Effects of Combined Application of Chemical Fertilizer and Microbial Fertilizer on the Chemical Components Contents of Flue - Cured Tobacco Leaves

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Abstract. [Objective] To determine the effect of microbial fertilizer combined with compound fertilizer on the chemical composition content of flue-cured tobacco leaves. [Method] Before planting the flue-cured tobacco, the local conventional fertilizer varieties and microbial fertilizer were applied to tobacco pond annular hole according to the conventional dosage. The experiment has four groups with different treatments, namely T1: without any fertilization; T2: 4 kg of pure nitrogen per mu, applying humic acid organic-inorganic compound fertilizer with 50 g/plant when planting tobacco; T3: reducing the total amount of conventional fertilization by 50%, and applying 80 g/plant of microbial fertilizer; T4: applying only 80 g/plant of microbial fertilizer. The trial adopted a randomized block design, with 3 replicates for each treatment. After the tobacco leaves were harvested and cured at the maturity stage, 5 kg of the lower (X2F), middle (C3F) and upper (B2F) first-cured samples were taken for chemical composition determination and analysis. [Results] The results show that T3 treatment can effectively increase the total sugar, reducing sugar, total nitrogen, nicotine, potassium, and chlorine content in X2F, C3F, and B2F grade tobacco leaves, which ratios are between 20.10% ~ 21.03% and 18.90% ~ 19.90%, 2.68% ~ 3.26%, 2.28% ~ 3.15%, 2.21% ~ 2.50%, 0.56% ~ 0.72%, meeting the production standards of high-quality tobacco. Secondly, T4 treatment can significantly improve the sugar-alkali ratio, nitrogen-alkali ratio, and potassium-chloride ratio of X2F grade tobacco leaves, and it can improve the sugar-nitrogen ratio of C3F and B2F grade tobacco leaves, but the effect is not significant; T3 treatment has a significant effect on B2F grade tobacco leaves. The nitrogen-nitrogen ratio of tobacco leaves has a significant effect on improving the sugar-nitrogen ratio, potassium-chloride ratio and the sugar-nitrogen ratio of X2F ~ B2F grade tobacco leaves, but the effect has not reached a significant level. [Conclusion] Microbial fertilizer combined with compound fertilizer can improve the content of chemical components in flue-cured tobacco. On the whole, the application effect of T3 treatment is better, that is, the application effect of 80 g/plant microbial fertilizer and 50% reduction of conventional chemical fertilizer is more ideal.
1. Introduction
The chemical composition of flue-cured tobacco is the material basis for the formation of flavor style and quality characteristics of tobacco leaves, which is an internal factor that determines quality characteristics such as smoking quality and smoke characteristics, and is also an important indicator of tobacco leaf quality identification [1-3]. Studies have shown that the total sugar, reducing sugar, total nitrogen, nicotine, potassium, chlorine and other chemical components in tobacco are important indicators for evaluating the internal quality of flue-cured tobacco [4].

[Research significance] In recent years, the over-dependence on chemical fertilizers in tobacco production has damaged the ecological environment of tobacco growing soil in China, resulting in the deterioration of the tobacco-growing soil quality and soil structure, the decline of soil organic matter, and nutrient imbalance, which indirectly leads to the quality and the aroma of tobacco leaves deteriorate [5-6]. Therefore, in view of the problems of flue-cured tobacco cultivation and production, the improvement of fertilization measures is of great significance to improve soil quality and promote the production of high-quality tobacco leaves.

[Previous research] Microbial fertilizer has the characteristics of stable fertilizer efficiency and no pollution to the soil environment [7], it can make up for the defects of chemical fertilizers to a certain extent. Studies have shown that microbial fertilizer have potential application value in various aspects like improving the fertility of tobacco-growing soil [8] and the rhizosphere soil microbial community environment [9], overcoming continuous cropping obstacles [10], improving the quality of flue-cured tobacco [11], saving costs, and increasing efficiency [12] and so on. Deng et al. [13] have shown that the combined application of water-soluble fertilizers with microbial fertilizers can improve soil physical and chemical properties and enzyme activities, agronomic traits of tobacco plants, and economic traits and quality of flue-cured tobacco leaves to varying degrees. Xu et al. [13] compared the effects of three different microbial bacterial fertilizers on the growth and quality of flue-cured tobacco. The results showed that microbial fertilizers can promote tobacco plant growth and increase the yield and output value of flue-cured tobacco; among them, in Xunyang, the Kun teng microbial inoculum used in the county and the bi-algae bio-organic fertilizer 2.0 used in Luonan County have a better effect, which can reduce the nicotine content, increase the potassium to chlorine ratio, and improve the coordination of chemical components. Guo et al. [15] studies have shown that microbial fertilizers can improve the quality of tobacco leaves. The tobacco leaves with Jinnong fertilizer showed good performance in oil content and color, suitable chemical composition and good coordination.

