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# *Effects of Exogenous Selenium on Selenium Absorption and Transformation in Macadamia*

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***Keywords:*** Exogenous Selenium, Macadamia Nuts, Selenium Absorption and Conversion, Selenium Content

***Abstract:*** At present, as a high-end snack, macadamia nuts have a variety of beneficial effects on human health, such as preventing cardiovascular disease, preventing diabetes, maintaining weight, etc., its rich nutritional value and health care functions have attracted more and more attention. In this paper, four different treatments were performed on the same type of macadamia through field experiments, and they were sprayed with different concentrations of exogenous selenium fertilizer. Based on the selenium content, the effects of macadamia nuts on selenium absorption and conversion were studied. . The test results showed that when the selenium fertilizer was diluted to 100-fold concentration, the selenium content of the sample plant increased by 107.4%, and the yield increased by 23.8%. When the selenium fertilizer was diluted to 200-fold concentration, the selenium content of the sample plant increased by 100.0%, and the yield It increased by 25.7%. When the selenium fertilizer was diluted to 300 times concentration, the selenium content of the sample plants increased by 55.6%, but the yield decreased by 1.0%, indicating that the appropriate concentration of selenium fertilizer has a certain effect on improving the selenium content and efficiency. Comparing the four treatments, it can be found that exogenous selenium can increase the yield of macadamia nuts, and its output will increase first and then decrease with the increase of the dilution factor and concentration, and the best dilution effect is 200 times.

## 1. Introduction

Macadamia nuts have very high nutritional value, very crispy and silky texture, and have a special milky flavor. They taste much better than other nuts, and can be said to be the best quality nuts in the world. Macadamia not only has strong adaptability, but also has a very high economic health value, so that the purchase price of fresh nuts is unique in the market. However, due to the

influence of geological, geomorphic, and climate factors in various countries around the world, the distribution of selenium in the soil is extremely irregular. Therefore, many countries and regions have various selenium deficiency states. In our country, the selenium content in the soil is very low in 72% of the regions, or the lack of selenium results in the selenium content of the agricultural products that grow up is very low. People will also cause selenium deficiency to varying degrees after consumption. Macadamia is a special vegetation that does not inject and store selenium in the body. Selenium usually exists in the state of elemental selenium in the soil. Most plants cannot be directly absorbed and transformed. Therefore, macadamia grows in those areas where selenium is lacking. The selenium content in the fruit is also extremely low, which cannot meet consumers' food health standards and food nutritional needs at all. Therefore, if you want to enrich selenium in macadamia nuts, it is a simple and effective way to supplement selenium through planting.

Selenium is an important chemical element, an essential element for the normal maintenance of animal and plant life, and plays a very important role in human health. The International Selenium Society recommends a human selenium requirement of 60g / d, the Chinese Nutrition Society recommends 50g / d, and the daily selenium intake of Chinese adults is 26,63g, which is far lower than the standard recommended by the Nutrition Society. The selenium deficiency is widespread and severe, and if it is severe, it can cause various diseases. Obtaining selenium from foods rich in selenium is the most effective way to supplement the body's daily selenium requirements. Enriching selenium resources, increasing the selenium content of kiwifruit, and increasing the intake of selenium in the diet of residents in selenium-deficient areas are of great significance for improving human health and preventing diseases.

Valencia, Gross N, Quero J L believed that the low selenium content in plants is caused by the low selenium content in the soil or its effectiveness, but at the same time, selenium in plants is also one of the main sources of selenium in the human body. Plants need to use a small amount of selenium in the soil and are also affected by many conditions, such as oxidation state, morphology, pH value, and competitive selenium ions, etc[1]. The research of WC, Li-MC and Wei-GS found that selenium mainly exists in calcareous soil in the state of selenate and has high utilization efficiency. Selenite is easily formed in the form of low-solubility selenium. It is difficult for plants containing iron and aluminum oxides in the soil to absorb and utilize selenium, so the efficacy of selenium is reduced. In neutral and acid soils, selenium and iron form highly soluble oxides and hydrogenated oxides, which greatly reduces their effectiveness and cannot be absorbed and utilized by plants. According to different combinations of soil selenium, soil selenium can be divided into different forms, but only soil selenium is the main form of crop selenium absorption[2].Barone V, Baglieri A, Stevanato P researched shows that due to the chemical similarity between phosphate and selenite, the absorption of phosphate and selenite by crops can share the same transport channel, namely the phosphate transport channel, Therefore, there is a competitive absorption effect between the two[3]. It can be seen that whether the effectiveness of soil selenium can be improved through rational fertilization is a rigorous scientific question.

