Scholar Publishing Group
Academic Journal of Environmental Biology
https://doi.org/10.38007/AJEB.2020.010404
ISSN 2789-8407 Vol. 1, Issue 4: 29-39

Improvement Effect of Biological Bacterial Fertilizer on Soil Ecological Environment Based on Data Mining Algorithm

Rashide Gulun*

Institute of IT & Computer Science, Afghanistan

**corresponding author*

Keywords: Data Mining Algorithm, Biological Bacterial Fertilizer, Soil Ecological Environment, Soil Improvement

Abstract: Soil is the basis of agricultural production, but in the process of industrial improvement, the corresponding discharge of by-products, and chemical agricultural production methods have caused more and more serious soil pollution. Due to the slow soil formation process, restoring the microecology of the degraded soil is an effective way to expand the area of agricultural land, increase food production and improve the soil environment. The research purpose of this paper is to improve the effect of biological bacterial fertilizer on soil ecological environment based on data mining algorithm. In the experimental method, it is necessary to calculate the membership function value of the compost index, and use the soil comprehensive evaluation index to analyze the principal components of each compost treatment and Comprehensive evaluation of composting effect and soil improvement effect. The results showed that the addition of compound inoculants and organic compost could improve the soil well, among which, the commercial bacterial compost had the best improvement effect.

1. Introduction

At present, in terms of agricultural land, soil pollution is mostly due to people's unreasonable use of land and extensive application of chemical fertilizers, resulting in serious soil pollution problems [1]. Soil contamination is difficult to detect in a short period of time, and by the time the problem becomes apparent it is too late. As the most promising soil improvement technology at present, soil conditioners can stabilize soil structure while maintaining soil moisture. At this stage, through the efficient use of bioremediation technology, soil pollution can be properly treated, and soil structure conditioners can improve There are many types of soil conditioners, with obvious advantages and disadvantages, and the improvement process is not yet clear. The remediation effect of the

combination of amendments and manure on degraded soil needs to be tested through practice.

As an alternative to chemical fertilizers, biological bacterial fertilizers can improve crop yields and soil fertility.Ohnuki T believes that the fate and associated radioactive effects of radioactive Cs deposited after the Fukushima accident depend on their movement from surface soils to forest ecosystems. The accumulation of radioactive Cs in fruiting bodies of wild mushrooms from the Fukushima forest in Japan was measured. The transfer factor of radioactive Cs from soil to fruiting bodies of wild mushrooms is similar to the reported range of fruiting bodies collected after the Chernobyl accident in Europe and nuclear destruction in parts of Japan. Comparison of wild mushrooms and mushroom hyphae grown on stock and agar medium showed that wild mushrooms had lower TF. After adding mineral zeolite, vermiculite, phlogopite, smectite or illite to the agar medium, the TF was less than 0.1. These results suggest that the presence of minerals reduces the uptake of Cs by fungi grown on agar medium, while filamentous fungi accumulate [2]. According to Mr. King, the demand for water is steadily increasing due to high population growth and urbanization and industrialization. The limited supply of surface water makes water supply increasingly dependent on groundwater. With increasing reliance on groundwater, groundwater quality and availability is becoming an increasingly important issue. Once groundwater is contaminated, contaminants remain in the semi-contaminated aquifer, and while it is technically impossible to restore the contaminated water to its natural state, remediation requires effort and favorable prices. Therefore, the importance of preventing groundwater pollution cannot be overemphasized. In this regard, it is of great significance to make clear provisions in relevant laws and regulations for the sustainable and effective management of domestic water resources. Worldwide, groundwater remediation is often performed concurrently with soil remediation [3].The research on the improvement of soil ecological environment by biological bacterial fertilizer is of great significance to deeply understand the effect of biological bacterial fertilizer application on soil nitrogen supply capacity.

