

Effects of Light Rare Earth Compound Fertilizer on Physiological Characters of Dechang Tobacco in Liangshan

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Abstract: in this experiment, tobacco leaves were planted in different regions in Dechang County, Liangshan Prefecture. According to different planting areas, the same concentration of LREE foliar compound fertilizer was sprayed to improve the quality of tobacco leaves. The results showed that the application of LREE foliar compound fertilizer could not only increase the content of Na and K in tobacco leaves, but also inhibit the content of Cl - in tobacco leaves. At the same time, it can also improve the continuous combustion of flue-cured tobacco, improve the overall quality of tobacco, so as to achieve the expected goal.

1. Introduction

The application of rare earth in agriculture has been studied at home and abroad. Most of the research on rare earth elements is mainly used to promote cereal crops, and its promotion is also carried out on cereal plants [3], compared with less research on tobacco and other economic crops [4]. Rare earth elements refer to the 17 elements of scandium, yttrium and lanthanide in the periodic table of chemical elements [5]. China is rich in rare earth resources, with rare earth as the basis for agriculture. Liangshan Prefecture is the main tobacco producing area in Sichuan Province, and the cultivation technology of tobacco is very important. Rational fertilization [6] as a cultivation technology applied to tobacco is very important for the increase of tobacco yield.

The related research mainly includes: Jia Jia et al. [7] dipped the root of strawberry, sprayed rare earth fertilizer and other treatments. Finally, the research shows that rare earth fertilizer can improve the disease resistance and agronomic traits of strawberry, and also improve the yield of strawberry. Yao Lu [8] found that rare earth phosphate fertilizer can not only promote maize emergence, but also improve the yield structure of maize itself. Zhang Changyun [5] studied the nonessential physiological elements in flue-cured tobacco, and concluded that rare earth element itself has enzymatic effect, and rational use of rare earth fertilizer can improve the yield of tobacco. Xiong bin [9] and others studied the effects of different application methods of rare earth fertilizer on tobacco leaves, and the main purpose was to solve the effects of different spraying methods of rare earth fertilizer on aroma substances in tobacco leaves. Gao Huajun [10] and others used rare

earth element fertilizer, mainly to study the effect on the yield and quality of flue-cured tobacco. All the above studies failed to study the effect of a specific rare earth element compound fertilizer on tobacco leaf traits in specific areas. Therefore, on the basis of the previous experiments, more specific research is carried out, and relevant data are obtained through more precise tests, so as to provide theoretical basis for the large-scale promotion and use of this cultivation technology.

2. Materials and Methods

2.1 Selection of Test Site and Test Object

The experiment was conducted in Dechang County, Liangshan Yi Autonomous Prefecture, Sichuan Province from March 2019 to September 2020. Dechang County is the distribution center of tobacco planting in slope farmland of Liangshan Yi Autonomous Prefecture, which is a good demonstration area.

The local tobacco varieties were selected in the experiment. In the process of planting, it is necessary to spray LREE compound fertilizer on the leaf surface of tobacco leaves. After spraying and harvesting, tobacco leaves with high maturity and bright color are selected for subsequent data determination.

2.2 Experimental Design

2.2.1 Test Group

The experiment needs to set up three experimental groups, the first group (blank), the second group (spraying once rare earth compound fertilizer), and the third group (spraying three times rare earth compound fertilizer). According to the conventional planting method.

2.2.2 Fertilization Methods

First of all, spray 0.04% rare earth solution on the leaf surface of tobacco [11] (Note: the time of spraying on the leaf surface is before 10 a.m., spray on the front and back of tobacco leaf, subject to wet dew on the leaf surface without dripping). Secondly, the first group (blank) did not spray rare earth compound fertilizer; the second group started Spraying Rare Earth Compound Fertilizer on the 5th day after transplanting, but only once; the third group started spraying the first rare earth compound fertilizer on the 5th day after transplanting, spraying the second rare earth compound fertilizer after 5 days, and spraying the third rare earth compound fertilizer after 10 days. The concentration of rare earth compound fertilizer sprayed three times should be consistent.

The main component of the rare earth solution is the rare earth nitrate containing cerium. In the spraying process, it is necessary to add water to the rare earth nitrate and adjust its pH value to 5. The application rate of foliar fertilizer (measured by REO) is 50g / mu.

2.3 Determination Index and Method

2.3.1 Determination of Na, K, Ce and Cl - in Tobacco Leaves

The tobacco leaves (plants) were sent to the professional testing center for determination according to the technical requirements for sample analysis of eco geochemical evaluation (dd2005-03) and silver nitrate titration (GB / T 575.05-2006).

2.3.2 Determination of Continuous Burning Time of Flue Cured Tobacco

The processed tobacco samples were sent to Xichang cigarette factory of Sichuan Zhongyan for determination. The combustibility of tobacco refers to the free flameless combustion performance of tobacco or cigarette after ignition. The combustion properties of tobacco include smoldering, free burning rate, combustion uniformity and combustion completeness. Generally, the combustion duration (tobacco leaf) or free combustion rate (cigarette) are used to describe the combustibility of tobacco [12]. In this experiment, the burning duration of flue-cured tobacco was used as an index to measure its combustibility.