This paper takes Macadamia as the research object, adopts four treatment methods, observes and records the various indexes during its growth, records experiments and comparisons, and finds that B and C treatments can increase the yield of Macadamia test plants. Compared with the control, the yield was increased by 23,8% and 25,7%, respectively, which significantly improved the yield. Among them, the second treatment B has the most significant yield improvement effect. Increasing the yield of macadamia nuts can be achieved by spraying organic selenium fertilizer. In the experiment, when the dilution concentration of selenium fertilizer was 200 times, the effect reached the optimal state. Therefore, research shows that the effect of exogenous selenium on macadamia

nut yield first increases and then decreases.

## 2. Proposed Method

### 2.1. Macadamia Nuts

Macadamia is recognized as a healthy food, and it is particularly effective in preventing cardiovascular disease. Consuming macadamia nuts can increase the antioxidant capacity of cardiovascular disease models, reduce the risk of inflammation, and have symptoms of cancer, cognition, asthma, and intestinal inflammation[4-5]. Not only that, there are many nutrients and bioactive ingredients in macadamia nuts. In addition, macadamia nuts contain some micronutrients, mainly minerals and vitamins; they contain fatty active substances such as monounsaturated fatty acids, polyunsaturated fatty acids, monoglycerides, triglycerides, triacylglycerides, sterols Esters, tocopherols, tocopherols, phytosterols and alcohols, sharks, terpenes, sphingolipids, carotenoids, chlorophyll, alkylphenols, etc[6]. Macadamia nuts also contain plant active substances (salicylic acid, hydroxybenzoic acid, hydroxybenzene Formic acid and other phenolic acids, lignin, naphthoquinone, hydrolyzed tannins such as tannins and tannins, perfume ingredients, inositol, scopolamine, terpenes, phytosterols, etc). More importantly, macadamia nuts also contain a variety of antioxidants Ingredients are very good for human health.

### 2.2 Species of Selenium in Soil

The concentration and form of selenium in soil have important effects on the absorption and metabolism of selenium in plants[7-8]. Soil selenium states are $Se^{2-}$, Se0, $Se^{4+}$ and $Se^{6+}$. There are mainly selenium, selenium salts, elemental selenium and hydrogen selenium in the environment. Under anaerobic conditions, elemental selenium is usually equivalent to 20% to 60% of total ground selenium. A volatile compound produced during soil microbial activity is called hydrogen selenium[9]. Organic selenium is an important biologically effective selenium. Some are the decomposition of selenium-containing tissues in plants and animals, and some are the metabolic transformation of soil microorganisms[10]. Selenium salts and selenium are two other important biologically effective selenium: they are rich in soil, have good solubility in water, and are easy to lose. Selenite easily combines with iron oxide and hydroxide to form soluble oxides in extremely low water. This situation did not occur in sulfates. After two weeks of surface treatment, it was found that selenium salts were still easily dissolved. Therefore, the bioavailability of diagenetic selenium on the ground is higher. In short, the formation of soil selenium is the result of a combination of soil pH and oxidation conditions[11]. Under specific alkaline and oxidizing environments, selenate is the main form of the soil; in acidic soils and strong degradation conditions, selenite is the main form of the soil; under strong reducing conditions, hydrogen selenite It is a kind of selenium that is soluble in the water in the soil. When the pH is less than 3,8, the main form of selenium in the soil is hydrogen selenium.

### 2.3. Plant Uptake and Transformation of Soil Selenium

(1) Absorption of soil selenium by plants

When plants are planted in some selenium-containing soil, the selenium in the soil will definitely be absorbed by the vegetation and used by the vegetation. However, plants have different absorption capacities for selenium. Generally, plants can be divided into three categories:

super-cumulative, cumulative and non-cumulative[12-13]. At the same time, the absorption of selenium by plants also depends on many conditions, such as environmental conditions, soil and plants, but the most important influencing factors are the existence form of selenium in the soil and the concentration of selenium[14-15]. Overall, selenomethionine and selenocysteine, the two existing forms of organic selenium, are used by plants to convert inorganic selenium, but studies have shown that plants can directly absorb this organic selenium. Other studies have shown that plants can absorb organic selenium (such as selenomethionine) using amino acid transporters on the cell membrane[16]. Not only that, research on macadamia nuts also found that macadamia nuts have a very high absorption rate of organic selenium (selenomethionine and selenium). Compared with inorganic selenium, organic selenium also has many advantages such as safety, non-toxicity, and fast absorption. Using selenium methionine to strengthen selenium in selenium can meet the production standard of selenium-enriched macadamia nuts, so organic selenium can be an important external source Selenium is used in the production and cultivation of crops[17-18].