This paper clarifies the soil status, soil amendments, data mining, and studies the concept of biological bacterial fertilizer, research overview and the effect of biological bacterial fertilizer on soil properties in the bio-bacterial fertilizer profile. In the experiment, the soil improvement effects of the compound microbial bacterial fertilizer and the self-developed compound microbial inoculant for composting, as well as the blank compost and commercial bacterial compost were compared and analyzed. The experiment set a blank control group. In the experimental method, it is necessary to calculate the membership function value of the compost index, and use the soil comprehensive evaluation index to analyze the principal components of each compost treatment and comprehensively evaluate the composting effect and soil improvement effect.

2. Research on the Effect of Biological Bacterial Fertilizer on Soil Ecological Environment Based on Data Mining Algorithm

2.1. Status of Soil

Soil is an important material basis for human production and life, and is an important resource that is difficult to regenerate. The effect of soil management and use directly affects agricultural production [4]. With the rapid improvement of social economy and large-scale human activities, the area of polluted soil has been continuously expanded, and the degree of damage has become more and more serious, which has seriously affected the realization of the strategic goal of sustainable improvement. Modern agriculture has affected the natural environment. In order to achieve the goal of high yield, the excessive use of chemical fertilizers and pesticides has damaged the soil, which

has become one of the important global environmental problems [5]. Today, my country's population is increasing, and the demand for residential land is increasing, which has led to the gradual reduction of agricultural land and the gradual increase in human demand for food. This contradiction cannot be solved by simply increasing the planting area. Therefore, simply relying on the increase of soil nutrients alone cannot meet the needs of the people. The use of chemical fertilizers in my country has rapidly increased grain production, but long-term application of inorganic fertilizers cannot maintain soil organic carbon levels and nutrients. Intensive agriculture relies heavily on the application of synthetic fertilizers and continuous monoculture, both of which lead to considerable environmental risks and economic losses.

The acidified and saline-alkali soils in our country are large, and the soil surface is hardened and agglomerated, leading to a vicious circle of soil degradation and the use of chemical fertilizers. Under the conditions that my country focuses on the improvement of ecological environment construction and environmental protection and safety, it is urgent to restore damaged soil and restore soil microecology. Therefore, the implementation of contaminated soil remediation activities is one of the most important means to achieve sustainable socioeconomic improvement by isolating pollution sources into the food chain and preventing them from harming human health [6].

2.2. Soil Conditioner

Since the late last century, my country's food demand has increased year by year. Due to the large population in my country and the small per capita arable land, it is necessary to increase the grain yield per unit area by increasing soil fertility, which has led to the rapid growth of chemical fertilizer application in China. The current situation that the use of farm manure, organic manure and other fertilizers has gradually decreased [8-9]. Most of the nutrients in crops are taken from soil, so soil nutrient content determines agricultural yield. The use of chemical fertilizers can directly increase soil nutrients and significantly increase agricultural yields. However, due to the huge differences in the materials covered by fertilizers and the differences in the preservation state of fertilizers before use, it is difficult to estimate the actual utilization of fertilizers. In addition, due to natural factors such as rainfall, some chemical fertilizers follow the inflow of surface rainwater into the groundwater, which is harmful to the environment adverse effects [8]. When chemical fertilizers are used, excessive application of fertilizers to the soil can cause environmental pollution or excessive losses due to the volatilization of nitrogen in the soil in the form of gases and ions. Therefore, testing the characteristics of various fertilizers is beneficial to estimate the amount of nutrients provided by the fertilizers to the crops, it is necessary to test the characteristics of fertilizers before use [10-11].

2.3. Overview of Biological Bacterial Fertilizer

(1) Research overview of biological bacterial fertilizer

Bio-bacterial fertilizer is a compound fertilizer rich in a variety of functional bacteria made by adding artificial beneficial microorganisms to organic waste and fermented at high temperature. It can also be called bio-organic fertilizer or bacterial fertilizer [13]. According to my country's agricultural industry standards, biological bacterial fertilizer not only has the characteristics of organic fertilizer, but also includes the function of microbial inoculum. Biological bacterial fertilizer itself has a certain fertility, which should be distinguished from pure bacterial strain or inoculum. Biological bacterial fertilizers can be directly applied to farmland, while inoculants need to be co-applied with other organic substances [14]. Bio-bacterial fertilizer is a microbial product with

very low harm to crops and soil. Compared with chemical fertilizers that are widely used now, it can be found that bio-bacterial fertilizer has the following characteristics. The first is to not destroy the soil structure, and can effectively improve the soil fertility; the second is to meet the economic and environmental double standards, that is, it can promote the growth of crops without polluting the environment, and is harmless to humans, animals and crops; Wastes such as pomace and garbage, as recyclables, are easily available in large quantities, making them low-cost and easy to popularize; finally, the fertilizer effect is lasting and the yield is increased, which is determined by the activity of functional bacteria [15].