[Penetration points of this paper] Although there have been reports on the improvement of the quality of flue-cured tobacco by increasing the application of microbial fertilizer, there are few reports on the application of microbial fertilizer on tobacco on the basis of reduced application of chemical fertilizers. [Key issues to be solved] For this reason, in this experiment, different ratios of compound fertilizer and microbial fertilizer were selected as fertilizer sources, and a one-time fertilization method was adopted. The chemical composition of tobacco leaves after different treatments was determined by collecting tobacco samples in different periods, and the improvement effect of different dosage of chemical fertilizer combined with microbial fertilizer on tobacco chemical composition was compared. These efforts are expected to provide the basis and beneficial reference for reducing chemical fertilizer and increasing green yield in flue-cured tobacco production.

2. Materials and methods

2.1 Overview of the test site
The test site is located at the Maitreya Breaking Base in Honghe Prefecture, with an altitude of 1451 m, east longitude: 103°27′36″; north latitude: 24°23′22″. The soil type is red soil, the soil texture is light loam, and the terrain is flat. The irrigation conditions are good, the vegetation conditions are also good, and the previous crop of wheat is buried.
2.2 Test materials
The tested flue-cured tobacco variety was K326, and the microbial fertilizer was selected from Wuhan Kono Biotechnology Co., Ltd.’s Shilibang, with a composition of 500 million Bacillus subtilis + jelly-like Bacillus sp., organic matter≥60%, humic acid≥10%. Compound fertilizer is a humic acid organic-inorganic compound fertilizer commonly used by local tobacco farmers to grow flue-cured tobacco.

2.3 Experimental design
There are 4 treatments in the experiment: T1 no fertilization; T2 conventional fertilization, that is, 4 kg pure nitrogen (N) per mu, and when tobacco is planted, humic acid organic-inorganic compound fertilizer 50 g per plant was applied in a circular way and covered with dry and fine soil until fertilizer disappeared; T3 reduced the total amount of conventional fertilization by 50%, combined with 80 g of microbial fertilizer per plant; T4 only applies microbial fertilizer. All treatments and fertilization methods were one-time fertilization, and field management was carried out in accordance with local standardized cultivation measures. The spacing between tobacco plants was 1.2 m × 0.55 m. The experiment adopted a random block design, with 3 replicates for each treatment, 60 tobacco plants in each treatment plot, about 39.6 m² (excluding the area of the protection line), and protection lines were set between each plot.

2.4 Measurement indicators and methods
After the flue-cured tobacco was harvested and cured at the maturity stage, the variegated and inferior tobacco leaves were removed, and 5 kg of the lower (X2F), middle (C3F) and upper (B2F) first-cured samples were taken for chemical composition analysis of the tobacco leaves. The measurement indicators include total sugar, reducing sugar, total nitrogen, nicotine, potassium, and chlorine content. On this basis, the sugar-alkali ratio, sugar-nitrogen ratio, nitrogen-alkali ratio and potassium-chlorine ratio were calculated. Among them, total sugar, reducing sugar, total nitrogen, nicotine, chlorine, and starch were measured by continuous flow analyzer, and potassium was measured by flame spectrophotometry.

2.5 Data analysis
Excel was used to classify and sort the chemical composition data of flue-cured tobacco leaves, and SPSS was used to further analyze the effects of various fertilization treatments and sampling times on the quality of flue-cured tobacco. After the multiple comparisons, DUNCAN (p <0.05) was used, and a histogram was drawn by Origin2018 mapping software.

