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Effects of Seed-pelleting on Physiological Characteristics of Rice

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Abstract. So as to study the effects of seed pelleting on the physiological characteristics of rice, took the japonica hybrid rice variety Tianlongyou 619 as the material, this experiment adopted different pelletized packaging materials and different sowing methods to test the physiological characteristics of rice at different growth stages under field cultivation conditions. Seen from The results, it showed that the soluble sugar content, soluble starch content, soluble protein content and peroxidase activity of the seed granulated rice were increased during the growth process, and the physiological indexes of rice in the T3 treatment (soil-to-fertilizer mass ratio was 100:1) increased the most. The seeding method of 4 seeds per hole was the most effective to improve the physiological characteristics of rice. The granulation of seed-pelleting and the seeding method with 4 seeds per hole have some advantages for the direct cultivation of northern japonica rice.

1. Introduction

With the improvement of living standards, the people's quality of life has also been improved. The situation of increasing people's land and reducing the rural labor force has also emerged out of the water. Therefore, we must further increase the yield per unit area of grain, but also have effort-saving in cultivation [1]. Seed pellet granulation is a new technology for processing and processing seeds in recent years [2-3]. It has been developed to meet the needs of mechanized precision sowing, fertilizer, and medicine and has also become a research in modern agricultural seed treatment. Hotspots [4], can change the physical properties of seeds, such as improving the strength, shape, etc., while pelleting seeds can also provide more precise and better seeding conditions for irregular seeds of small grains. When the pelleted seeds are sown into the soil, the fertilizer can also help to promote the growth of the crop and protect the environment [5]. Rice is a short-day plant and one of the main food crops in China. It is also the staple food of one-third people from the world. The pelletization of rice seeds is to be undoubtedly a brand-new breakthrough in China's agricultural sector. The phytoantioxidant enzyme system plays a role in preventing membrane lipid peroxidation and maintaining the home's active oxygen homeostasis. If the active oxygen homeostasis is broken, it will help to promote membrane lipid peroxidation [6-7]. After suffered the threat, plants are relieved of oxidative stress by up-



regulating antioxidant enzyme activity. Among them, POD removes the peroxide and hydrogen peroxide produced by metabolism, which can prevent membrane lipid peroxidation in plant cells [8]. Previous studies have shown that seed-pelleting rice can increase seeds yields [9]. The research on physiological and biochemical indexes of seed pellet granulation are mostly concentrated on wheat [10], corn [11] and other crops, but no research is on rice. In this study, the hybrid Tianlongyou 619 was selected to test the granulated rice seeds, and the soluble sugar, starch, protein content and protective enzyme activity during the growth process from different growth stages. Explore the changes in its indicators in different proportions of pelletized material. It aims to understand the growth mechanism of pelleted seeds, reveal the relationship between the relevant indicators of different rice varieties and the ratio of pelletization, and provide a theoretical basis for the further study of rice pelletization.

2. Materials and Experimental Design

2.1. Test materials

Rice hybrids: Tianlongyou 619 (japonica-type hybrid rice variety, hereinafter referred to as Longyou 619) were selected and provided by Tianjin Tianlong Seed Industry Technology Co., Ltd. The common soil and high clay used for pelletization are provided by Sanyin Concave Earth Technology Co., Ltd. Wherein common soil is also called attapulgite. The attapulgite is earthy, the color is white or grayish white, the soil is fine and fine, and it has strong water absorption. Besides that, It also has viscosity and plasticity when wet. There is no big crack after drying, and water immersion can be scattered. The fertilizer of the rice seed bed conditioner is provided by Tianjin Tianlong Seed Industry Technology Co., Ltd., and the indexes such as nitrogen, phosphorus, potassium, zinc, sulfur and iron all up to the national standards.