(2) The concept of biological bacterial fertilizer

Biocatalysis is a technology that uses enzymes or microbial cells as biocatalysts to catalyze reactions [16]. Microbial fertilizer is a kind of biocatalyst, which refers to a specific type of product containing active microorganisms, which can provide nutrients to plants and regulate plant growth through microorganisms [17]. It can be used directly in agricultural production or as an additional beneficial supplement to chemical fertilizers. Bio-organic fertilizer is one of the most effective soil conditioners. It has the function of boosting the formation of soil particle structure, increasing porosity and maintaining the size of aggregates, expanding the interior space of the soil, and improving the circulation of air and water in the soil. Bio-bacterial fertilizer contains a variety of non-pathogenic microbial flora, which restrict each other in the process of microbial reproduction, promote the production of various antibiotics and promote the production of cell growth hormones, which can not only control the proliferation of plant pathogenic microorganisms, but also realize the prevention and control of diseases and insect pests. It can also stimulate the growth of plant branches and leaves, promote the synthesis of chlorophyll, cellulose and nucleotides, and increase plant stress resistance. For the vitamins, hormones and humic acids formed by the decomposition and transformation of microbial bacteria, the application of bio-organic fertilizers can stimulate the growth and improvement of crop roots and improve the photosynthesis efficiency of crops. Specifically, the advantages of bio-organic fertilizers are mainly reflected in high ear formation rate, accelerated crop root growth, improved ear shape, high dry matter accumulation, and increased yield. At the same time, biological fertilizers are rich in many nutrients, including several organic nutrients, inorganic elements, many enzymes and microorganisms, which are unmatched by other chemical fertilizers. In addition, biological bacterial fertilizer has a special role in maintaining nutritional flavor and improving the quality of agricultural products [18]. Biological bacterial fertilizer can reduce the use of commercial fertilizers and improve the utilization rate of farmyard manure, which is beneficial to the improvement of green and sustainable agriculture in my country. It also has certain advantages in improving salinized soil and reducing the harm of soil pollution. At present, the cheapest and most effective way to treat soil pollution is bioremediation technology, which has broad prospects in improving the speed of soil remediation by using the variety and quantity of microbial flora rich in biological fertilizers.

(3) The effect of biological bacterial fertilizer on soil properties

Bacterial fertilizer can reduce soil bulk density, increase total porosity and saturated water holding capacity. Bacterial fertilizer can increase soil moisture content, reduce soil bulk density, and increase soil total porosity at the heading, grain-filling and mature stages of oat [19]. Different bacterial fertilizers have different effects on soil physical environment. Compared with other bacterial fertilizers, "Jiandefeng" can significantly reduce soil bulk density, and "Taifeng No. 1" can significantly increase soil total porosity compared with other bacterial fertilizers. The environmental factors are affected by the type and quantity of bacterial fertilizer. Bacterial fertilizer can significantly increase soil nutrients and reduce soil pH, and different bacterial fertilizers have

different functions. Adding bacterial fertilizer to the soil with more serious soil salinization can improve the soil, improve soil fertility, and improve the survival rate of plants. Bacterial fertilizer is rich in microorganisms, which can improve soil, maintain soil microbial balance, and maintain plant root activity. Soil enzymes are closely related to soil microorganisms, and the activity of soil microorganisms affects the activity of soil enzymes.

