



# Introduction to the Field Practice and Application Analysis of “Century Tianwang Bio-Organic Fertilizer” in the Past 20 Years

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## ABSTRACT

Ensuring food security, increasing farmers' income and improving people's living standards are the focus of attention of all countries in the world today. “Century Tianwang” biological organic fertilizer has been upgraded to multi-functional biological organic fertilizer innovation, accepted as a new invention patent. “Century Tianwang” multifunctional biological organic fertilizer is a long-term natural biological organic fertilizer with high concentration. It is a new kind of slow-release fertilizer, with both quick and long-term effects. It can both fully meet the nutrient requirements of the crop, and maintain water and fertilizer, improve soil and prevent disease. It can not only control agriculture pollution, improve the crop quality and promote the yield of various crops, but also have special effects on the improvement of saline-alkali land, restoration of polluted cultivated land and degradation of agricultural residues. It is a kind of slow-release, long-acting bio-organic fertilizer that does not need any other fertilizer to be used with field crops and does not need topdressing during the whole growing period of crops. “Century Tianwang” multi-functional bio-organic fertilizer collects the essences of various medicinal plants, natural minerals, nano organic compounds and aerospace microbial agents, through special process, refined and processed, non-toxic, harmless, without side effects.

## 1. Introduction

“Century Tianwang” multifunctional bio-organic fertilizer technology is developed by the team of Sun Cheng, who is the chief scientist of the Academic Committee of the United Nations International Information Development Organization, the chairman of the Cypedia International Federation of Science and Technology Scholars, and the chairman of the executive committee of the International Academician Association, “Father of Fertilizers in China,” the scientist and academician of the World Academy of Productivity Sciences. It is a major scientific and technological invention patent, conducted in-depth

research and innovation on a series of problems such as low utilization of agricultural fertilizers, soil compaction, and environmental pollution, and successfully developed. “Century Tianwang” bio-organic fertilizer is a major invention patented technology achievement of the academician Sun Cheng's team from 1988 to 1999, after 11 years of research and development and large-scale field trials. In 2000, it was listed as a national key new product plan project and a high-tech industry key demonstration project; the Ministry of Science and Technology, the Chinese Association for Science and Technology and the Chinese Rural Professional Technology Association have successively issued documents for national promotion and popu-

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larization. In 2006, the book “Technology and Application of New Slow-release Fertilizers of Century Tianwang” edited by the Department of Rural and Social Development of the Ministry of Science and Technology was published and distributed nationwide as a training series of the National Spark Program to promote the popularization of “Century Tianwang”.

As of 2020, nearly 30 enterprises in more than a dozen provinces, cities, and regions including Beijing, Tianjin, Nanchang, Shanxi, Liaoning, Jilin, Hubei, Hunan, Fujian, Hebei, Henan, Shandong, Inner Mongolia, and Sichuan have successively introduced the “Century Tianwang” “New slow-release fertilizer technology. And with Beijing Gutian Fertilizer Co., Ltd., Hubei Fengyi Fertilizer Co., Ltd., Lu’an Yiniu Biotechnology Co., Ltd., Jiangxi Qijia Fertilizer Co., Ltd. and other enterprises with an annual output of more than 100,000 tons as the backbone enterprises, it has formed China’s largest bio-organic fertilizer enterprise network alliance- “Century Tianwang Enterprise Alliance”. The product has been used in practice for 20 years, with an application area of more than 500 million acres, which not only covers most of China, but also has been exported to North Korea, Vietnam, Malaysia and many other countries. The products are well received by farmers, and are known as the “King of Fertilizer” and “Magic Fertilizer”, and have won more than 50 honors and awards at home and abroad.

“Century Tianwang” bio-organic fertilizer has been innovatively upgraded to a multi-functional bio-organic fertilizer, and has been accepted as a new invention patent. It is a world-leading high-tech achievement that integrates nanotechnology, biotechnology, aerospace technology, humic acid dispersion, emulsification technology, medicine and fertilizer integration technology, and plant growth and reproductive nutrition balance regulation technology. It can control agricultural pollution. The eco-friendly fertilizers that improve crop quality and increase crop yields can not only increase the yield and income of various crops, but also have special effects on the improvement of saline-alkali land, the restoration of contaminated farmland, and the degradation of pesticide residues.

Innovative and upgraded “Century Tianwang” multifunctional bio-organic fertilizer. In 2020, there will be Hubei Ruidi Biotechnology Co., Ltd., Hunan Green Kungfu Biotechnology Co., Ltd., Baotou Baokang Fertilizer Co., Ltd., and Sichuan Hehai Fertilizer Co., Ltd. The company introduced this technology, improved the technical content of the company’s original products, expanded the product sales market, and built a new production line.