3. Result and analysis
3.1 The effect of different microbial fertilizer application rates on the chemical composition content of flue-cured tobacco leaves
Table 1 shows the effect of applying microbial fertilizer on the chemical quality of flue-cured tobacco leaves. According to Wang et al. [16] tobacco quality standards for evaluation, in general, the total sugar content of the flue-cured tobacco leaves of the four treatments with microbial fertilizers was between 11.05% ~ 23.29%, the ratio of reducing sugar content was between 10.04% ~ 19.90%, and the ratio of total nitrogen content was within the range of 1.78% ~ 3.26%, the ratio of nicotine content is between 1.20% ~ 3.15%, the potassium content is between 0.94% ~ 2.50%, and the chlorine content is between 0.22% ~ 0.72%. The sugar-alkali ratio is between 6.23% and 10.89%, the sugar-nitrogen ratio is between 4.67% and 7.19%, the nitrogen-alkali ratio is between 1.02% and 2.01%, and the potassium-chloride ratio is between 2.71% and 6.43%.
Table 1: Effects of different application rates of microbial fertilizer on chemical components of flue-cured tobacco leaves

| Rank | Treatment | Total sugar (%) | Reducing sugar (%) | Total nitrogen (%) | Nicotine (%) | Potassium (%) | Chlorine (%) | Sugar alkali ratio | Ratio of sugar to nitrogen | Ratio of nitrogen to alkali | Potassium chloride ratio |
|------|-----------|-----------------|-------------------|-------------------|--------------|---------------|--------------|------------------|---------------------------|---------------------------|--------------------------|
| X2F  | T1        | 11.05 c         | 2.15 b            | 1.36 c            | 0.36 b       | 7.38 c        | 4.67 c       | 1.38 b           | 3.44 b                    |                           |                          |
|      | T2        | 18.75 b         | 16.23 b           | 2.29 b            | 1.19 b       | 0.51 a        | 10.89 a      | 1.54 b           | 3.51 b                    |                           |                          |
|      | T3        | 18.90 a         | 2.68 a            | 2.36 a            | 2.21 a       | 0.66 a        | 8.01 b       | 7.05 a           | 3.35 b                    |                           |                          |
|      | T4        | 17.13 b         | 15.18 c           | 2.96 a            | 1.47 b       | 0.55 a        | 10.33 a      | 5.13 b           | 3.48 a                    |                           |                          |
| C3F  | T1        | 13.32 c         | 2.26 d            | 1.20 c            | 0.22 c       | 9.88 a        | 5.24 c       | 1.88 a           | 5.73 ab                   |                           |                          |
|      | T2        | 22.62 a         | 17.01 b           | 2.91 b            | 2.16 b       | 0.35 b        | 8.42 b       | 5.85 b           | 6.17 a                    |                           |                          |
|      | T3        | 20.97 a         | 19.64 a           | 3.26 a            | 2.50 a       | 0.56 a        | 6.23 d       | 6.02 ab          | 4.46 c                    |                           |                          |
|      | T4        | 19.97 b         | 16.45 c           | 2.39 b            | 1.59 c       | 0.30 b        | 6.91 c       | 5.78 c           | 5.30 b                    |                           |                          |
| B2F  | T1        | 12.93 c         | 1.78 c            | 1.81 b            | 0.94 c       | 6.61 c        | 6.72 b       | 0.98 c           | 2.94 b                    |                           |                          |
|      | T2        | 21.29 a         | 16.95 b           | 2.37 b            | 2.11 b       | 0.61 a        | 8.03 ab      | 7.15 a           | 3.43 a                    |                           |                          |
|      | T3        | 21.03 a         | 19.90 a           | 2.87 a            | 2.31 a       | 0.72 a        | 8.73 a       | 6.93 ab          | 3.21 a                    |                           |                          |
|      | T4        | 19.33 b         | 14.74 c           | 2.05 bc           | 2.01 ab      | 0.52 ab       | 7.33 b       | 7.19 a           | 2.71 b                    |                           |                          |