2.4. Overview of Data Mining

Literally understood as mining data and extracting useful information from it. This information is usually presented in specific ways such as concepts, laws or models to form the so-called decision basis [20]. Data mining is to discover these potential laws in a more efficient way in this large environment, and the analyzed and processed data can be converted into information with practical application significance. Data mining has higher and higher requirements for storage, especially data mining in traffic and other aspects, and the requirements for database storage modules are particularly high for the analysis and processing of massive data. The database needs to quickly perform operations such as searching and modifying the data in the massive data. Today, in order to be able to adapt quickly and efficiently, storage modules have begun to use distributed storage and distributed computing.

Businesses in different fields may use the same model or algorithm, and in the same field, different data types correspond to different algorithms. Data mining has a wide range of applications in various fields such as medical care, transportation, commercial finance, etc. In each application, the way of data processing is very different, and the structure of data is also very different. There are various methods and means of data mining, which originate from the actual needs of production practice. Data mining has a wide range of functions, and the coordination and cooperative research of these functions also provides an important way for the improvement of data mining.

3. Investigation and Research on the Improvement Effect of Biological Bacterial Fertilizer on Soil Ecological Environment Based on Data Mining Algorithm

3.1. Experimental Method

In order to study the improvement effect of self-developed compound microbial fertilizer on soil moisture content and soil microbial species and quantity, and to eliminate plant factors that are often ignored in laboratory research but are unavoidable under realistic conditions, this experiment adopted a comparative analysis of The effect of compound microbial bacterial fertilizer and composting self-developed compound microbial inoculant, blank compost and commercial bacterial compost on soil improvement, the experiment set a blank control group.

3.2. Test Indicators and Test Methods

Since each compost index has differences in unit and numerical representation, and different indexes have different positive and negative correlations with the composting effect, it is necessary to calculate the membership function value of the compost index. The measured value of an index, X_{max} and X_{min} are the maximum and minimum values of the index value under the processing

conditions, respectively, $X_{(U)}$ is the membership function value of the compost indicator. Calculated as follows:

$$X_{(U)} = \frac{X - X_{min}}{X_{max} - X_{min}} \tag{1}$$

The principal component analysis method and the soil comprehensive evaluation index (SQI) were used to comprehensively evaluate the improvement effect of each treatment on the soil. In the formula, W_i is the weight value of each soil index, and $F(X_i)$ is the membership function value of each soil index. The calculation formula of the comprehensive evaluation index (SQI) of soil improvement effect is as follows:

$$SQI = \sum_{i=1}^{n} W_i \times F(X_i) \tag{2}$$

4. Analysis and Research on the Improvement Effect of Biological Bacterial Fertilizer on Soil Ecological Environment Based on Data Mining Algorithm

4.1. Principal Component Analysis of Each Composting Treatment and Comprehensive Evaluation of Composting Effect

If there is a positive correlation between the compost index and the decomposing effect of compost, formula 1 is used to calculate; if there is a negative correlation between the compost index and the decomposing effect of compost, formula 2 is used to calculate. The eigenvalue and variance contribution value of each principal component can be obtained from the calculated membership function value, and the principal component is selected by the cumulative contribution rate of the principal component, as shown in Table 1 and Figure 1:

Table 1. Compost data sheet

Ingredient	1	2
Temperature	0.364	0.853
Rate of water content	0.931	-0.251
PH	-0.995	0.458
EC	0.854	-0.732
Organic matter	-0.510	0.045
Full N amount	0.993	0.408
CIN	-0.061	0.964
Seed germination index	0.947	0.208