“Century Tianwang” multifunctional bio-organic fertilizer is a high-concentration natural long-acting bio-or-

ganic fertilizer and a new type of slow-release fertilizer. It is both quick-acting and long-acting, which can fully satisfy the nutrition of crops. Need slow-release and controlled-release fertilizers that have the functions of water retention, fertilizer retention, slow release, soil improvement, and biological control. The formula is novel and unique, which is the first at home and abroad. It is a kind of slow-release long-acting bio-organic fertilizer that does not require any other fertilizers to be used in conjunction with a single-use plantar fertilizer, and does not require top dressing throughout the growth period of the crop.

The economic and technical indicators of “Century Tianwang” multifunctional bio-organic fertilizer are in the leading position at home and abroad. Compared with chemical fertilizers with the same substrate, it can save more than 30%-40% of fertilizer application. Grain crops and fruit trees increase by 10%-15%, and vegetable yields increase by 15%-25%. The application of “Century Tianwang” bio-organic fertilizer can significantly improve the quality of agricultural products, ensure food security, increase the sugar content of various fruits, watermelons and melons by 2 to 5 degrees, increase the color index of the fruit, and have a thin peel and good taste. The application of “Century Tianwang” bio-organic fertilizer can reduce the amount of chemical fertilizer by 30%-40%, increase the fertilizer utilization rate by more than 40%, and increase the soil organic matter content.

“Century Tianwang” biological organic-inorganic slow-release compound fertilizer, when the organic matter reaches 20%, the total nutrient content of nitrogen, phosphorus and potassium can reach more than 30%-40%. The technical indicators are at the international leading level. The innovative and upgraded “Century Tianwang” multifunctional bio-organic fertilizer can reach 45% organic matter and 20 million active bacteria/g, and the total nutrients of nitrogen, phosphorus and potassium can reach more than 20%-25%. The technology is currently at the leading international level. “Century Tianwang” bio-organic fertilizer achieves technical indicators that cannot be achieved by any other brand fertilizer in the world. This is a miracle in the history of fertilizers in the world. In the preparation of the “1 Million Tons of Energy-Saving And Environmentally Friendly Organic-Inorganic High-Efficiency Controlled And Slow-Release Compound Fertilizer Project Funding Application Report”, the expert group of the Institute of Foreign Economic Relations of the National Development and Reform Commission of China pointed out: “The chemical fertilizer industry is shocked. It will make an immeasurable contribution to improving production efficiency, land yield, resource utilization, agricultural productivity, and the development of eco-friendly,

efficient and ecological modern agriculture, ensuring food security, and increasing farmers' production and income. This is a great contribution to the benefit of mankind. The major issues for future generations are of strategic significance for the development of China's high-tech industry and participation in international competition. It will have a huge saving and demonstration effect on the formation of an internationally competitive high-tech industry clusters and new economic growth points."

"Century Tianwang" multifunctional bio-organic fertilizer collects the essence of various medicinal plants, natural minerals, nano-organic compounds and aerospace microbial inoculants, etc., through special technology, refined processing, non-toxic and harmless, without any side effects.

## 2. The Significance of the Project

Ensuring food security, increasing farmers' income, and improving people's living standards are the focus of attention of all countries in the world today.

According to a survey by the United Nations Food and Agriculture Organization, agricultural fertilizers account for 40%-60% of the increase in food production, and China accounts for 58%. In China, agricultural fertilizer costs account for 50% of the total agricultural production costs. For farmers to increase their production and income and ensure China's food security, agricultural fertilizers play a pivotal role.

However, China is currently basically a chemical agriculture and has become the world's largest country in the consumption and production of chemical fertilizers. Since the 1980s, the long-term application of chemical fertilizers has been mainly instant fertilizers, with low utilization rate. Nitrogen fertilizer is 30-35%, phosphate fertilizer is 10-15%, and potash fertilizer is 35-50%.

Due to single, excessive, unscientific and unreasonable application, the fertilizer utilization rate is extremely low, resulting in a lot of waste of nutrients and increasing agricultural costs. For this reason, although the state has introduced a series of favorable agricultural policies over the years, and has continuously increased subsidies for grain production and grain farmers, it is regrettable that the benefits brought by these favorable agricultural policies have often been consumed by the increase in cost of agricultural materials.

The low utilization rate of fertilizers not only increases farmers' costs, affects farmers' increase in production and income, but also causes a series of serious social problems such as soil compaction, decline in the quality of agricultural products, and water resources and environmental pollution. At present, the overall situation of China's

soil environment is worrying, with serious pollution in some areas. From April 2005 to December 2013, China conducted the first national soil pollution survey, and the actual survey area was 6.3 million square kilometers. The country's total soil over-standard rate was 16.1%, among which the potential ratios of light, light, moderate and severe pollution were 11.2%, 2.3%, 1.5% and 1.1%, respectively. The pollution types are mainly inorganic, organic second-child, and composite pollution has a relatively small proportion. The number of inorganic pollutants exceeding the standard point accounts for 82.8% of all the number of exceeding standard points.