3.1.1 Comparison of the chemical composition of the same grade tobacco leaves in different treatments

It can be seen from Table 1 that in the X2F grades cured tobacco leaves, the contents of reducing sugar, nicotine, total nitrogen, potassium, and chlorine in T1 ~ T4 treatments are 10.04% ~ 18.09%, 1.36% ~ 2.36%, 2.15% ~ 2.96%, 1.24% ~ 2.21%, 0.36% ~ 0.66%, respectively; sugar-alkali ratio, sugar-nitrogen ratio, nitrogen-alkali ratio, and potassium-chloride ratio are between 7.38% ~ 10.89%, 4.67% ~ 7.08%, 1.14% ~ 2.01%, 3.35% ~ 6.43%. Among them, the reducing sugar contents of T1 and T4 treatments are less than 15.20%, which is lower than the standard of high-quality tobacco (16.00% ~ 20.00%); in the treatment of T3, the nicotine content only meets the standard of high-quality tobacco (1.50% ~ 3.50%), and its proportion is 2.36%; the total nitrogen content of the 4 treatments is within the standard range of high-quality tobacco leaves (1.50% ~ 3.50%); the potassium content of the T1 and T4 treatments are lower than the standard of high-quality tobacco leaves (> 1.50%), and their contents are 1.24% and 1.35% respectively; the chlorine content of T1 ~ T4 treated tobacco leaves meets the standard of high-quality tobacco (0.30% ~ 0.80%); secondly, the ratio of sugar and alkali in T1 treatment only accounts for 7.38%, which does not meet the standard content of high-quality tobacco (8.00% ~ 12.00%); The ratios of sugar and nitrogen in T2 and T3 treatment were 7.08% and 7.05% respectively, which meet the standard of high-quality tobacco (6.00% ~ 10.00%); it is worth noting that the ratio of nitrogen to alkali in T1 ~ T4 treatments are all higher than the standard of high-quality tobacco (0.80% ~ 1.00%), but the potassium-chloride ratio in T4 treatment only meets the high-quality tobacco leaf standard (≥ 4.00%).

In C3F grade tobacco leaves, the contents of reducing sugar, nicotine, total nitrogen, potassium, and chlorine in T1 ~ T4 treatment are between 11.85% ~ 19.64%, 1.20% ~ 3.15%, 2.26% ~ 3.26%, 1.26% ~ 2.50%, 0.22% ~ 0.56%, and sugar-alkali ratio, sugar-nitrogen ratio, nitrogen-alkali ratio, potassium-chloride ratio are in the range of 6.23% ~ 9.88%, 5.24% ~ 6.35%, 1.03% ~ 1.88%, and 4.46% ~ 6.17%. Among them, the total nitrogen contents of these four treatments are within the standard for high-quality tobacco; but the contents of reducing sugar, nicotine, potassium, and chlorine in the T1 treatment are all lower than the standard for high-quality tobacco production, and their proportions were 11.85%, 1.20%, 1.26%, 0.22%; T3 and T4 treatments sugar-alkali ratios are 6.23% and 6.91%, respectively, which are lower than the standard for high-quality tobacco; T1 and T2 sugar-nitrogen ratio cannot meet the standard for high-quality tobacco, and their content is 5.24% and 5.85%; The ratio of nitrogen to alkali in the T1 ~ T4 treatments are all above the standard for high-quality tobacco, and their ratios of potassium to chlorine are all within the range of the standard for high-quality tobacco.

In B2F grade tobacco leaves, the content ratios of reducing sugar, nicotine, total nitrogen, potassium, and chlorine in T1 ~ T4 treatments are between 11.97% ~ 19.90%, 1.81% ~ 2.28%, 1.78% ~ 2.87%, 0.94% ~ 2.31%, 0.32% and 0.72%, respectively. Sugar-alkali ratio, sugar-nitrogen ratio, nitrogen-alkali ratio, and potassium-chloride ratio are between 6.61% ~ 8.73%, 6.72% ~ 7.19%, 0.98% ~ 1.26%, 2.71% ~ 3.43%. Among them, the only contents of reducing sugar and potassium in T2 and T3 treatments meet...
the standards for high-quality tobacco, and their contents are 16.95%, 19.90%, 2.09%, and 2.31%; the contents of nicotine, total nitrogen and chlorine in T1 ~ T4 treatments are all meet the standards for high-quality tobacco. However, sugar-nine ratios are only 6.61% and 7.33% in T1 and T4 treatments, which are lower than the standards for high-quality tobacco. The sugar-nitrogen ratios of T1 ~ T4 are all within the range of high-quality tobacco standards. Only nitrogen-alkali ratio of T1 treatments meet the standards of high-quality tobacco, and its ratio is 0.98%; unexpectedly, the potassium-chloride ratios of these four treatments in this experiment were all lower than the standard for high-quality tobacco.