The flue-cured tobacco to be tested was pretreated and then divided into 7 groups. Finally, the arithmetic mean value of the continuous burning time of each group of flue-cured tobacco was calculated as the combustion performance value of this group of flue-cured tobacco.

3. Test Results and Analysis

3.1 Spraying Lree Foliar Compound Fertilizer with the Same Concentration in Different Tobacco Planting Areas, the Content Changes of Na, K and Ce Are Shown in Table 1.

Table 1 Detection Results Of Na, K and Ce in Tobacco Leaves from the Same Planting Area

Sample number	Test items and results		
	Na	K	Ce
1	0.02%	1.67%	0.001%
2	0.02%	2.42%	0.006%
3	0.03%	2.52%	0.008%
4	0.03%	2.58%	0.009%
5	0.04%	3.07%	0.012%
6	0.04%	3.15%	0.017%
7	0.05%	3.78%	0.018%

It can be seen from the test results in Table 1 that Na elements in plants have less changes after spraying light rare earth compound fertilizer, mainly due to the increase of K and CE. K is a necessary element in metabolism of plants. The lack of K will affect the transformation and transportation of sugar in plants, and thus affect the photosynthesis and transpiration rate of plants themselves. With the same concentration of light rare earth (containing Ce) compound fertilizer on the leaf surface, the spraying times of different areas are different in different planting areas. K content increased with the increase of Ce content. This is consistent with the study of poplar family [4], which can promote the absorption of potassium in tobacco by enhancing the enzyme activity and physiological metabolism of plants. Meanwhile, the planting land also feedback that the tobacco leaves with light rare earth compound fertilizer have better growth.

3.2 Spraying Lree Foliar Compound Fertilizer with the Same Concentration in Different Tobacco Planting Areas, the Change of Cl - Content is Shown in Table 2.

Table 2 Detection Results Of Cl - in Tobacco Leaves from Different Planting Areas

Sample number	Test items and results
	$\rho(\text{Cl}^-)/\text{mg/L}$
1	495.25
2	402.37
3	325.89
4	316.20
5	276.15
6	204.77

7	180.96
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It can be seen from table 2 that the content of Cl⁻ in tobacco leaves in different planting areas decreased with the different times of spraying LREE compound fertilizer. The results are consistent with the expected results.

3.3 The Results of Continuous Burning Time of Flue-Cured Tobacco in Different Areas Are Shown in Table 3.

Table 3 Results of Continuous Burning Time of Flue Cured Tobacco in Different Areas

	T1(s)	T2(s)	T3(s)	T4(s)	T5(s)	average value (s)
blank	22.51	23.54	24.78	25.43	29.52	25.16
1	25.89	26.74	27.32	27.96	28.71	27.32
2	24.91	25.62	26.52	27.03	28.01	26.42
3	22.46	23.72	24.24	25.43	26.13	24.40
4	20.51	21.76	22.35	23.41	24.32	22.47
5	18.72	19.45	20.03	21.31	22.41	20.38
6	16.92	17.99	19.02	20.89	21.31	19.23
7	14.02	15.78	16.52	17.89	19.01	16.62

As mentioned above, elements are the main components of tobacco, and also play an important role in the growth and development of tobacco [14] and combustion [15]. It can be seen from table 3 that the continuous burning time of flue-cured tobacco decreased with the increase of spraying times of LREE compound fertilizer in different planting areas. The continuous burning time of flue-cured tobacco is closely related to its K content. According to the data in Table 1, table 2 and table 3, the content of K element and Cl⁻ in tobacco leaves will affect the continuous combustion time of flue-cured tobacco. The higher the content of K element and the lower the content of Cl⁻, the shorter the continuous combustion time of flue-cured tobacco and the better the combustion performance of flue-cured tobacco.

4. Conclusion

Although rare earth elements are not the physiological essential elements of tobacco leaves, they are the characteristic elements that have an important impact on the internal quality of tobacco leaves. In the process of planting tobacco, the rare earth elements are not only from the soil, but also from the soil. From the above study, it can be clearly seen that in different planting areas, different times of light rare earth compound fertilizer was sprayed on the planted tobacco leaves. With the application of light rare earth foliar compound fertilizer, the content of CE in tobacco leaves was increasing, the content of K was increasing, and the content of Cl⁻ was decreasing. The purpose of adding CE was to increase K and inhibit Cl⁻, so as to improve the quality of tobacco leaves. The increase of K also provided a strong proof for improving the continuous combustion performance of flue-cured tobacco.

In conclusion, the results showed that spraying LREE (containing Ce) foliar compound fertilizer could not only increase the content of K in tobacco leaves, but also inhibit Cl⁻. It provides a strong basis for improving the continuous combustion of flue-cured tobacco, improving the quality of flue-cured tobacco in Dechang County of Liangshan Prefecture, and also makes a certain preparation for promoting the technology in the future.

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