The ecological environment is related to the future of the nation and the quality of agricultural products maintains the health and safety of consumers. The inability of agricultural products to go abroad and the increase in farmers' income are restricted. Thus, the purchasing power of farmers, who account for 70% of the Chinese population, restricts our economic development to a large extent.

In order to realize as soon as possible the guiding spirit of General Secretary Xi Jinping: "China is strong, agriculture must be strong, China rich, agriculture must be prosperous, China beautiful, and rural area must be beautiful". The fundamental way to promote the green development of agriculture is to rely on technological progress and technological innovation. Therefore, it is of great strategic significance to popularize the "Century Tianwang" multifunctional bio-organic fertilizer, a world-leading high-end technology product.

"Century Tianwang" multifunctional bio-organic fertilizer is based on high and new technology, based on the theory of ecological agriculture, and based on the theory of plant vegetative growth and reproductive growth balance. Fertilizer-type organic matter such as grass charcoal, distillers' grains, lignite, straw, livestock manure, sludge, garbage, agricultural and sideline products, etc. are used as basic (carrier) raw materials, and a unique "fertilizer nano slow-release agent" and unique ST high are added. Concentrated compound aerospace microbial inoculants, unique native natural humic acid, natural medicinal plant extracts and nutrient elements that can promote the life activities of microorganisms, formulated according to the scientific principles of plant nutrition growth and reproductive growth microecological nutrition balance, after specific Craft processing is made. Its resources can be obtained from local materials, waste utilization, and endless circulation, which is in line with the development direction of ecological agriculture.

"Century Tianwang" multifunctional bio-organic fertilizer is a full-nutrient fertilizer with a high content of

active ingredients. It not only contains a large amount of organic matter, humic acid and the three major elements of nitrogen, phosphorus and potassium, but also contains a variety of medium quantities necessary for plant growth. , Trace elements and a variety of organic compounds, at the same time, it also contains a large number of beneficial microorganisms. This fertilizer is different from chemical fertilizers, organic composts and general biological fertilizers. In addition to providing relatively balanced nutrients for crop growth, it is mainly to improve the utilization rate of inorganic fertilizers and promote the life activities and reproduction of microorganisms in the rhizosphere of plants. , Increase soil fertility, stimulate crop growth, increase crop yield, improve quality, degrade pesticide residues, and achieve zero pesticide residues in all inspectable agricultural products.

“Century Tianwang” multifunctional bio-organic fertilizer, its notable functional characteristics are “three nos”, “three highs”, “two completes” and “one degradation”. “Three nos”, that is no toxin, no harm, and no peculiar smell; “three highs”, that is high nutrient, high organic matter, and high humic acid; “two completes”, that is, fertilizer has complete nutrient elements and complete fertilizer efficiency; “one degradation” “, is to degrade pesticide residues. Field crops can be exempt from pesticides, and vegetables, fruits, and cash crops can be reduced by 80% to 90%. It has the following characteristics:

(1) It has low solubility in water, and slow release of nutrient elements in the soil, reduced the loss of nutrient elements, increasing fertilizer utilization by more than 30%-40%;

(2) The fertilizer effect is stable for a long time, and the energy source continuously meets the nutrient demand of the plants during the whole growth period; the fertilizer effect period is more than doubled than that of ordinary chemical fertilizers, reaching 110-130 days;

(3) Special nano-functional materials such as “nano slow release agent” and “nano hydroxyapatite” contained in the fertilizer can effectively reduce the salt content and alkalinity of the soil, reduce and remove harmful heavy metals in the soil, and are used to improve saline-alkali land and pollute cultivated land. Repair special fertilizers with special effects. The fertilizer has a low salt index. Even in high-temperature climates, there will be no “burning seedlings” when applied;

(4) The number and frequency of fertilization are reduced and costs are saved. Under the same yield conditions, it can save more than 30%-40% of the fertilization amount. Field crops are fertilized at one time without top-dressing;

(5) It is suitable for different types of soil and plants,

and can improve the soil structure and the availability of soil nutrients, and reduce soil compaction;

(6) It is tolerant to flooding, drought, lodging, saving labor, saving fertilizer, increasing production and income, with an average increase of 10%-20%;

(7) It improves crop quality, reduces pollution, and ensures food security;

(8) It has strong stress resistance, effective prevention and control of various crop diseases and insect pests. The fertilizer contains plant-derived Chinese herbal medicine extracts, which can effectively degrade pesticide residues;

(9) It has a long storage period and is easy to transport. The actual validity period can reach more than three years.

This technical achievement can not only meet the market’s fertilizer needs and the urgent needs of saline-alkali land improvement projects and contaminated farmland restoration projects, but also provide an effective way for the resource utilization of organic solid wastes such as livestock manure treatment. Therefore, the fertilizer project was constructed. It has great significance.

