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Research Progress on the Effect of Fertilizer Types on the Growth and Quality of Mung Bean

Zhu Rui[1, a], Xiaoling Wang[1], Hongquan Liu[1, b, *]

[1]Agricultural University of Hebei, Baoding 071000, China.

[a]2640995160@qq.com, [b]lhq@hebau.edu.cn

Abstract

By consulting a large number of related research literature, we can see that chemical fertilizer, micro-fertilizer, organic fertilizer and bacterial fertilizer are very important to the cultivation of mung bean, and play different roles: chemical fertilizer based on nitrogen, phosphorus and potassium has a great impact on the growth and development of mung bean, especially on its yield. micro-fertilizer plays a unique role in improving the quality of mung bean, while organic fertilizer and bacterial fertilizer are of great significance for green cultivation and sustainable development of mung bean.

Keywords

Mung bean; fertilizer; microelement; organic fertilizer; bacterial fertilizer.

1. Introduction

Mung beans have been cultivated in China for more than 2,000 years. The original place of production was in India and Myanmar. At present, it is commonly planted in East Asian countries, and a small amount is planted in Africa, Europe, and the United States. China, Myanmar and other countries are the main exporters of mung beans. Mung beans are rich in protein, vitamins, mineral elements and other nutrients, and have medicinal value[1]. Mung beans have a short growth period and can be well adapted to arid and barren land. Because mung beans have the characteristics of nitrogen fixation and can improve soil fertility, mung beans have become the main economic source of remote economic areas such as remote mountainous areas in China[1]. Yield and quality of mung bean are affected by many factors such as cultivated soil, variety, cultivation technology, field climate, and so on. Soil nutrients are important factors that affect mung bean yield and quality. Therefore, rational allocation of fertilizer ratio to improve the soil nutrient environment is one of the important means to ensure the normal growth and development of mung beans and improve quality.

2. Effects of N, P and K Fertilizer on Mung Bean Growth and Yield

The amount of fertilizer used is increasing every year. Nitrogen, phosphorus, and potassium are a large number of elements essential for crop growth and development, and they play an extremely critical role in crop growth and development. The reasonable ratio of nitrogen, phosphorus and potassium fertilizers has an important effect on the growth and development of mung beans. Fertilization has an effect on the yield traits such as the effective pod number per single plant and the number of single pods. Scientific and reasonable nitrogen, phosphorus, and potassium fertilizer ratios can not only meet the nutritional elements required for the growth and development of mung beans, but also promote the coordination of growth and development of a single plant. Optimizing yield components [2] .

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2.1. Effect of Nitrogen Fertilizer on Mung Bean

Nitrogen is the main component of many important compounds in crops such as proteins, nucleic acids, chlorophyll, and enzymes, and it is also a component of some vitamins and alkaloids. According to the current domestic experiments on nitrogen application, proper application of nitrogen fertilizer can significantly increase crop yield. In addition, the amount of fertilization will have different effects on the agronomic characteristics of mung bean and the utilization efficiency of nitrogen fertilizer.

According to the test results of the Institute of Crops of Anhui Academy of Agricultural Sciences in 2018, it was proved that increasing nitrogen fertilizer promoted the accumulation of dry matter and chlorophyll production Effect, especially in the mung bean seedling stage and flowering stage, to maintain the chlorophyll content of mung bean at a high level, and help photosynthesis to produce nutrients. After the analysis of the experiment, the number of nodules, fresh weight and dry weight showed a trend of increasing first and then decreasing with the increase of nitrogen fertilizer application[3]. Plants need multiple nutrients, and nitrogen is especially important. Worldwide, nitrogen is the primary factor limiting plant growth and yield among all essential nutrients[4].

In 2011, the farm of Inner Mongolia University for Nationalities conducted an experiment on the effect of Nitrogen Application on the yield and quality of mung bean. Through their experiments, it was further proved that proper nitrogen application played a positive role in promoting the number of pods per plant, the number of seeds per pod, the weight of 100 seeds and the quality of mung bean. However, excessive nitrogen application can inhibit the production of yield and nutrients. Edible bean is a good intercropping crop for Gramineae, so some scholars have studied the experiment of nitrogen application amount on the productivity and nitrogen absorption accumulation of intercropping system. Through the experiment, it is found that the intercropping of mung bean and oats has yield advantage, and the productivity of intercropping system is 30% higher than that of the two crops. However, the results showed that the productivity, biomass and nitrogen absorption rate of intercropping system did not increase with the increase of nitrogen application. When there was no nitrogen application or the amount of nitrogen application was low, the intercropping system of oats and mung bean did not reduce the yield through the mechanism of interspecific nitrogen nutrition complementation, High land equivalent ratio (LER), biological yield and nitrogen accumulation can be obtained; high nitrogen content and interspecific interaction make crops "luxury absorption" of nitrogen, and under high nitrogen conditions, legume nitrogenase is inhibited or inactivated, resulting in "nitrogen repression"[5].