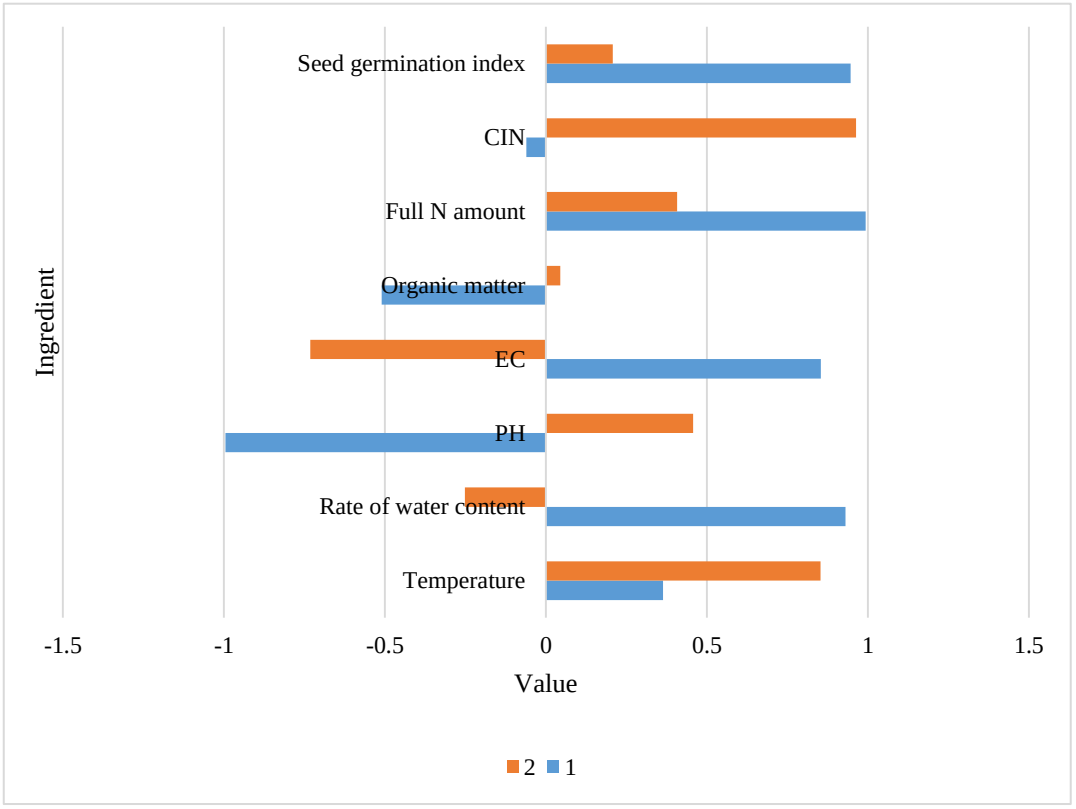

Figure 1. The initial factor loading intercept of compost maturity indicators

The data show that the compost moisture content, PH, EC, organic matter, total N content and seed germination index have higher loads on the first principal component, indicating that the first principal component basically reflects the information of these compost indexes; compost temperature and C The /N index has a higher load on the second principal component, indicating that the second principal component basically reflects the information of the two indexes of reactor body temperature and C/N.

The compost is divided into blank bacterial compost, self-developed bacterial compost and commercial bacterial compost. The comprehensive evaluation results of the compost maturity are obtained and sorted. The results are shown in Table 2 and Figure 2:

Table 2. Sterile compost evaluation table

Compost	Blank space	Self-research	Commerce
The first principal component	0.21	0.53	0.53
The second principal component	0.82	0.58	0.03
Comprehensive principal components	0.13	0.55	0.29