Because sulfur and the same main group, they have very similar chemical structures and properties, leading to a very similar absorption of selenium and sulfate by plants. Except for some plants that can accumulate selenium, most plants are unable to distinguish these two substances simply and clearly. Se / S value is also considered to be a very effective indicator to distinguish the selenium accumulation level. Under different supply conditions of selenium and sulfate, both selenium and sulfate enter the plant through the sulfur transport channel. As carriers of sulfur, they are commonly found in plants, and they accumulate selenium in different parts of the root, vascular bundle system, and leaves[19]. At the same time, they also play their due function of absorption or transport. They can be roughly divided into four categories. The first transporter has a high sulfur affinity and plays an important role in absorbing selenate in roots; the second transporter has a low sulfur affinity and is distributed in vascular and root bands, leaves and other organ systems, The main purpose is to migrate and transport selenium. The third type of transporter exists in the chloroplast in large quantities[20]. They are responsible for the transport of selenate through the chloroplast membrane. The absence of this transporter will significantly reduce the sulfate content in the chloroplast. Some scholars have also found that by treating plants with sulfur deficiency, under sulfur-deficient conditions, plants can regulate the expression of sulfur-bearing genes in the roots, thereby increasing the plant's uptake of selenate and its uptake by the population. It can be seen that the metabolism of selenium and sulfur is very closely related.

(2) Plant Transformation of Soil Selenium

From the state of selenium on the ground, there are still some differences in the metabolic transformation of selenium in plants[21-22]. After the plant absorbs organic selenium, it can always maintain the original form of organic selenium and directly participate in protein metabolism and composition in a non-specific manner. The assimilation process after the plant absorbs selenium through the root mainly occurs on the ground, and the chloroplast is the main absorption site of selenium. Unlike selenium, selenium should be reduced to selenium for later conversion. When the free root system absorbs moon salt into the soil through a sulfur belt, it passes through the wood and into the chloroplast through the belt[23-24]. With the participation of ATP, selenite is first activated by ATP sulfate enzyme to produce adenosine phosphate. Subsequent formation of selenium under depletion of adenosine phosphate. Since APS and APR isoenzymes are also present in the cytoplasmic matrix, it is likely that a reduction in selenate is also present in the cytoplasmic matrix. In these processes, the reduction of selenium to selenium is the stage that limits the rate of selenium metabolism to normal plants: ATP-sulfatase and APR are involved in the reaction and are the basic enzymes of these rhythm-restricted stages. Subsequent reduction reactions may occur after selenium

is converted to selenium[25-26]. The reduction reaction is similar to sulfate, which is caused by reduced sulfate, and only exists in chloroplasts. In addition, reduced glutathione also plays an important role in the non-enzymatic reduction of selenium[27-28].

## 3. Experiments

### 3.1. Data Sources

The test site in this article was selected at the Macadamia Experiment Institute. It is a scientific research base in the tropical region, which specializes in agricultural science. A number of 10-year-old Macadamia experimental plants were selected. Organic selenium is used as an exogenous selenium fertilizer to spray plants. Their main active ingredients include: amino acid 100 g/L, trace elements> 20 g / L, organic selenium synthetic agent> 6 g/L; it is a This kind of liquid organic selenium is specially used for crops.

### 3.2. Experiment Method

In this experiment, four treatment methods were used to treat the experimental macadamia plants. The first treatment method was to dilute organic selenium 100 times and spray it on the leaves of the experimental plant, and named it treatment A. The second treatment method : Dilute the organic selenium 200 times and spray it on the leaves of the experimental plant, and name it treatment B; The third treatment method: Dilute the organic selenium 300 times and spray it on the leaves of the experimental plant, and name it Treatment C; The fourth treatment was named D treatment, which was used as the comparison object of the first three treatments: only water was sprayed on the leaf surface of the experimental plant, and no other treatment was performed. In order to ensure the accuracy of the results, the experimental strains are arranged in random blocks. Three rounds of experiments are used for each round of experiments, and the results are obtained multiple times to average the results.

### 3.3. Test Method

The experiment was started at the most appropriate time of the year, because after the first automatic drop of macadamia fruit, its growth and fruit development were vigorous, so this time was chosen to start the experiment. After the first spraying of the plants is completed, four consecutive sprayings need to be performed, and the interval between each spraying is selected as one month, and the changes of the plants after each spraying are observed and recorded. Time is strictly managed during the test to ensure the correctness of the data. The sampling time should be one month after the last spraying to ensure that the plants completely absorb selenium fertilizer.

