from the tip to the first line).), and in turn marked as No. 1, No. 2, No. 3, No. 4 ... every 0.4 cm and then use the filament-like label paper ring, can't be loose, nor too tight[6]. Although this mark can't tell the specific location and length of each part, the change of the equidistance line is obvious, and there will be obvious dents (or a paper circle break) in the part marked with a paper circle. According to observations, the growth of the two parts of the meristem and the root canopy is not obvious, and the combined growth is less than the elongation zone. Indiscriminate labeling does not affect the "fastest growth of the root tip" experimental results[7] .

Observation And Record

For the roots of soybean (or about 3cm in length) marked with an oil-based pen, the upper part is covered with a water-impregnated tissue or the like, and the lower part is not in contact with the container[8]. This not only prevents rooting in the object, but also prevents the root from being damaged. And it can prevent the oily mark from blurring or disappearing and affect the second measurement of the experiment. Measurement records and observations are:

Table 1 Measurement record table

Segment number	No.1	No.2	No.3	No.4	No.5	No.6
Length before test/cm	0.1	0.2	0.2	0.2	0.2	0.2
Length after 24h/cm	0.7	0.6	0.5	0.2	0.2	0.2
Net increase/cm	0.6	0.4	0.3	0.0	0.0	0.0

Observe the phenomenon: At the place marked with paper strips, some paper strips have obvious cracks, and some do not[9]. However, after removing the paper strip, it can be seen that there is an obvious light yellow dent on the young root. There is a large protrusion about 1cm from the cotyledon, which is conical from the root tip to its place (small to large). There is always a dark cap at the tip of the apex. There are more protrusions about 1.5cm closer to the top[10].

Results analysis

Based on the above data and observations, the following conclusions can be drawn: The fastest root tip growth is about 0.5 cm from the tip, because the growth of the two parts of the meristem and the root crown are not obvious, and they grow together. The length is also less than the elongation zone. Indiscriminate marking does not affect the experimental results, so the fastest growing root tip is the elongation zone.

References

[1] Mohamed, A., Shoker, A., Bendjelloul, F., Mare, A., Alzrigh, M., Benghuzzi, H., & Desin, T. (2003). Improvement of experimental allergic encephalomyelitis (EAE) by thymoquinone; an oxidative stress inhibitor. *Biomedical sciences instrumentation*, *39*, 440-445.

[2] Matter, A. M., Folweiler, K. A., Curatolo, L. M., & Kline, A. E. (2011). Temporal effects of environmental enrichment–mediated functional improvement after experimental traumatic brain injury in rats. *Neurorehabilitation and neural repair*, *25*(6), 558-564.

[3] Wittwer, T., Fehrenbach, A., Meyer, D., Brandes, H., Albes, J., Richter, J., & Wahlers, T. (2000). Retrograde flush perfusion with low-potassium solutions for improvement of experimental pulmonary preservation. *The Journal of heart and lung transplantation*, *19*(10), 976-983.

[4] Postlethwaite, J. C., Goyle, K. B., Dormandy, J. A., & Hynd, J. W. (1977). Improvement in experimental vascular graft patency by controlled defibrinogenation. *British Journal of Surgery*, *64*(1), 28-30.

[5] Page, J. W. (1932). An improvement in experimental method for investigation of vitamin G. *Proceedings of the Society for Experimental Biology and Medicine*, *30*(1), 87-88.

[6] Hu, J., Li, M., Zhao, L., Xia, B., & Ma, Y. (2015). Improvement and experimental research of CO2 two-rolling piston expander. *Energy*, *93*, 2199-2207.

[7] Garrido, S., Schubert, E., & Bangert, D. (2016). Musical prescriptions for mood improvement: An experimental study. *The Arts in Psychotherapy*, *51*, 46-53.

[8] Kamimura, Y., Yamashita, A., Yamazaki, M., Enomoto, S., Wake, K., & Ugawa, Y. (2015). Improvement of experimental system for tracking the threshold of current perception. *Bulgarian Journal of Public Health*, *7*(2 Suppl. 1), 87-93.

[9] Amrouche, B. (2014). Improvement and experimental validation of a simple behavioural model for photovoltaic modules. *Solar Energy Materials and Solar Cells*, *128*, 204-214.

[10] Fu, K., Murphy, J., Yang, M., Otto, K., Jensen, D., & Wood, K. (2015). Design-by-analogy: experimental evaluation of a functional analogy search methodology for concept generation improvement. *Research in Engineering Design*, *26*(1), 77-95.