2.2. Effect of Phosphate Fertilizer on Mung Bean

Phosphorus is one of the main elements affecting plant growth and development and life activities. It is a component that constitutes macromolecular substances and many important compounds. Appropriate application of phosphorus fertilizer can increase crop yield[6]. The rational application of phosphate fertilizer is very important for the growth, development, yield and quality of mung bean[7]. Some scholars have proved through experiments that the output of mung bean shows a trend of first increase and then a slight decrease with the increase in the amount of phosphate fertilizer applied. When the amount of phosphorus application is in the range of 0 ~ 135 kg / hm_2, as the amount of phosphate fertilizer increases, mung bean The yield of the population showed an increasing trend. If the amount of phosphorus exceeded 135 kg / hm_2, the yield of mung bean showed a downward trend, indicating that the proper application of phosphate fertilizer could coordinate the relationship between the source of mung bean and promote the development of the group's potential for increasing yield[8]. Phosphorus is one of the three elements of crop nutrition, and it has multiple effects on the entire growth stage of the crop. Some scholars have demonstrated through experiments that the proper supply of

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phosphorus nutrients can actively promote various physiological metabolic processes in mung beans. At the same time, phosphate fertilizer had different effects on the accumulation and distribution of nitrogen, phosphorus, and potassium in mung bean at different growth stages.

The Qiqihar Branch of Heilongjiang Academy of Agricultural Sciences established tests and models in 2009. It was concluded that at low levels of phosphate fertilizer, mung bean output increased with increasing potassium levels, and at high levels of phosphate fertilizer, mung bean output decreased with increasing potassium levels. Low potassium fertilizer and high phosphorus fertilizer can significantly increase the yield of mung bean[9]. Reasonable application of phosphate fertilizer can promote the differentiation of mung bean at the flowering stage to a certain extent. In addition, increasing the application amount of phosphate fertilizer can increase the number of pods per plant, the number of single pods and the 100-grain weight to a certain extent. Reasonable application of phosphorus fertilizer can increase the accumulation of nitrogen, phosphorus and potassium nutrients in mung bean plants.the accumulation of phosphorus can be increased by 50% to 71%, and the accumulation of potassium can be increased by 38% to 70%. When the amount of phosphorus is less than 180 kg / hm_2, it can be increased by 44% ~ 56%[8]. According to the results of the pot experiment of the Anhui University of Science and Technology in 2013, the appropriate application of phosphorus fertilizer can promote the growth and nutrient absorption of TongShan mung bean and its nodules. The best growth time, the most nutrient absorption and accumulation, the highest yield and nutritional value of fresh grass, phosphate fertilizer utilization rate is also the highest at this time, but excessive application of phosphate fertilizer will make green fertilizer and its nodules grow poorly, the nutritional value is reduced, the yield is reduced[10]. Hao Lei found through experiments that phosphate fertilizer is a component of cell protoplasm in plants and plays an important role in the growth and proliferation of cells; phosphorus also participates in photosynthesis in plant life processes and has a role in transmitting sugar and starch; It can promote the growth of the root system. During the pod setting period of mung bean, phosphorus is transferred to the grains, making the grains large and full[11].

2.3. Effect of Potassium Fertilizer on Mung Bean

Potassium is one of the indispensable elements in the whole growth stage of plants. Potassium ions participate in various enzyme conversion processes in the crop, especially for protein synthesis and photosynthesis in the crop. Appropriate amount of potassium not only promoted the growth and development and quality of mung beans, but potassium also increased the use efficiency of nitrogen fertilizer by mung beans and enhanced the ability of mung beans to modulate nitrogen. Some studies have found that increasing the amount and quality of legumes by increasing the amount of potassium fertilizer is mainly due to the fact that potassium improves the photosynthesis intensity of leguminous crops, strengthens the synthesis and movement of nutrients in legumes, and at the same time, potassium The absorption and utilization efficiency of leguminous crops to other fertilizers such as nitrogen and phosphorus. At the same time, potassium fertilizer is conducive to the toughness of the mung bean stems, preventing the stems from lodging, thereby increasing the yield[11].