### 3.4. Testing Standards

The main indicators measured in this experiment are: First, the appearance and quality of macadamia nuts. The main observations are the shell weight, kernel weight, fruit weight, seed rate, kernel rate, yield, and first-rate nut rate. Second, the intrinsic and quality of macadamia nuts need to be measured by chemical measurement methods. The protein is mainly determined by Kjeldahl method, the fat is measured by Soxhlet extraction method, and the soluble sugar content is anthrone Colorimetric method. The total amino acid is determined by high performance liquid

chromatography. The detection of selenium content is determined by HNO33-HClO4-digestion-HCl-reduction-hydride atomic fluorescence spectrometry.

## 4. Discussion

### 4.1. Exogenous Selenium Fertilizer on The external Quality of Macadamia Nuts

(1) Single fruit (kernel) is heavy

The experimental statistics show that the effects of different treatments on the single fruit (kernel) weight of macadamia nuts are shown in Table 1 and Figure 1:

*Table 1. The effect of different treatments on single fruit ( kernel) weight of macadamia nuts*

| Treatmen | Single fresh fruit weight(g) | Compared with D(%) | Single shell weight(g) | Compared with D(%) | Single kernel weight(g) | Compared with D(%) |
|---|---|---|---|---|---|---|
| A | 20.3 | 12.8 | 10.90 | 4.7 | 2.83 | -1.4 |
| B | 21.0 | 16.7 | 11.15 | 7.0 | 2.84 | -1.0 |
| C | 20.0 | 11.1 | 10.63 | 2.1 | 2.71 | -5.6 |
| D | 18.0 | - | 10.41 | - | 2.87 | - |

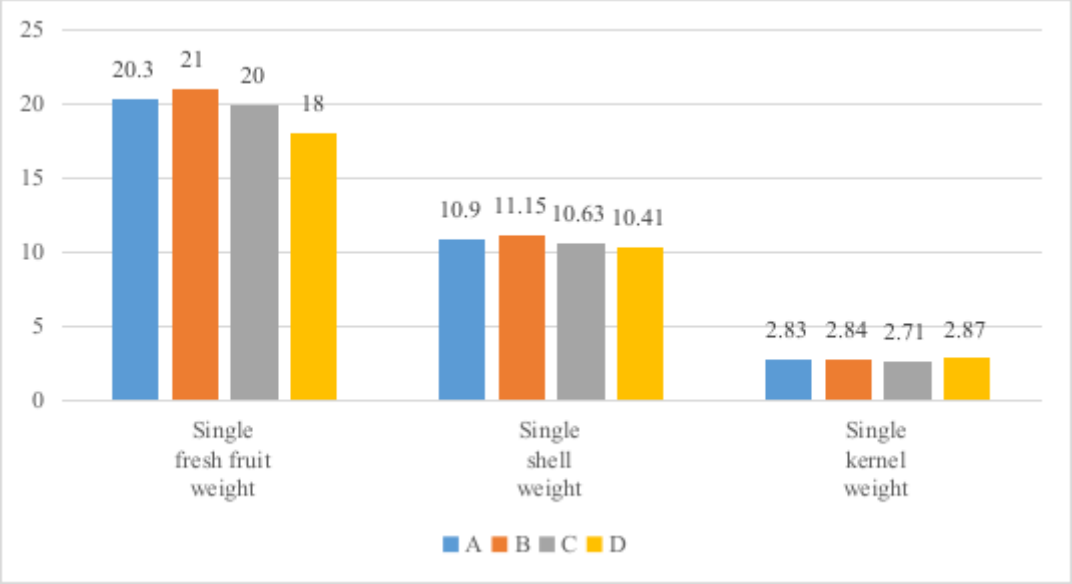


*Figure 1. The effect of different treatments on single fruit ( kernel) weight of macadamia nuts*

It can be seen from Table 1 and Figure 1 that different treatments can increase the single fruit weight and single husk fruit weight of Macadamia experimental plants. The single fruit weight after A treatment increased by 12.8% compared to D treatment, and the single fruit weight after B treatment increased than D treatment. After 16.7%, the weight of single fruit increased by 11.1% after treatment C. Among them, the weight of single fruit increased the most by treatment B. However, it can be seen from the analysis of the data that the difference between the different treatments is not very obvious, indicating that the impact is not very large. Big. In different

treatments, the weights of nuts in single shells of A, B, and C increased slightly compared to D treatments, and the specific growth rates were 4.7%, 7.1%, and 2.1%. As in the previous case, the first three treatments and D treatments The difference is not very obvious, but it has increased slightly. It can be seen that the growth of single fruit fresh weight and single shell fresh weight is similar. Compared with the D treatment, the weight of the single kernel of each treatment was only slightly reduced, and the reduction rates were 1.4%, 1.0%, and 5.6%. Analysis of these reasons may be due to the different shells of organic selenium sprayed during seeding Due to the thickness, slight differences are normal.