### 3. Technical Route and Innovation of “Century Tianwang” Multifunctional Bio-organic Fertilizer

The core technical route and innovation of “Century Tianwang” multifunctional bio-organic fertilizer are the combination of organic and inorganic, nano slow-release technology and aerospace microbial technology, natural humic acid dispersion, emulsification, adsorption technology and medicinal plant extraction The combination of technology, the combination of medicine and fertilizer, the integrated technology, following the relationship between plant nutrient growth and reproductive growth and micro-ecological nutrition balance, design advanced, scientific and reasonable crop special fertilizer formula, processed by a special controlled and slow-release production process.

The technical route and innovation of Century Tianwang Multifunctional Bio-organic Fertilizer are based on following the theoretical methods of Chinese traditional Chinese medicine technology and obtaining sufficient scientific information and digital basis to realize invention and innovation. The main points of following the theoretical methods of Chinese TCM technology are:

Adopting “looking, listening, inquiring, feeling” Chinese medicine-style symptomatic scientific formula fertilization technology - Inquiring: inquire the growers about the type, performance, special requirements of the crops grown, the yield per mu (average, highest, and lowest) of 3 to 5 years, the corresponding fertilization status (manufacturer, fertilizer type, nutrient composition, inspection

results), and the status of pests and diseases; Feeling: plant seeds or leaves of crops and take soil, analyze and test items according to requirements (according to the requirements of planting crops, what is missing, and how much is missing, the principle of how much is missing), check local weather data for 3 to 5 years, and predict future annual weather conditions; Looking: the expectations and hopes for planting crops and the training that growers should have the planting literacy of the crop; Listening: the appearance of the planted crops on site is related to other crops in the surrounding environment, the level of growers or plant protection personnel.

The technical route and innovation points of Century Tianwang Multifunctional Bio-organic Fertilizer to realize invention and innovation are:

### 3.1 Using new nanometer slow-release technology

In fertilizers, a nano-organic compound “fertilizer nano slow release agent”, which integrates nitrification inhibition, urease inhibition, nitrogen stabilization and plant growth regulation, is added to enable plants to perform photosynthesis, chlorophyll synthesis, and protein during the day. The activity of synthesis and enzymes reaches the optimal state quickly, and promotes the metabolism and growth of plants; nano-organic compounds can reduce the soil bulk density, increase the porosity, and have strong water permeability, promote the decline of salt leaching, and have extreme desalination and salt tolerance. Strong, quickly reduce the salt index and reduce the salt content; the nano-organic compound in the fertilizer has a strong ammonia-fixing ability, which can effectively inhibit the formation of nitrate nitrogen in the soil, inhibit the activity of nitrifying bacteria, and reduce the pH in the soil It can adjust the pH value, increase the adsorption strength of soil colloids and clay particles to ammonia ions and sodium ions, which can not only reduce the salt-alkali concentration, but also enable the slow release of nutrients in the soil, reduce nutrient element losses, improve fertilizer utilization, and meet plant nutrient needs.

### 3.2 Adopting aerospace microbial technology

In the fertilizer, a non-toxic, harmless, and odorless pure natural organic material containing high organic matter and high humic acid is added with a unique “ST highly concentrated compound special aerospace microbial agent”, which realizes microbial technology. High integration with space technology. The microbial strain was successfully carried on the Shenzhou spacecraft, using cosmic rays in space, ultra-vacuum, ultra-clean, microgravity, etc., to change factors, causing the microbial

strain to mutate, improving the activity and resistance of the strain, and exerting Its comprehensive effectiveness. The effect of microbial agents depends on the vitality, reproduction speed, quantity and the secreted metabolites of microorganisms. The innovation of ST high-concentration composite aerospace microbial fermentation process is to use the combined fermentation method of *Bacillus subtilis* and *Bacillus subtilis*, and at the same time, use metal ions to promote the formation of *Bacillus subtilis* and quickly increase the number of *Bacillus subtilis*. It can shorten the fermentation cycle, increase the effective number of viable bacteria, and promote the formation of bacterial spores.

The specific effects of aerospace microbial agents are shown in:

(1) The first is that the ST special inoculum has multiple functions: this unique inoculum forms a huge dominant flora in the roots of crops. In the inoculum, *Bacillus* reproduces one generation in 20 minutes, and it can multiply by fission to the 72th power of  $z$  in 24 hours.

(2) The second is that the ST special bacterial agent secretes a large number of metabolites and is rich in a large number of antibacterial substances, which causes the pathogenic bacteria to deform, cell rupture, and loss of the activity of the contents, thereby losing the ability to infect crops and also secrete a large number of enzymes. It is like cutting large molecules into small molecules with a knife, which directly facilitates the absorption of plants. For example, the main component of the nematode shell in the soil is chitin. Lateral spores can secrete chitinase, which breaks the nematode surface cells and makes them lose their pathogenic ability.

(3) The third is that ST bacteria can also secrete active substances, organic acids, carbonic acid, natural growth factors, promote the absorption of nitrogen, phosphorus, potassium and its organic matter, reduce the amount of chemical fertilizers, and extend fertilizer efficiency.