3. Effect of Trace Element Fertilizer on Mung Bean Quality

With the country's continuous support for agriculture, China's agriculture has achieved great development. In today's agricultural production, chemical fertilizers play an increasingly important role in crop growth and development, quality and yield, but the imbalance of fertilization still exists in agricultural production, especially the neglect of trace element fertilizers. In the current process of mung bean planting and cultivation, the phenomenon of unreasonable fertilization and fertilization is very prominent. In order to increase mung bean yield and improve mung bean quality, nitrogen, phosphorus, and potassium fertilizers have

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been blindly added, thereby ignoring the supplement of trace element fertilizers and ignoring trace element The important role of crop growth and development makes the lack of trace elements in the soil, and the effect of increasing fertilizer application not only cannot be fully exerted, but also inhibits the normal development of mung beans, resulting in a reduction in mung bean yield and quality, and it is more likely to cause soil physical and chemical Deterioration.

Although the content of trace elements in the crop is small, it plays a key role in the entire growth and development of the crop. Trace elements are components of enzymes and coenzymes in crops, and have strong specificity. They are indispensable and irreplaceable components in crop growth and development.

3.1. Effect of Boron Fertilizer on Mung Bean

Boron is not a structural component in plants, but it has important effects on some important physiological processes in crops. Boron directly affects the photosynthetic capacity of plant leaves and participates in the synthesis of carbohydrates during leaf photosynthesis, which is conducive to protein synthesis. At the same time, boron can improve the nitrogen-fixing activity and increase the nitrogen-fixing capacity of leguminous crop rhizobium. Jiao Xiaoyan and other scholars studied the effect of boron deficiency on photosynthetic characteristics and carbohydrate content of mung bean leaves through solution culture. The results of the study showed that boron deficiency had no effect on leaf chlorophyll content, and boron deficiency reduced photosynthetic rate and stomatal conductance, But has no effect on intercellular carbon dioxide concentration; boron deficiency increases stomatal limitation rate [12]. Although boron deficiency reduced photosynthetic rate, it increased the content of soluble sugars, especially glucose and starch, in the leaves[12]. At the same time, the effect of boron deficiency on plant growth was not due to lack of carbohydrates, but to a decrease in photosynthetic rate due to a decrease in reservoir activity[12]. Hao Lei and other scholars sprayed boron fertilizer on mung bean plants and found that spraying boron fertilizer can promote more flowering of mung beans, more grains, and a significant increase in mung bean yield[11]. Spraying boron fertilizer at the seedling stage of mung bean can promote the growth of mung bean root system.It has an important effect on the synthesis and operation of carbohydrate products, carbohydrates, and has a special promotion effect on the fertilization process of mung bean. Drought and disease resistance, and promote early maturity of mung beans[11].

3.2. Effect of Zinc Fertilizer on Mung Bean

Zinc in mung bean nitrogen metabolism can change the ratio of organic nitrogen and inorganic nitrogen in mung bean body, greatly improve the ability of mung bean to resist drought and low temperature, and promote the healthy growth of mung bean branches and leaves. At the same time, zinc participates in the production of chlorophyll, prevents chlorophyll degradation and the formation of carbohydrates. In addition, zinc also participates in the synthesis of various enzymes in mung beans. B. Singh and other scholars studied through pot experiments, zinc fertilizer on the weight of mung bean rhizobium, the dry matter accumulation of mung bean during 50 days of growth, and the dry matter accumulation of mung bean during harvest was significant. Thereby prolonging the development of mung beans[13]. At the same time, they found that the increase in the amount of zinc will increase the protein content in mung bean grains and increase the yield of mung bean grains.