(2)Kernel Rate, Seed Rate, And First-rate Kernel Rate

According to experimental statistics, the effects of different treatments on macadamia kernel seeding rate, seeding rate, and first-rate kernel rate are shown in Table 2 and Figure 2:

*Table 2. The effect of different treatments on seed rate, kernels rate and first-class kernels rate of macadamia nuts*

| Treatmen | Seed rate (%) | Compared with D(%) | Kernel rate (%) | Compared with D(%) | First grade kernel (%) | Compared with D(%) |
|---|---|---|---|---|---|---|
| A | 50.87 | 7.3 | 33.4 | +0.4 | 99.5 | +1.0 |
| B | 52.38 | 3.7 | 35.43 | +6.5 | 100.0 | +1.5 |
| C | 50.0 | -1.0 | 32.53 | +2.2 | 99.0 | +0.5 |
| D | 50.5 | - | 33.27 | - | 98.5 | - |

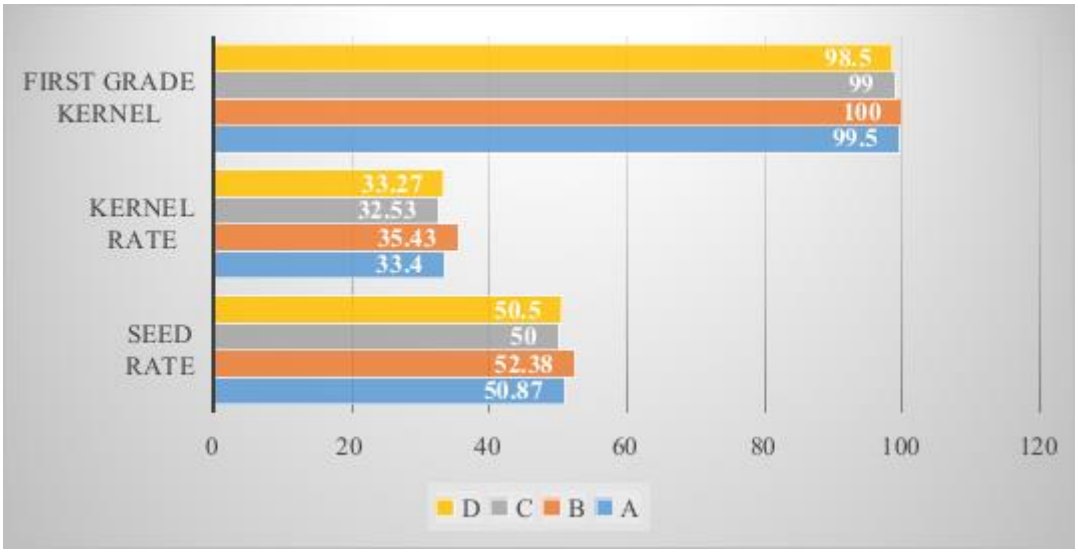


*Figure 2. The effect of different treatments on seed rate,kernels rate and first-class kernels rate of macadamia nuts*

As can be seen from Table 2 and Figure 2, the seeding rate is compared. After A treatment, the seeding rate is 7.3% higher than D treatment. After B treatment, the seeding rate is 3.7% higher than D treatment. After C treatment, On the contrary, the seeding rate is 1.0% lower than that of the D treatment. Analyzing these gaps, the difference is not particularly obvious and is basically the

same. The kerneling rate is compared. After the A treatment, the kernel yield is 0.4% higher than the D treatment. After treatment, the kernel yield was 6.5% higher than that of D treatment, and the seed yield after C treatment was 2.2% higher than D treatment. It can be seen that among them, B treatment has the best growth effect and the most growth, And the difference looks very obvious compared to other treatments. Kernel rate comparison, the kernel rate after treatment A is 1.0% higher than that of D, the kernel rate after treatment B is 1.5% higher than D, and the kernel rate after C is 0.5 higher than D %, It can be seen that although each treatment has a slight increase in the nut rate, the difference is basically the same.