(4) The fourth is that ST bacteria can secrete viscous substances, promote the formation of aggregates, balance the soil structure, and improve the ability to retain fertilizer, water and heat.

(5) The fifth is to improve the utilization rate of fertilizers. The metabolites are rich in enzymes such as protease, amylase, esterase and organic acid substances, which decompose nutrients in organic matter and insoluble salts in inorganic fertilizers to increase the utilization rate. It can make the inherent functions and functions of organic matter and humic acid in organic materials play more fully.

(6) The sixth is that the microbial flora in the fertilizer and the original beneficial microorganisms in the soil form

a dominant flora to promote the virtuous cycle of carbon, nitrogen, oxygen and other elements in the soil ecosystem, thereby repairing the soil ecological environment system and making the ecosystem reach a new stable balance.

Organic matter is decomposed by microorganisms and converted into humus, which can improve the buffering capacity of the soil, and react with sodium carbonate to form sodium humate, which reduces soil alkalinity. Sodium humate can also stimulate crop growth and enhance salt resistance. Humus can promote soil formation of agglomerate structure increases the porosity and water permeability, which is conducive to salt leaching, adjusts the balance of water and salt, and inhibits the production of a large amount of organic acids in the decomposition process of the returned organic matter. On one hand, it can neutralize the alkalinity of the soil; On the other hand, it accelerates the decomposition of nutrients, promotes the conversion of late-acting nutrients, and improves the availability of phosphorus.

The organic materials through the action of microorganisms can not only reduce the salt content, neutralize the alkalinity of the soil, adjust the pH value, but also effectively increase the soil organic matter, improve the soil structure, prevent soil compaction, and promote the growth of plants and improve crops. Natural disease resistance and lodging resistance.

In the “Century Tianwang” special fertilizer for saline-alkali land, the organic matter decomposed by microorganisms not only fully improves the soil in the improvement of saline-alkali land, it improves soil organic matter and functions such as water retention, fertilizer retention, salt reduction, alkali pressure, and soil loosening. It also plays an important role in repairing heavy metal contaminated farmland. It is mainly manifested in: on one hand, organic matter directly interacts with heavy metal ions, affecting their form, migration, transformation, and biological effectiveness in the environment, thereby fixing heavy metals and reducing their activity; on the other hand, these organic materials can effectively improve the soil structure and properties after being applied to the soil, such as the soil organic matter content and pH value, and improve the soil’s own buffering and fixing capacity for heavy metals.

In short, Century Tianwang Multifunctional Bio-organic Fertilizer, the restoration mechanism of inorganic pollutants is that after the fertilizer enters the soil ecosystem, aerobic bacteria, anaerobic bacteria and other microbial probiotics will reduce the acidity of the soil and increase the acidity of the soil through its own biological reaction. The pH value of the soil can reduce the toxicity of harmful heavy metals in the soil. At the same time, the

microorganisms in the fertilizer can fix the heavy metals, promote the active heavy metals in the soil to become organically bound, forming a filter layer and isolation layer, and reduce the crop’s absorption of heavy metals in the soil.

The effect of the biological fertilizer on the restoration of organic pollutants such as pesticides in the soil is to reduce the frequency of prevention and control of pests and diseases, reduce the amount of pesticides used, and thereby reduce the amount of pesticide residues in crops. One is that dominant colonies are formed around the roots of crops, which strongly inhibits the reproduction of pathogens and reduces the number of pests and diseases. On the other hand, microorganisms produce a variety of substances during their life activities, such as hormones, humic acids and antibiotics. These substances can stimulate the growth of crops and enhance the ability of crops to resist diseases.

### **3.3 Following the balanced ratio of plant vegetative growth and reproductive growth, and designing various advanced, scientific and reasonable special fertilizer formulas according to the actual conditions of saline-alkali soils**

The so-called proportional relationship between plant vegetative growth and reproductive growth is the proportional relationship between the amount of nutrients needed in the early stage of plant growth and the number of plant reproductive growth. The two are interdependent. Vegetative growth provides nutrients for reproductive growth, and reproductive growth provides conditions for the next generation of vegetative growth. Besides, there is mutual restriction. There is nutrient competition between vegetative growth and reproductive growth. When vegetative growth is excessive, reproductive growth is inhibited, and when reproductive growth is too vigorous, the supply of vegetative growth is insufficient. There is a certain rule for each crop to achieve the yield and how much nitrogen, phosphorus, potassium, and other nutrients are required. This rule is determined by the respective nutrient characteristics of each crop and soil conditions.

When designing fertilizer product formulations, we should not only design scientific and reasonable formulas based on the nutritional characteristics of plants, but also consider soil conditions.