3.3. Effect of Molybdenum Fertilizer on Mung Bean

Molybdenum is an essential trace element in plants and was first discovered by Arnon et al in 1939[14]. Through the research of Steinberg, Skinner and other scholars, [15-16], the physiological function of molybdenum in plants is achieved by its composition of certain

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enzymes[16]. In plants, molybdenum is an essential component of nitrate reductase. In addition, molybdenum also participates in the formation of nitrogenase, which is indispensable for the biological nitrogen fixation of legumes and various autogenous nitrogen-fixing bacteria[17]. Molybdenum also participates in photosynthesis and respiration in crops, and is an indispensable element for maintaining crop chloroplast structure. The application of molybdenum fertilizer can increase the photosynthetic intensity of crops by 10% -40% than that without application[19]. Molybdenum plays an important role in key enzymes of the respiratory process in crops[20]. Tang Bo et al. Studied the effect of molybdenum fertilizer on the growth and nutrient absorption of mung beans through pot experiments. The test results show that the application of medium and low levels of molybdenum fertilizer can significantly promote the growth and nutrient absorption of mung beans, and improve the quality of mung bean forage. Molybdenum fertilizer inhibits mung bean growth[21]. They researched that the optimal use of molybdenum fertilizer in mung bean cultivars is to apply 6mg of molybdenum fertilizer per kilogram of soil[21].

4. Effects of Organic and Bacterial Fertilizers on Mung Bean Growth

Organic fertilizers and bacterial fertilizers can improve soil and fertility, and can also stimulate organic matter to release nutrients, increase crop yield, and improve quality. At the same time, it can also improve the absorption of soil nutrients by crops, enhance the resistance of crops to the environment, and their resistance to diseases and insect pests. Resistance. The development and use of organic fertilizers provide new options for the development of agriculture, and provide a certain material basis for promoting cost-effective and green production modes. Xiuqin Wang and other researchers studied the effects of commercial organic fertilizers on mung bean yield and soil environment, and found that the application of commercial organic fertilizers can not only significantly increase the yield of mung beans, but also improve the physical and chemical properties of the soil, and improve soil quality. With the continuous increase of soil fertility, the improvement effect of soil fertility improvement and the production of mung bean continued to increase[22]. Renfeng Xue and others applied 5 different bacterial fertilizers to mung beans to screen out the best fertilizer for increasing mung bean yield and income. After experimental research, the effect of the microbial complex bacterial agent treatment was obvious. The fresh weight of the plant reached 172.0g, the dry weight of the plant reached 45.7g, the fresh weight of the aerial part reached 164.0g, and the dry weight of the aerial part reached 40.0g. Fresh weight was 0.20g, and nodule dry weight was 0.05g. The yield of TBK complex microbial protozoal agent and microbial complex bacterial agent was the highest, reaching 2077.3 kg / hm2, 1938.3 kg / hm2[23]. The test results show that TBK complex microbial protozoa and microbial complex bacterial agent can effectively promote the growth and development of mung bean, stimulate related physiological and biochemical reactions, and significantly increase the mung bean yield[23].

5. Conclusion

Various nutrients required by mung bean at the growth stage are mainly from the soil. From the analysis of soil nutrient status in the main mung bean producing areas in China, although the nutrients contained in the soil can allow mung beans to grow normally, the yield and quality often fail to meet expectations. Therefore, it is necessary to supplement the nutrient supply in the soil by applying fertilizers, so that the output and quality of mung beans can meet the needs of the market, thereby bringing good economic effects. However, according to the purchase and use of fertilizers in the main mung bean producing areas, many farmers blindly applied nitrogen, phosphorus, and potassium fertilizers in order to one-sidedly pursue mung bean yields, ignoring the important role of trace elements in the growth and development of mung beans,

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regardless of Application of trace element fertilizer. Therefore, in order to reasonably improve the yield and quality of mung beans, it is necessary to take into account the application of trace element fertilizers, coordinately apply trace element fertilizers with nitrogen, phosphorus, and potassium fertilizers, and balance the nutrients necessary for the growth and development of mung beans in the soil. At the same time, in order to maintain the sustainable use of soil fertility, organic fertilizer should be appropriately applied to fertilize the fertilization in mung bean planting, and appropriate time should be selected for fallow cultivation to ensure that the soil fertility can be effectively restored. According to the above summary, according to the different conditions of soil fertility, there are planned application of different elemental fertilizers and organic fertilizers to ensure a coordinated and balanced soil nutrition. At the same time, on the premise of sustainable development combined with soil fertility, research on various component fertilizers was increased, and a coordinated and balanced application of different component fertilizers was sought.

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