### 4.2. Effect of Exogenous Selenium Fertilizer on Inner Quality of Macadamia Nuts

According to experimental statistics, the effects of different treatments on the intrinsic quality of macadamia nuts are shown in Table 3 and Figure 3:

*Table 3. The effect of different treatments on internal quality of macadamia nuts*

| Treatmen | Protein (g/kg) | Compared with D(%) | Fat (%) | Compared with D(%) | Soluble sugar(g/kg) | Compared with D(%) | Total amino acid (g/kg) | Compared with D(%) |
|---|---|---|---|---|---|---|---|---|
| A | 88.1 | -9.4 | 745 | 1.9 | 32.2 | 15.4 | 8.41 | -3.6 |
| B | 88.7 | -1.8 | 772 | 5.6 | 37.2 | 33.3 | 8.75 | 3.7 |
| C | 88.8 | -1.7 | 754 | 3.1 | 32.0 | 14.7 | 8.65 | 2.5 |
| D | 90.3 | - | 731 | - | 27.9 | - | 8.44 | - |

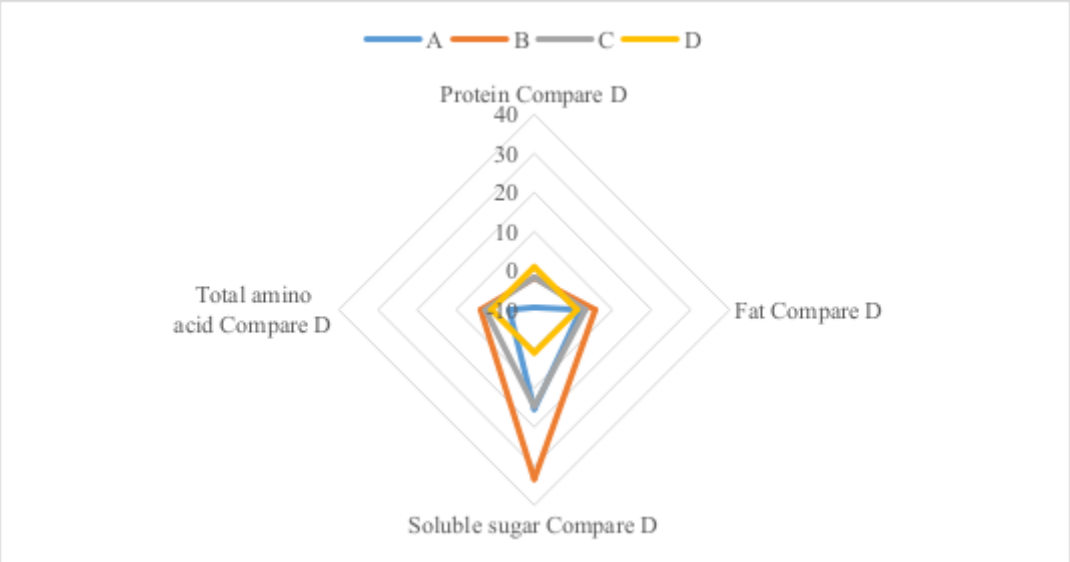


*Figure 3. The effect of different treatments on internal quality of macadamia nuts*

As can be seen from Table 3 and Figure 3, the intrinsic substance measurement was performed on each treated Macadamia experimental plant fruit, mainly measuring kernel protein, fat, soluble total sugar, and total amino acid. According to the actual protein content test results, comparison with D treatment As a result, the protein content of Macadamia fruits after each treatment of A, B,

and C all decreased, and the reduction rates of the three treatments gradually decreased with the increase of the dilution factor. The fat content test results show that the fat content after A treatment is increased by 1.9% compared to D treatment, the fat content after B treatment is increased by 5.6% than D treatment, and the fat content after C treatment is increased by 3.1% compared to D treatment. The difference between treatment B and treatment D is obvious, and the difference between the other two treatments is very small, which is basically the same. The results showed that the soluble sugar after A treatment increased by 15.4% compared with D treatment, the soluble sugar after B treatment increased by 33.3% than D treatment, and the soluble sugar after C treatment increased by 14.7% from D treatment. After three treatments, Compared with D treatment, the soluble sugar content has a significant gap. Among them, B treatment has the most increase effect. The amino acid content test results show that compared to the result of D treatment, the total amount of amino acids treated by B increased by 3.7% and the total amount of amino acids treated by C increased by 2.5%, but the total amount of amino acids treated by A decreased by 3.6%. It can be found that A, The differences in total amino acids in the four treatments of B, C and D were obvious.