### **3.4 Combine natural humic acid dispersion, emulsification and adsorption technology with medicinal plant extraction technology**

The physiological activity of humic acid on plants is

shown as stimulating plant growth and metabolism, improving fruit quality and enhancing plant resistance to stress, and has a strong ability to accumulate heavy metals in the soil. One kilogram of concentrated humic acid powder is equivalent to 30 tons of animal manure. Humic acid can significantly promote the aggregation of soil colloidal particles, improve the adsorption capacity of colloidal particles, prevent surface water runoff and soil erosion, and increase the ability to retain water and fertilizer; there are many charged groups in humic acid molecules, equivalent to many hands, can grasp (chelate) some cations or anions free in the soil solution at any time, so that there is not too much OH<sup>-</sup> or H<sup>+</sup> in the soil solution, and then buffer the alkaline or acidity of the soil. In other words, the soil has the function of adjusting the pH value of the soil. Humic acid also has the function of a biocatalyst, which can promote a variety of metabolic reactions in plants, thereby promoting plants to synthesize more chlorophyll, sugar, amino acids, making plant growth healthier, and humic acid is also equivalent to a variety of microorganisms' culture medium ingredients.

"Century Tianwang" multifunctional bio-organic fertilizer adopts a unique original natural humic acid containing more than 100% organic matter, mixed with non-hazardous organic solid waste such as poultry manure as the fertilizer organic matter carrier and the combination of pyrethrum and other medicinal natural plant extracts exerts a variety of special effects.

(1) The original ecological natural humic acid contains more hydrophilic groups, and combined with pyrethrum and other medicinal plant extracts with insecticidal and bactericidal effects, it can effectively exert its good dispersion and emulsification effects, thereby helping to improve pesticides' activity greatly reduces the decomposition rate of organic phosphorus.

(2) The natural humic acid in the bio-organic fertilizer has a large internal surface area, and has a strong adsorption effect on organic and inorganic substances. It can be combined with materials that have the function of mediating pesticides and pesticide-contaminated soils, which will form a high stability complex, which has a slow-release effect on pesticides, can greatly reduce the amount of pesticides and delay the efficacy.

(3) After the natural humic acid is compounded with pesticides, its toxicity is greatly reduced, which is of great significance for reducing environmental pollution and developing pollution-free crop production.

(4) The native natural humic acid in the "Century Tianwang" multifunctional bio-organic fertilizer, in addition to its good dispersion, emulsification, and adsorption effects, improves the activity of medicinal plant extracts, and de-

grades the pesticide residues in the soil, the natural humic acid also has the function of improving soil and can be used as soil amendment. It can promote the formation of soil aggregates and the functions of water storage and fertilizer retention; enhance soil buffering performance, improve low-yield soil; have nutritional functions, can be used as urease inhibitors, effectively inhibit urease activity in the soil, increase nutrients, adjust nutritional quality, and achieve nutrient balance, improve the utilization rate of nitrogen fertilizer and phosphate fertilizer; have stimulating function, can be used as a plant growth regulator, enhance respiration, strengthen roots, promote absorption, increase enzyme activity, promote metabolism, stimulate crop growth and so on. Natural humic acid also has many functions that are beneficial to improving soil and crop growth.

### **3.5 Combination of medicine and fertilizer, adding pure natural plant source Chinese herbal medicine extracts and microecological preparations to the fertilizer, effectively killing insects, killing bacteria, and degrading pesticide residues**

(1) "Century Tianwang" multifunctional bio-organic fertilizer, which contains nitrogen, phosphorus, potassium elements and the insecticide fungicide pyrethrum and other medicinal plant extracts, changes the surface activity of pesticides and increase their insecticidal activity. Reasonable mixing and application of fertilizers and insecticidal and fungicidal medicinal plant extracts can improve the insect resistance of plants by increasing the penetration, inhalation and conduction of insecticides in plants and pests, thereby improving the control effect and reducing insecticide dosage.

(2) The mixed combination of bio-organic fertilizer and medicinal plant extracts such as the insecticide and fungicide pyrethrum, the integration of medicine and fertilizer has the effect of mutual synergy. For example, the combination of nitrogen, phosphorus, potassium in fertilizers and the insecticide and fungicide pyrethrum can increase the yield by more than 10% compared with the equivalent element fertilizers alone. At the same time, it also has an inhibitory effect on some crop diseases.

"Century Tianwang" special bio-organic fertilizer for crops, due to the combination of organic and inorganic, the combination of nano slow-release technology and agricultural aerospace biotechnology, and advanced and reasonable product formula, determines that it can not only meet the nutritional needs of plants throughout the growth period, and ensures that increasing production and income can also increase soil organic matter, improves