Table 1 Experimental study on physical nature of bump Rod Stone

Item	Colloid index(ml/15g soil)	swelling capacity(m l/g soil)	Methylene Blue trihydrate capacity/100gsoil	Specific surface area(m ² /g soil)	CEC(milligram equivalent/100 gsoil)	Decolouring capacity(after activation)
Index	55-65	4-6	≤24	400-500	25-50	>170

Table 2 High clay quality indicators

Item	Palygorskite content	PH value	Liquid water content	Grain size	Color	Oil absorption rate
Index	≥70%	7±0.5	≤7%	200-325	Off white	220

3. Experimental design

This experiment was carried out in the Filed Practice Base of Shenyang Institute of Technology. Field planting was executed for the rice Longyou 619. In light with the preliminary test results, the common soil and high clay were mixed based on a certain proportion, and the control group was divided into the control group in accordance with the amount of fertilizer added; (only soil, no fertilizer and 5 treatment groups), T1: soil-fertilizer ratio is 80:1; T2: soil-fertilizer ratio is 90:1; T3: soil-fertilizer ratio is 100:1; T4: soil-fertilizer ratio is 110:1; T5 : The ratio of soil to fertilizer is 120:1. For each variety, select the seeds with the same size and seeds are full. Soak the seeds with distilled water first, then mix the mixed soil and fertilizer base on the ratio of CK and T1, T2, T3, T4 and T5 to make the pellets of rice. The pelletized rice after pelleting should be placed in a ventilated place for air drying. There are three ways of sowing: strip sowing, hole 4 sowing (4 seeds per hole), hole 7 sowing (7 seeds

per hole), 3 repetitions, in the experimental field (area 34.2m*28.8m=984.96m²). A random block design is used. The indicators were determined in the emergence, jointing and heading stages of rice.

4. Measurement index and methods

The contents of soluble sugar, soluble starch, soluble protein, and the activity of peroxidase were measured, with the method of spectrophotometer [12].

Statistical analysis was used by Excel 2010, and the average number of each index was calculated, and the graph was analyzed for variance.

5. Results

5.1. Effects of seed pellet granulation on soluble sugar content in rice.

It can be seen from Table 3 that the soluble sugar content of the grained rice seeds during the growth process is higher than that of the control group. In the process of rice growth, the change of soluble sugar content showed a trend from low to high. From the emergence stage to the jointing stage, the soluble sugar content in rice showed a slow upward trend, from the jointing stage to the heading stage, soluble sugar in rice. The content showed a rapid upward trend. During the change process, the upward trend in the early stage was obviously smaller than the late rising trend. For the seeding method of rice seeds, the treatment group with the highest soluble sugar content showed 4 capsules per hole, while from rice. The soluble sugar content of T3 was the highest in the treatment group compared with the other treatment groups, while the soluble sugar content in the hole 4 in the T3 treatment group was the highest.

Table 3 Effect of different proportions of rice seeds on soluble sugar content (%) in different growth stages

	Seedling stage			Jointing stage			Heading stage		
	Strip sowing	Hole 4 sowing	Hole 7 sowing	Strip sowing	Hole 4 sowing	Hole 7 sowing	Strip sowing	Hole 4 sowing	Hole 7 sowing
C	1.02	1.08	1.07	1.37	1.69	1.43	2.02	2.23	2.14
K									
T	1.05	1.12	1.08	1.26	1.62	1.37	2.01	2.15	2.11
1									
T	1.13	1.21	1.18	1.35	1.76	1.41	2.24	2.38	2.32
2									
T	1.18	1.24	1.22	1.47	1.92	1.55	2.38	2.47	2.43
3									
T	1.02	1.08	1.07	1.37	1.69	1.43	2.02	2.23	2.14
4									
T	0.98	1.04	1	1.31	1.48	1.39	1.92	2.21	2.08
5									

5.2. Effects of seed pellet granulation on soluble starch content in rice.

It can be seen from Table 4 that the soluble starch content is the highest in the control group compared with the treatment groups. During the growth of rice, the soluble starch content in the rice body changes from high to low, and transitions to jointing in the rice emergence stage. At the beginning of the period, the soluble starch content of rice decreased rapidly. After the jointing stage, the soluble starch content increased when the rice transitioned to the heading stage, but the rising rate was significantly lower than that of the previous stage. From the seeding method, soluble starch The highest content was spot 4; from the treatment group, the highest soluble starch content was in the T3 treatment group, and the lowest was the control group.