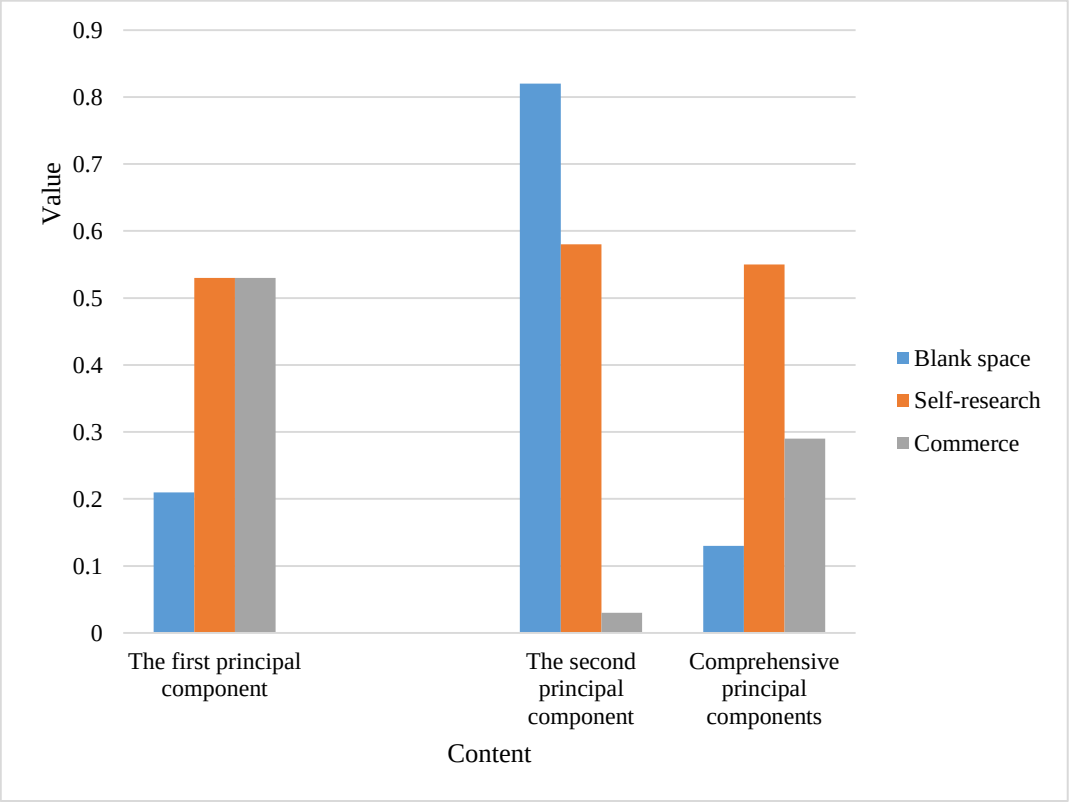

Figure 2. Comprehensive evaluation results of principal component analysis of compost rot ripening index

The results showed that in the first principal component analysis of the main load indexes such as the water content of the heap, PH, EC, organic matter content, total N content and seed germination index, the composting effect of commercial bacteria was the best, followed by self-developed bacteria, blank compost is the worst. In the second principal component analysis with compost body temperature and C/N as the main loads, the composting effect of blank compost is the best, followed by composting with self-developed bacteria, and the composting with commercial bacteria is the worst, which is consistent with the previous single index analysis results. In the most important comprehensive principal component analysis, the self-developed compost had the best decomposing effect, followed by the commercial compost, and the blank compost was the worst. This is consistent with the expected experimental results, and also proves that the addition of self-developed inoculants and commercial inoculants can well promote the decomposing of the heap.

4.2. Comprehensive Evaluation of Soil Improvement Effect

Since different soil indicators have different units and different degrees of variation, if the original data is used, the comprehensive evaluation results will be inaccurate. Therefore, it is often necessary to standardize the original data before evaluation. The comprehensive evaluation results of soil improvement effect are shown in Table 3 and Figure 3:

Table 3. The table of comprehensive evaluation of soil improvement effect

	SQI	Ranking
CK	0.0452	5
Microbial inoculum	0.3641	4
Blank space	0.5694	3
Self-research	0.8542	2
Commerce	0.9514	1