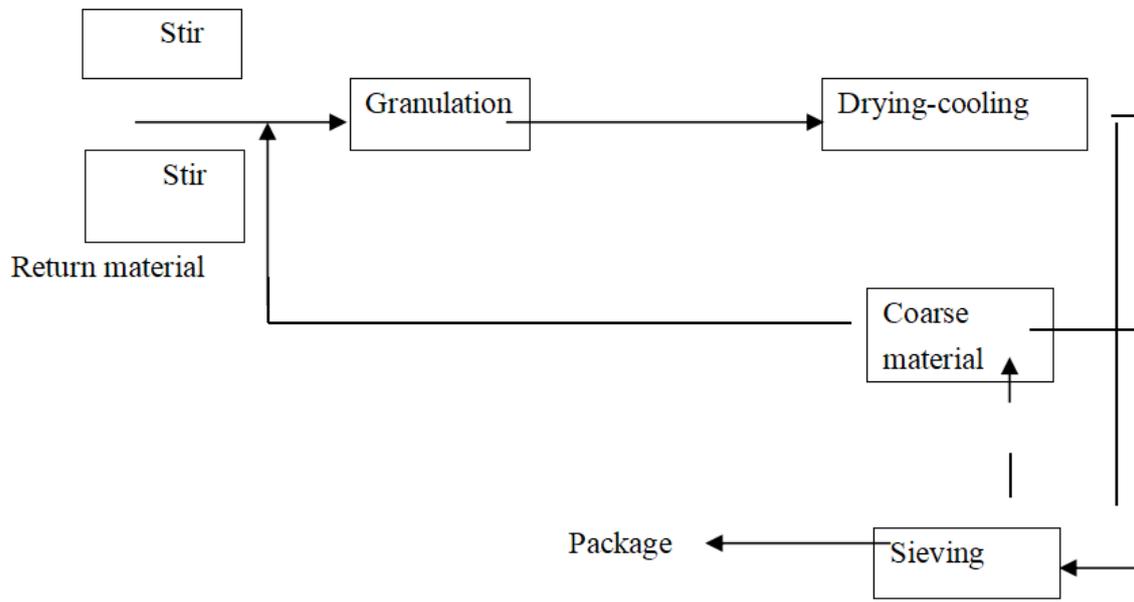


Figure 1. Process flow chart of production line

soil structure, improves crop product quality, enhance crop resistance, prevents various diseases and insect pests, and degrades pesticide residues.

Applying “Century Tianwang” crop special bio-organic fertilizer not only has a good effect, but also has a lower input cost than any other fertilizer.

Compared with other similar products, the market price of “Century Tianwang” fertilizer products is not only slightly lower in price, but also the amount of fertilizer can be reduced by 30-40%. Some field crops are applied with enough base fertilizer at one time, without topdressing, saving labor and time, The increase in crop yield is also higher than that of other fertilizers. Therefore, “Century Tianwang” bio-organic fertilizer has strong competitiveness in domestic and foreign markets.

#### 4. Typical Case of the Practical Application of “Century Tianwang” Bio-organic Fertilizer

“Century Tianwang” bio-organic fertilizer covers more than half of China and is exported to many countries. It has been used for more than 20 years. It is known as the “King of Fertilizer” and “Shen Fertilizer” and has created many miracles. Typical cases include:

(1) Helping “Father of Hybrid Rice” Academician Yuan Longping to break through the 900 kilograms of rice per mu mark with one action

When the “Father of Hybrid Rice” Academician Yuan Longping conducted the fourth phase of the public relations test of 900 kg per mu of super hybrid rice, he conducted 6 consecutive years of research and experiment, and he did not

exceed the 900 kg per mu mark. In 2011, in Longhui County, Hunan Province, at a high altitude (380 meters above sea level) 900 kg super rice research and demonstration site, used nitrogen, phosphorus and potassium produced by Anhui Lu’an Yiniu Biological Technology Co., Ltd., a product quality benchmarking enterprise of Century Tianwang Enterprise Alliance. Organic-inorganic compound fertilizer with 34% total nutrients, in the same area, the same soil, the same management team, the same rice seed “Liangyou No. 2”, under the same irrigation system, broke through the 900 kilograms that Academician Yuan Longping has not broken for 6 consecutive years. Yield per mu. On September 18, 2011, the Ministry of Agriculture organized experts to test and accept on-site production. The average yield per mu reached 926.6 kg, breaking the 900 kg mark for the first time. From December 15th, 2010 to May 12th, 2011, Academician Yuan Longping also used eight different fertilizer varieties from eight units at home and abroad each year to conduct comparative experiments at the Hunan Crop South Propagation Center of the Sanya Security Zone Farm in Hainan. The seeds are also the rice varieties “Y Liangyou No. 2” and “Y58S/P143” tested by the National Hybrid Rice Engineering Technology Research Center. The test results showed that the only fertilizer produced by Anhui Lu’an Yiniu Company exceeded 900 kg. Fertilizers have not broken through, and the compound fertilizer including the “Three 15s” of the United States has not exceeded 900 kilograms.

Field experiments have proved that the organic-inorganic compound fertilizer produced by Anhui Lu’an Yiniu Company not only helped Academician Yuan Longping to break through the 900 kg mark, but also passed the

comparison test with the “Three 15s” imported from the United States (15 for each of nitrogen, phosphorus and potassium). Not only can it save about 30% of the amount of fertilization, but it can also improve the organic matter of the soil. The “Three 15s” chemical compound fertilizers in the United States do not have the function of organic-inorganic compound fertilizer.