Table 4 Effect of different proportions of rice seeds on soluble starch content (%) in different growth stages

	Seedling stage			Jointing stage			Heading stage		
	Strip sowing	Hole 4 sowing	Hole 7 sowing	Strip sowing	Hole 4 sowing	Hole 7 sowing	Strip sowing	Hole 4 sowing	Hole 7 sowing
C K	8.4	10.3	9.2	14.3	16.8	14.9	9.3	11.7	10.1
T ₁	9.5	10.3	9.5	15.9	16.9	16.2	10.2	11.5	10.8
T ₂	10.9	11.7	10.4	16.6	17.8	17.2	11.4	12.6	11.9
T ₃	11.8	12.5	11.6	16.8	18.3	17.9	12.5	12.8	12.5
T ₄	10.2	11.2	10.8	15.9	17.6	17.0	12.1	12.3	12.3
T ₅	11.3	11.6	11.6	15.5	17.8	16.1	11.8	12.2	12.0

5.3. Effects of seed pellet granulation on soluble protein content in rice.

The change trend of soluble protein content measured by the varieties in different treatment groups was similar (Table 5), and the solubility in the treatment group (T₁, T₂, T₃, T₄, T₅) of the variety was compared with the control group. The protein content increased, and the soluble protein content increased rapidly during the emergence of rice. After the jointing stage, it showed a downward trend (the downward trend was less than the upward trend). In each case, the soluble protein content of the T₃ group was the highest overall; in the seeding method, the protein content of 4 capsules per hole was the highest.

Table 5 Effect of different proportions of rice seeds on soluble protein content (mg/g) in different growth stages

	Seedling stage			Jointing stage			Heading stage		
	Strip sowing	Hole 4 sowing	Hole 7 sowing	Strip sowing	Hole 4 sowing	Hole 7 sowing	Strip sowing	Hole 4 sowing	Hole 7 sowing
C K	63	69	64	38	42	39	21	25	22
T ₁	69	74	71	43	51	47	24	36	29
T ₂	71	75	72	45	52	47	25	39	33
T ₃	76	79	77	54	58	55	32	41	37
T ₄	75	77	77	48	42	45	30	37	31
T ₅	68	69	69	46	48	48	33	40	35

5.4. Effects of seed pellet granulation on peroxidase activity in rice.

It can be seen from Table 6 that the activity of peroxidase (POD) in rice seeds was significantly higher than that in the control group after the pelletization treatment, and the activity of POD showed a

relatively stable increase from the seedling stage to the jointing stage. Trends, with the growth of rice, after the jointing stage, the POD activity of rice is gradually decreasing until the heading stage of rice. In the process of activity change, the ascending rate of the early stage was significantly lower than that of the later stage. In all treatment groups, the POD activity of the sowing method was the highest. For different treatments, the POD activity of the rice in the T3 treatment group was high.

Table 6 Effect of different proportions of rice seeds on POD activity (U/min·g) at different growth stages

	Seedling stage			Jointing stage			Heading stage		
	Strip sowing	Hole 4 sowing	Hole 7 sowing	Strip sowing	Hole 4 sowing	Hole 7 sowing	Strip sowing	Hole 4 sowing	Hole 7 sowing
C K	873	920	892	1756	1839	1792	498	567	528
T 1	923	987	953	1890	1902	1893	523	557	534
T 2	957	1089	998	1922	2031	1986	579	611	601
T 3	988	1167	1032	2135	2238	2197	697	715	711
T 4	961	1036	984	2021	2167	2111	603	697	634
T 5	921	958	935	1845	1963	1894	552	602	579

6. Discussion

Soluble sugars are mainly classified into glucose, fructose and sucrose. It is a direct product of plant photosynthesis and a material basis for the synthesis of macromolecular compounds such as polysaccharides, proteins and fats in plants [13]. Liang Yanrong [14] and others have shown that in the growth stage of green onions, soluble sugars are High-low-high variation law. The results of this experiment indicated that the soluble sugar content of rice seeds increased after emergence in the stage of emergence, jointing and heading, and the soluble sugar content showed a slow upward trend from the emergence stage to the jointing stage. After the jointing stage and the heading stage, the soluble sugar content showed a rapid upward trend, and the soluble sugar content in the heading stage was significantly higher than that in the emergence stage. Between the control group and the treatment group, the soluble sugar content of each treatment was higher than that of the control group, and the sugar content of the T3 group was the highest, and the sugar content of the seeding method was the highest, followed by the T2 group; for three different seeding methods. The content of soluble sugar was the highest in cave 4, followed by 7 in the well, and the soluble sugar content in the control group was the lowest. Therefore, in this experiment, the T4 treatment group had the highest soluble sugar content and the best rice quality. Rice is the main food crop in China. It is the main food in people's diet. The main reason is that it is rich in starch, and starch is the most important, rich and digestible food polysaccharide [15]. Studies by Wang Yuefu [16] et al. and Li Caihong [17] and others showed that the soluble sugar content of rice was negatively correlated with starch content. This experimental study shows that there are also different differences between the groups. The soluble starch content of rice in each growth period was higher than that in the control group. The soluble starch content was higher in the emergence stage due to the decrease of soluble sugar content. At the jointing stage, the soluble sugar content increased, so that the soluble starch content during this period was increased. Decrease, at the heading stage, due to the increase in soluble sugar content, the starch synthesis rate decreases, forming a decreasing trend. In general, the soluble starch content of the control group was the lowest in the control group. In the treatment group, the soluble starch content of the T3 group was