### 4.3. Effects of Exogenous Selenium Fertilizer on Selenium Content in Macadamia Nuts

According to experimental statistics, the effects of different treatments on selenium content and yield of macadamia nuts are shown in Table 4 and Figure 4:

*Table 4. The effect of different treatments on selenium content andyield of macadamia nuts*

| Treatment | Selenium (mg/kg) | Compared with D (%) | Plant production (kg) | Compared with D (%) |
|---|---|---|---|---|
| A | 0.56 | 107.4 | 19.6 | 23.8 |
| B | 0.54 | 100.0 | 19.9 | 25.7 |
| C | 0.42 | 55.6 | 15.67 | -1.0 |
| D | 0.27 | - | 15.83 | - |

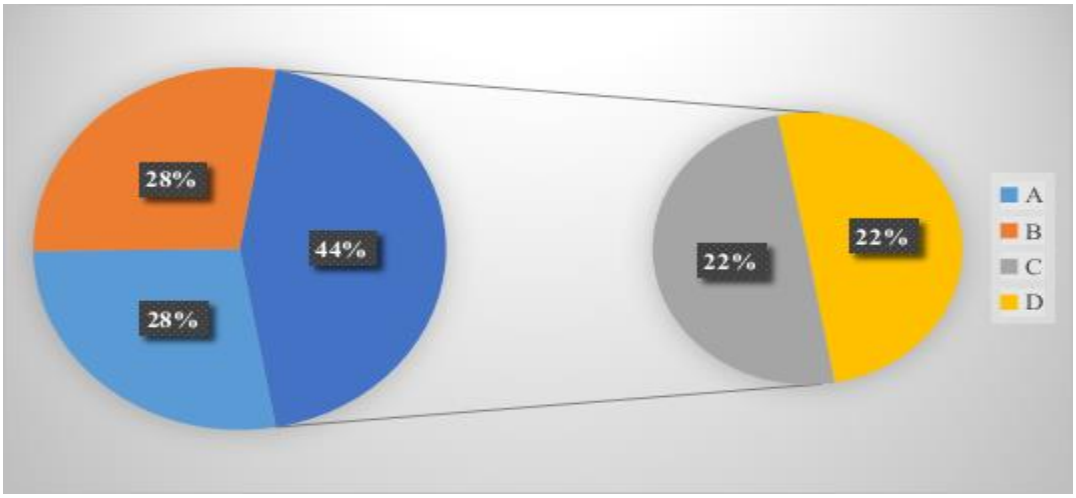


*Figure 4. The effect of different treatments on selenium content and yield of macadamia nuts*

As can be seen from Tables 4 and 4, after testing, the selenium content in Macadamia A treatment was 5.6g/kg, the selenium content in B treatment was 5.4g/kg, and the selenium content in C treatment was 4.2g/kg, compared with D without treatment, A treatment was 107.4% higher, B treatment was 100.0% higher, and C treatment was 55.6% higher. The analysis results can be seen, of which A and D treatments, B and D treatment nuts The difference in selenium content is very large, which indicates that the selenium content in macadamia can be increased by using exogenous selenium, and when the organic selenium dilution concentration for spray cultivation is 100-300 times, the selenium content of the nut kernel is sprayed with selenium Decreasing the concentration results in a decrease in the selenium content.

### 4.4. Effects of Exogenous Selenium Fertilizer on Macadamia Nut Yield

At the same time, Table 4 and Figure 4 show that A and B treatments can increase the yield of experimental Macadamia experimental plants. The plant yields are 23.8% and 25.7% higher than D, respectively. Compared with D treatment, a significant effect is achieved, of which B treatment effect Most obvious. Because it can be shown from the results that the spraying of organic selenium can increase the yield of macadamia nuts, and it increases first and then decreases with the increase of the dilution factor, and the dilution concentration is 200 times the optimal concentration.