The fertilizer of Anhui Lu’an Yiniu Company helped to break the 900 kg per mu yield. Academician Yuan Longping was very happy. He deeply felt to Academician Jiang Guoquan, Chief Engineer of Lu’an Yiniu Company: “To achieve high yields, only good crop varieties are No, good fertilizer must be available.” Therefore, Academician Yuan Longping has successively designated Lu’an Yiniu Company and Jiangxi Qijia Fertilizer Co., Ltd. Century Tianwang Enterprise Alliance as the “Yuan’s Super Hybrid Rice Special Fertilizer Designated Production Enterprise”, and he has also served as Lu’an Yiniu Company and Jiangxi Yiniu Company. Qijia Company put up a plaque. Academician Yuan Longping was also happy to take the initiative to take the lead in establishing the “Academician Workstation” for Lu’an Yiniu Company, and personally wrote an inscription for the enterprise “Good Food for Crops Yiniu Fertilizer”

Since then, the organic-inorganic compound fertilizer produced by Lu’an Yiniu Company helped Academician Yuan Longping overcome the 1,000 kg per mu yield until it reached 1,500 kg per mu.

(2) Helping the national model worker Sun Zusheng to set a record in the history of early rice in southern China, CCTV “News Broadcast” reported

National model worker, Sun Zusheng, Party branch secretary of Jiangxi Excellent Village, Dazhou Village, Xinjian County, Jiangxi Province, has contracted 5000 mu of rice planting himself. In 2008, he applied the “Century Tianwang” brand organic-inorganic compound fertilizer with 30% total nutrients of nitrogen, phosphorus and potassium produced by Jiangxi Qijia Fertilizer Co., Ltd. The average yield per mu reached 1,100 jin (=1/2 kilogram, and the highest was 1,200 jin, a national early rice highest per mu yield in history. This was reported on the “News Broadcast” program on July 13, 2008. The national model worker Sun Zusheng specially invited the main members of the “Father of Chinese Fertilizer” Academician Sun Cheng’s team to his home. On the field, he excitedly said to Academician Sun Cheng: “Thank you for inventing such a good fertilizer. It has not only improved my soil, increased my production but also made me appear on ‘News Broadcast’.”

(3) Assisting the full launch of China’s soil ecological restoration project

“Century Tianwang” bio-organic fertilizer can not only

increase crop yields and ensure food security, but more importantly, it can effectively carry out soil ecological restoration, improve soil organic matter, degrade pesticide residues and remove soil heavy metals, and achieve zero pesticide residue planting Cultivation to ensure the safety of agricultural products and food. Therefore, “Century Tianwang” bio-organic fertilizer and “Century Tianwang” all kinds of special remediation agents for contaminated soil have become the most important restoration materials for soil ecological restoration in China.

On December 16, 2018, at the “New Era Total Factor Productivity Innovation Forum” conference, the graduate school of the Chinese Academy of Social Sciences, the Rural Education Development Center and other conference organizers grandly held the “SC TCM Agricultural Soil Ecological Restoration Comprehensive New Technology Project” At the launching ceremony, Liu Zhiren, counselor of the State Council of the People’s Republic of China, Jia Jingdun, director of the Torch Center of the Ministry of Science and Technology, researcher Jia Jingdun, Kuang Tingyun, academician of the Chinese Academy of Sciences, and Sun Cheng, academician of the World Academy of Productivity Sciences (WAPS), jointly pressed the project start button as the project launching guests.

In May 2019, the “Century Tianwang” saline-alkali soil fertilizer and salt balance bio-nano improvement technology project with the “Century Tianwang” bio-organic fertilizer and a special remediation agent for contaminated soil as the core was listed as a key research and development plan of Shandong Province (major scientific and technological innovation project).

## References

- [1] Jiang Shanxiang “Fertilizer Engineering Series: Phosphoric Acid, Phosphate Fertilizer and Compound Fertilizer”, *Chemical Industry Press* 1999.
- [2] Xi Zhenbang “Modern Chemical Fertilizer Science”, *China Agriculture Press*, 2003.
- [3] Lin Bao, “Fertilizers and Non-pollution Agriculture”, *China Agriculture Press*, 2003.
- [4] Sun Cheng “Technology and Application of New Type Slow Release Fertilizer of Century Tianwang”, *Taiwan Publishing House*, 2006.
- [5] Sun Hongfeng “Practice and Thinking on the Transformation of Scientific and Technological Achievements” *China Journal of Scientific and Technological Achievements* 2021.
- [6] Jiang Shanxiang “Fertilizer Engineering Series: Phosphoric Acid, Phosphate Fertilizer and Compound Fertilizer”, *Chemical Industry Press* 1999.