the highest, followed by the T4 treatment group. Among the different sowing methods, the soluble starch content of each of the 4 capsules was the highest.

Soluble protein is a regulating substance of cell metabolism and a promoting substance. Through the change of its content, it can reflect the ability of plant synthesis and metabolism from one aspect [18]. Protein is an important substance of biological life activities. Soluble protein in plants is an enzyme involved in various metabolisms, and its content is also a measure of the quality of agricultural products [19]. In this experiment, the soluble protein content in the emergence, jointing and heading stages of rice growth was measured. The results showed that the protein content of each treatment group was higher than that of the control group in the control group and the treatment group, indicating that the content of soluble protein in rice can be increased during pelleting. In these three periods, the content of soluble protein in rice showed a decreasing trend. During the emergence stage to jointing stage, the protein content decreased rapidly. During the jointing stage to the heading stage, the rate of protein content decreased. In the five treatment groups, although the soluble protein content of each treatment was higher than that of the control group, there was a significant difference between them. The protein content of the T3 treatment group was significantly higher than that of the other four groups. In this treatment group, the sowing method was the best protein content of the spot 4, so the protein content of the T3 group was the best from the perspective of the treatment group. From the perspective of the seeding method, the protein content of the hole 4 was the highest, and the rice was expressed at the jointing stage. The performance was most prominent in rice extraction period. Peroxidase is an antioxidant enzyme, which acts as a membrane lipid antioxidant in plants and maintains the dynamic balance of reactive oxygen species in the body. If the dynamic balance of reactive oxygen species is broken, the rate of membrane lipid peroxidation depends on whether the active oxygen dynamic balance is broken. Experiments in Xiong Yuanfu [20] et al. and Liu Xili [21] have shown that seed coating agents can increase the activity of rice antioxidant enzymes. The increase of POD activity is beneficial to plant cells to scavenge reactive oxygen species, which can eliminate the harm of hydrogen peroxide and control. Lipid oxidation reduces damage to the membrane system. The results of this experiment also showed that the POD activity of the grained rice seeds was higher than that of the control group during the growth and development period, and the change pattern showed a low-high-low trend. In the seedling stage of rice, the activity of POD was lower. At the jointing stage, the POD activity was higher. During this process, the POD activity increased steadily; at the heading stage of rice, the POD activity was lower. During this process, the POD activity in rice decreased rapidly. Compared with the control group, the POD activity of T3 was the most significant in the treatment group. In this treatment group, the seeding method of the seeding method showed the highest POD activity, and the POD activity reached the highest value at the jointing stage; the seeding method had the lowest POD activity. This may be due to the uneven distribution of nutrients absorbed during rice growth. In general, pelletized rice seeds can increase enzyme activity, but T3 treatment can activate POD activity.

7. Conclusion

After pelleting, the soluble sugar content, soluble starch content, soluble protein content and peroxidase activity of rice increased during the growth and development. In the control group and the treatment group, the indexes of the treatment group were higher than those of the control group, and the T3 treatment group was the most obvious. Among the 3 different seeding methods, 4 capsules per hole had the best effect, and the soluble sugar, starch, protein and POD activities were very high, which indicated that in the pelletized material, the ratio of soil to fertilizer ratio of 100:1 was suitable for Tianlong 619 pellets, the granulated rice seeds can not only increase the soluble protein and soluble sugar content during the growth and development period, but also increase the activity of protective enzymes, increase the starch content, and the amount of soluble starch can judge the quality of rice is an important indicator.

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