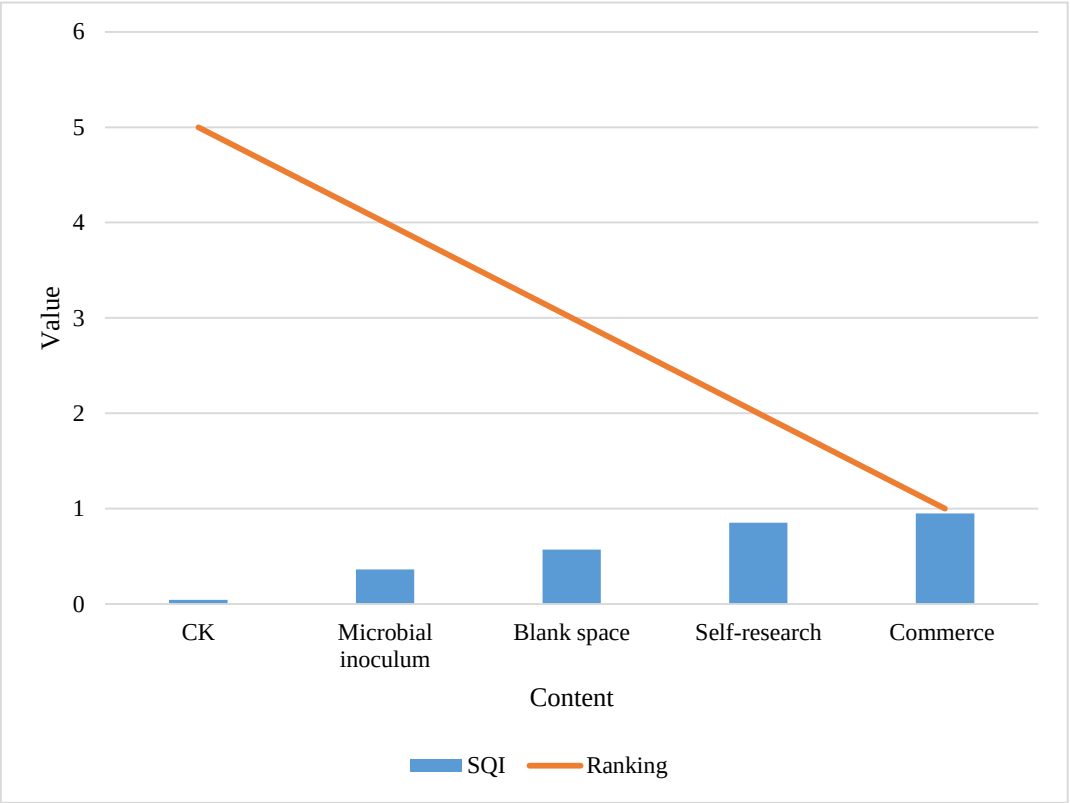

Figure 3. Comparison chart of the comprehensive evaluation data and ranking of biological bacterial fertilizer

The soil improvement effect of the five treatments was comprehensively evaluated by the soil comprehensive evaluation index (SQI), and the results showed that the addition of compound inoculants and organic composts could improve the soil very well, and the improvement effect of commercial bacterial compost was the best, and the self-developed bacteria were second, slightly worse than the commercial bacteria compost, but significantly better than the blank compost. The improvement effect of the compound microbial inoculum was between the blank control (CK) and the blank compost.

5. Conclusion

The fertilization method using biological bacterial fertilizer can effectively reduce the soil bulk density, and has a significant effect on soil structure improvement, achieving the effect of increasing soil water holding capacity and increasing air permeability. It can improve the index of soil

chemical properties, significantly improve the content of organic matter in the soil, increase soil fertility, provide long-term effective nutrients for the growth of ginger, and can also effectively improve the pH of the soil. It has a good acidifying effect on salinized soil. Provides a good growing environment for ginger growth. As a biological catalyst, biological bacterial fertilizer has high economic and ecological benefits, can improve soil properties, increase nutrients, and increase crop yield, which is a powerful guarantee for sustainable agricultural improvement. Biological bacterial fertilizer will definitely become a hot spot in the fertilizer industry and has broad improvement prospects.

Funding

This article is not supported by any foundation.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

References

[1] Li Z, Hassan M Q, Jafferji M, et al. Correction: Biological functions of miR-29b contribute to positive regulation of osteoblast differentiation.. Journal of Biological Chemistry, 2019, 294(25):10018-10018.