### 4.5. Discussion and Analysis of Experimental Results

According to the research in this paper, after applying selenite, the selenium content and enrichment coefficient of Macadamia organs decreased significantly with the increase of fertilization. The ability of plants to enrich selenium in soil is called the enrichment coefficient. Generally, Now, when the plant's enrichment factor is greater than 1, it means that the plant has a strong ability to absorb selenium in the soil. In this study, it was found that the enrichment factors of phosphate fertilizer and selenium fertilizer are both less than 1; The ability to transfer to the ground becomes the transfer coefficient. When the selenite is applied, it will be found that the coefficient of each Macadamia organ decreases significantly with the increase in the amount of phosphorus applied; at the same time, under conditions of exogenous selenium application, The selenium utilization rate of Macadamia nuts treated with high selenium was significantly lower than that of Macadamia nuts without selenium treatment, indicating that selenium application significantly reduced the selenite absorption of macadamia nuts. The combined application of phosphorus with phosphate fertilizer and selenium fertilizer significantly increased the selenium content and selenium enrichment capacity of Macadamia organs. The selenium enrichment coefficient of Macadamia organs was greater than 1. At the same time, the phosphorus fertilizer significantly increased the selenium content and selenium content of various organs of kiwifruit. Transit capability. The results showed that the application of phosphate fertilizer could significantly increase the selenium enrichment ability of kiwifruit organs Macadamia. At present, some studies have also found that organic matter in the soil has a strong adsorption capacity for selenite. With the increase of phosphorus application, the content of soluble selenium and interchangeable selenium in the soil decreased significantly, while the content of iron oxide and organic selenium increased significantly with the increase of phosphorus application. The conversion of selenium into stable selenium reduces the bioavailability of selenite. The redox potential and pH of the soil have a great impact on the efficacy of some soils, because they determine the selenium form in the soil. For example, in high pH and high redox potential soils, selenite is in the soil. The main form, selenite is mainly present in the soil with low pH and low redox potential. The bioavailability of selenite is

higher than selenite, because selenite has higher absorption capacity for soil than salt Absorptive capacity. Therefore, phosphorus application can activate iron oxide in the soil and selenium in organic selenium, indicating that phosphorus application can significantly increase the selenium content in macadamia organs. The test results showed that the selenium content in the roots, stems, leaves and ears of Macadamia nuts treated with selenite was higher than that in selenite treatment, mainly because the bioavailability of selenite was higher than that in selenite treatment.

## 5. Conclusion

Macadamia's absorption of selenium is similar to other nutrients. In a certain period, the nutrient absorption of macadamia organs increased with the increase of the application amount. When the application amount exceeded a certain interval, with the increase of the application amount, the absorption and accumulation of elements by the crop would decrease accordingly, and the utilization It will also decrease. When selenium is in plants, the range from beneficial to toxic is limited. Providing an appropriate amount of exogenous selenium will promote the rapid growth of plants to a certain extent, but excessive amounts of exogenous selenium cannot be added. Excessive amounts of exogenous selenium can cause serious damage to plants and even cause plant malnutrition. At the same time, the selenium content of the same plant usually has a large variation range. Generally speaking, the selenium content of the edible parts of the same crop is lower than that of the non-edible parts.

This paper studies the absorption and conversion of Macadamia nuts into exogenous selenium. The results showed that spraying exogenous selenium to various parts of macadamia plants could increase the selenium content of macadamia plants, and the plant selenium content increased with the increase of the sprayed exogenous selenium, but after exogenous selenium application, The percentages of selenium in different organs of plants are not exactly the same. When exogenous selenium was sprayed on the roots of Macadamia plants, the selenium content of the plant showed the highest in the root system; when exogenous selenium was sprayed on the leaf surface, the percentage of selenium in the leaves was the highest, and with the exogenous selenium sprayed With the increase, this phenomenon becomes more obvious.

The test results in this article show that spraying an appropriate amount of organic selenium on the macadamia test plants can increase the selenium content in the kernel, improve the quality and texture of the kernel, and increase the weight of fresh fruits and the weight of single-shell fruits. To produce better fruits, increase the kernel rate and first-rate kernel rate, and produce more excellent fruits. Exogenous selenium also significantly increased the fat content, soluble sugar content, and plant fruit yield. The results of this test show that the macadamia fruit will decrease with spraying selenium concentration, the nut fat content will increase first and then decrease, and the soluble sugar content will increase first and then decrease as the fat content. Yield increases and then decreases, which indicates that the exogenous selenium cannot be sprayed wirelessly, and the plant has an absorption limit. In this experiment, four methods of spraying were performed. When the concentration was diluted to 100 times, the selenium content of the sample plants increased by 107.4%, and the yield increased by 23.8%. When the concentration was diluted to 200 times, the selenium content of the sample plants increased. When the concentration was diluted to 300 times, the selenium content of the sample plant increased by 55.6%, but the yield decreased by 1.0%. It can be proved that the appropriate concentration of selenium fertilizer can increase the selenium content and growth of the plant. Efficiency has a corresponding promotion effect. Among them, the effect of treatment B is the most obvious. It can be shown that exogenous selenium can increase the

yield of macadamia nuts, and it increases first and then decreases with the increase of the dilution factor and concentration, and the best dilution effect is 200 times. The concentration of sprayed selenium fertilizer is also closely related to this. Therefore, different types of fruit trees have different requirements for the concentration of sprayed selenium. In agricultural production, farmers must first conduct small-scale experiments based on different varieties of fruit trees and test the optimal solution before they can be widely promoted to achieve Maximize the benefits.

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## 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.

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