As shown in Figure 1, in X2F grade tobacco, compared with no fertilizer (T1), single application of compound fertilizer (T2), microbial fertilizer combined with halved compound fertilizer (T3) and single application of microbial fertilizer (T4) can increase the sugar-alkali ratio, sugar-nitrogen ratio, nitrogen-alkali ratio, and potassium-chlorine ratio of tobacco leaves. In terms of sugar-alkali ratio, the difference between T2 and T4 treatments is not significant, and the effect of T2 and T3 on the improvement of tobacco leaf sugar-nitrogen ratio is basically the same. The improvement effect of nitrogen-alkali ratio and potassium-chlorine ratio of tobacco leaf in T4 treatment is obvious. It is worth noting that the effect of T1 treatment on the sugar-nine ratio and nitrogen-nine ratio of C3F grade tobacco leaves is higher than that of the other three treatments, and it also improved the potassium-chloride ratio of tobacco leaves, but the difference did not reach a significant level. This result needs to be verified again in the subsequent experiments. T3 treatment improves the sugar-nine ratio, sugar-nitrogen ratio, nitrogen-nine ratio and potassium to chlorine ratio in B2F grade tobacco leaves, but the difference was not significant.

3.1.2 Comparison of the chemical components of different grades of tobacco leaves in different treatments

According to Table 1, the contents of sugar-nine ratio of tobacco leaves in X2F, C3F, and B2F grades are in the range of 7.38% ~ 10.89%, 6.23% ~ 9.88%, 6.61% ~ 8.73%, and the contents of sugar-nitrogen ratio are between 4.67% ~ 7.08%, 5.24% ~ 6.35%, 6.72% ~ 7.19%; the distribution ranges of nitrogen to alkali ratio content are between 1.14% ~ 2.01%, 1.03% ~ 1.88%, 0.98% ~ 1.26%; the ratios of potassium to chlorine are between 3.35% ~ 6.43 %, 4.46% ~ 6.17 %, 2.71% ~ 3.43 %. Combining Table 1 to draw Figure 2, it can be seen that the chemical composition ratio of each tobacco leaf in the T1 ~
T4 treatment showed an overall downward trend in the X2F ~ B2F grade. It also shows that the single application of compound fertilizer (T1) and single application of microbial fertilizer (T4) can both improve the sugar-nine ratio content of X2F grade tobacco leaves. Secondly, adding microbial fertilizer (T3) on the basis of half compound fertilizer had a better effect on the sugar-alkali ratio of B2F grade tobacco than compound fertilizer (T2) alone. In terms of the ratio of sugar to nitrogen in tobacco leaves, the T3 and T4 treatments with microbial fertilizers have improved the chemical composition, and the T4 treatment has a significant effect on improving the nitrogen-alkali ratio and the potassium-chlorine ratio of the X2F grade tobacco leaves. The T3 treatment has a significant effect on nitrogen-alkali ratio and potassium-chlorine ratio of the B2F grade tobacco also have obvious effects.

In general, the addition of microbial fertilizer on the basis of compound fertilizer for flue-cured tobacco can improve the chemical composition of flue-cured tobacco leaves to a certain extent. Among them, T4 treatment can significantly improve the sugar-alkali ratio, nitrogen-alkali ratio, and potassium-chloride ratio of X2F grade tobacco leaves. It also improves the sugar-nitrogen ratio of C3F and B2F grade tobacco leaves to a certain extent, but its effect is not significant; T3 treatment significantly improved the nitrogen-alkali ratio of B2F grade tobacco, and improved the sugar-nitrogen ratio of X2F ~ B2F grade tobacco, but this effect has not reached a significant level. In addition, it also has a certain improvement effect on the sugar-alkali ratio and potassium chloride ratio of B2F grade tobacco leaves.

Fig.2 Comparison of chemical components in different grades of tobacco leaves among different treatments