[2] Ohnuki T, Sakamoto F, Kozai N, et al. Role of filamentous fungi in migration of radioactive cesium in the Fukushima forest soil environment. Environmental Science: Processes & Impacts, 2019, 21(7):1164-1173. https://doi.org/10.1039/C9EM00046A

[3] Kim M, Kim H. Comparison of the Soil Environment Conservation Act and the Groundwater Act in the Republic of Korea. Water Policy, 2019, 21(2):344-350. https://doi.org/10.2166/wp.2018.200

[4] A,Letamend á, Lastres P,, Botella L M, et al. Role of endoglin in cellular responses to transforming growth factor-beta. A comparative study with betaglycan. The Journal of biological chemistry, 2019, 273(49):33011-9. https://doi.org/10.1074/jbc.273.49.33011

[5] Jack C R, Bennett D A, Blennow K, et al. NIA-AA Research Framework: Toward a biological definition of Alzheimer's disease. Alzheimer\"s & Dementia, 2018, 14(4):535-562. https://doi.org/10.1016/j.jalz.2018.02.018

[6] Both C, Artemyev A V, Blaauw B, et al. Large-scale geographical variation confirms that climate change causes birds to lay earlier.. Proceedings. Biological sciences, 2018, 271(1549):1657-62. https://doi.org/10.1098/rspb.2004.2770

[7] Pretty J. Agricultural sustainability: concepts, principles and evidence. Philosophical transactions of the Royal Society of London. Series B, Biological sciences, 2018, 363(1491):447-65.

[8] Donoghue M J, Smith S A. Patterns in the assembly of temperate forests around the Northern Hemisphere. Philosophical transactions of the Royal Society of London. Series B, Biological

sciences, 2018, 359(1450):1633-44.

[9] Charmantier A, Garant D. Environmental quality and evolutionary potential: lessons from wild populations. Proceedings. Biological sciences, 2019, 272(1571):1415-25.

[10] Tarpy D R. Genetic diversity within honeybee colonies prevents severe infections and promotes colony growth. Proceedings. Biological sciences, 2018, 270(1510):99-103. https://doi.org/10.1098/rspb.2002.2199

[11] Burton G W, Foster D O, Perly B,, et al. Biological antioxidants. Philosophical transactions of the Royal Society of London. Series B, Biological sciences, 2018, 311(1152):565-78.

[12] Dinan T G. Glucocorticoids and the genesis of depressive illness. A psychobiological model.. British Journal of Psychiatry the Journal of Mental Science, 2018, 164(3):365-365. https://doi.org/10.1192/bjp.164.3.365

[13] Federico B, Tania C C, Perrone-Bizzozero N I. Novel recognition motifs and biological functions of the RNA-binding protein HuD revealed by genome-wide identification of its targets. Nucleic acids research, 2018, 38(1):117-30. https://doi.org/10.1093/nar/gkp863

[14] Debra L, John T, Leda C. Does morality have a biological basis? An empirical test of the factors governing moral sentiments relating to incest. Proceedings. Biological sciences, 2018, 270(1517):819-26.

[15] Nolan E M, Jacek J, Ken-Ichi O, et al. QZ1 and QZ2: rapid, reversible quinoline-derivatized fluoresceins for sensing biological Zn(II). Journal of the American Chemical Society, 2018, 127(48):16812-23. https://doi.org/10.1021/ja052184t

[16] Oliver K M, Jaime C, Moran N A, et al. Population dynamics of defensive symbionts in aphids. Proceedings. Biological sciences, 2018, 275(1632):293-9.

[17] Andrews P W. From teratocarcinomas to embryonic stem cells. Philosophical transactions of the Royal Society of London. Series B, Biological sciences, 2018, 357(1420):405-17.

[18] Foulstone M, Reading C. Assay of amoxicillin and clavulanic acid, the components of Augmentin, in biological fluids with high-performance liquid chromatography.. Antimicrobial agents and chemotherapy, 2019,22(5):753-62. https://doi.org/10.1128/AAC.22.5.753

[19] Purdon S E, Hudson K A, Bennett S, et al. Use of octadecasilyl-silica for the extraction and purification of peptides in biological samples. Application to the identification of circulating metabolites of corticotropin-(1-24)-tetracosapeptide and somatostatin in vivo. The Biochemical journal, 2019, 168(1):9-13.

[20] Vabulas R M, Sibylla B, Norbert H, et al. The endoplasmic reticulum-resident heat shock protein Gp96 activates dendritic cells via the Toll-like receptor 2/4 pathway. The Journal of biological chemistry, 2020, 277(23):20847-53. https://doi.org/10.1074/jbc.M200425200