4. Discussion
In recent years, people in the industry have paid more and more attention to the chemical quality of tobacco leaves as the total sugar, reducing sugar, total nitrogen, nicotine, potassium, and chlorine in tobacco leaves are important indicators to measure the intrinsic quality of tobacco leaves and their flavors. [1, 17]. The sugar-nine ratio, sugar-nitrogen ratio, nitrogen-alkali ratio, and potassium-chloride
ratio of tobacco leaf are used to characterize whether the chemical components of the tobacco leaf are coordinated, and are also the key inspection indicators for controlling the quality of cigarettes in production \[17, 18\]. To explore the effects of different fertilization methods on flue-cured tobacco production, this study used 4 different fertilization methods to analyze the total sugar, reducing sugar, total nitrogen, nicotine, potassium, and chlorine in X2F, C3F, and B2F grade tobacco leaves after harvesting and curing. The content was determined, and the sugar-alkali ratio, sugar-nitrogen ratio, nitrogen-alkali ratio, and potassium-chloride ratio were calculated, and the effect of different fertilization methods on the chemical composition of flue-cured tobacco was clarified. The results show that the combined application of microbial fertilizer treatment (T3) on the basis of halving the compound fertilizer of flue-cured tobacco can increase the total sugar, reducing sugar, total nitrogen, nicotine, and potassium in X2F, C3F, and B2F grade tobacco to a certain extent. The ratio of potassium and chlorine content is between 20.10% ~ 21.03%, 18.90% ~ 19.90%, 2.68% ~ 3.26%, 2.28% ~ 3.15%, 2.21% ~ 2.50%, 0.56% ~ 0.72%, which meet the international high-quality tobacco leaf standards, the chemical composition of total sugar (18.00% ~ 22.00%), reducing sugar (16.00% ~ 20.00%), total nitrogen (1.50% ~ 3.50%), nicotine (1.50% ~ 3.50%), potassium (>1.50%), chlorine (0.30% ~ 0.80%) content requirements\[16\]. This is similar to some research reports in this field. For example, Wang et al. \[20\] have studied the effects of different biomass charcoals on the growth and quality of flue-cured tobacco. The results show that the effect of biomass charcoal on the chemical composition content of C3F grade tobacco leaves is greater than that of B2F grade; secondly, the chemical compositions of tobacco leaves with a biomass charcoal dosage of 0.20 kg/plant and 0.40 kg/plant are closer to the standard of high-quality tobacco leaves. Chen et al. \[21\] have shown that the application of Woyido microbial fertilizer can reduce the nicotine content of tobacco leaves, while also increasing the potassium content of tobacco leaves, which makes the internal chemical components of flue-cured tobacco more harmonized. Some researchers believe that the most important chemical elements that affect the main aroma components of flue-cured tobacco are total nitrogen, nicotine and protein. The specific manifestations are that higher total nitrogen, nitrogen-alkali ratio and lower total sugar, nicotine, and protein are beneficial to the main aroma components of flue-cured tobacco highlight. \[22\] Soil is an important environmental factor affecting the quality of flue-cured tobacco. The application of conventional chemical fertilizers, microbial fertilizers, organic fertilizers or biomass charcoal will affect the physical and chemical properties of the soil and indirectly change the quality of flue-cured tobacco. Studies have pointed out \[22\] that nitrogen is an important nutrient element that affects the yield and quality of tobacco leaves, and sugar is an important indicator for identifying the quality of flue-cured tobacco. They can reflect the supply capacity of nitrogen and carbon by the content of total nitrogen and nicotine, total sugar and reducing sugar in the tobacco leaves. In this study, the total sugar, reducing sugar, total nitrogen and nicotine content of tobacco leaves in T3 treatment are higher than other treatments. We speculated that the application of microbial fertilizer increased the C/N content in the soil, thereby increasing the ratio of disaccharides and nitrogen in tobacco leaves. Secondly, this study found that the two treatments T3 and T4 with additional application of microbial fertilizer, compared with T1 and T2 treatments, have a better improvement effect on the compositions of sugar-nine ratio, sugar-nitrogen ratio, nitrogen-nine ratio, and potassium-chlorine ratio of B2F grade tobacco leaves, and their ratios are closer to the production requirements of high-quality tobacco. Microbial fertilizer is a kind of functional fertilizer with stable and long-lasting fertilizer effect and harmless to the soil environment. However, the effect of using it alone is not ideal \[7\]; conventional chemical fertilizers have the shortcomings of fast fertilizer efficiency but short fertilizer supply time. Therefore, by combining microbial fertilizer with reduced-dose compound fertilizer, we can not only reduce the amount of chemical fertilizer, but also avoid the insufficiency of microbial fertilizer in the using process, thereby ensuring the demand for nutrient elements in the process of tobacco cultivation. This study is only a preliminary method of using microbial fertilizers and compound fertilizers to explore the effect of this fertilization method on the quality of flue-cured tobacco, which is to provide a certain experimental basis for the improvement of fertilization methods in tobacco cultivation. However, the number of samples processed in the
experiment is limited, in the future, more experiments need to verify the effect of combined application of microbial bacterial fertilizer and reduced compound fertilizer on the chemical composition of tobacco.

5. Conclusion
Microbial fertilizer combined with compound fertilizer can improve the content of chemical components in flue-cured tobacco. To sum up, the application effect of T3 treatment is better, that is, the combined application of microbial fertilizer 80 g/plant reduces the amount of conventional chemical fertilizers by 50%.

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