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Accelerated machine the process of soaking and germinating seeds

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Abstract

Germinated seed production is a processing of high value seeds but takes many days to produce because many steps require meticulousness, especially soaking and germination process, which is an important step that affects the amount of GABA and the overall quality. This project is to fabricate a machine to speed up the process of soaking and germinating the seeds. Using the principle of water flowing through the seeds by spraying water, adding moisture to the seeds together with the spray off that is allow the seeds to germinate the roots. Studying factors affecting seed germination include 3 spraying periods (20, 40 and 60 min) and 3 take a rest period (20, 60 and 100 min) by controlling the flow rate at 2.64 L/min/kg of paddy. Jasmine 105 paddy rice was used as a sample. The results showed that the water spray duration of 20 min and the take a rest time of 60 min is the shortest condition that causes the paddy to germinate within 24 h and the root length is approximately 1 mm after 36 h, which helps to reduce the soaking and germinating time by 2 times compare with the traditional process about 2-3 days without adding substances, accelerating the water condition, reduce water and times consumption with the traditional process about 5 times and 3 time, respectively. in addition, the rice quality detected the amount of GABA increasingly.

Keywords: Germinate, Seed, Speed up

1. Introduction

Germination is a process that occurs during plant growth. The germination process affects the nutrients in the seed, resulting in a large amount of important substances. The number is greater than that of plants, usually germinated plants (Sprout) The most popular sprouts are rice, beans, sunflowers, etc. In germinating plants, there are important enzymes and The benefits to the human body are superoxide dismutase (Superoxide dismutase or S.O.D.) and coenzyme Q10, an antioxidant enzyme [1]. At present, there are many ways to germinate, such as soaking the plants that need to germinate in water and rinsing them thoroughly and then cultivating them on a basket. Cover with a thin white cloth dampened with water. In a closed container, leave at ambient temperature (Ambient temperature) But during infusion it will take a long time. Difficult to control, with a musty smell. uneven germination; Use plenty of water. It has been found that there are chemical methods to stimulate seed germination, such as pretreatment of soaking water by adding acidic-alkaline substances. Calcium Chlorized Chitosan or conditioning the soaking water to a higher temperature, but such a method increases the cost and production process. If it is the production of seeds for consumption, it is not safe from contamination with unpleasant substances [2].

Germinated plants that are local wisdom of Thailand are: Hang Sprout Rice This is rice processing by soaking paddy in water. To stimulate the nutrients from the rice husk to be absorbed into the rice grain and then steamed to store the nutrients to be preserved, then the paddy is dried and milled by a conventional rice milling machine. gamma-aminobutyric acid (GABA) As a nutrient, Hang Sprout rice is a nutritious product that contains antioxidants that are gaining popularity among health-conscious consumers. There are several steps, including selecting and cleaning the paddy grains, soaking, germinating, steaming, dehumidifying, shelling and packaging. It usually takes about 7 days to produce [3].

In the process of soaking and germination, it still takes about 3-4 days together, which is quite a long time and becomes a bottleneck of the production process. Farmers still use traditional production techniques to soak and germinate by soaking 50 kilograms of paddy in a 150-liter plastic drum, which is a difficult method to operate because the water has to be changed every 4-6 hours to ensure that the rice does not smell musty due to microorganisms throughout the soaking period of 1 day. However, large amounts of water are discharged, causing pollution, i.e. polluted water in the production area. There is also unhygienic conditions.

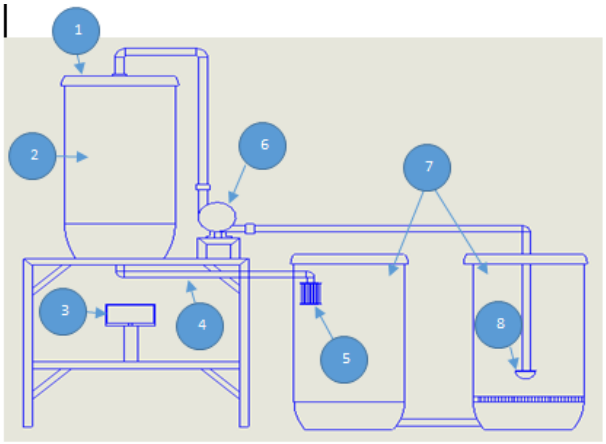
According to research on soaking germinated brown rice to shorten the time and increase the substance. GABA was found to be immersed in an acid-alkaline solution 5 at 40°C for 3 hours. pH 5) at 40 degrees Celsius for 8 hours Brown rice germination at 40 degrees Celsius for 36 hours The soaking and germination process of paddy for germinated brown rice production showed that the

process of soaking paddy using circulating water flows through it at a flow rate of 3 liters per minute per kilogram of paddy. The water flow time for paddy is 32 hours, the water temperature is about 30 degrees Celsius, and there is no need to germinate, etc.

Therefore, the project has been given the issue of developing two production processes, namely soaking and incubating seeds for germination, in the expectation of obtaining tools or equipment that facilitate it. This makes it less complicated. Increase the quality of Hang Sprout rice production and be able to control the quality of rice regularly by applying engineering knowledge. The objective is to create an accelerator for the process of soaking and germinating seeds and studying suitable factors for germination.

2. Materials and methods

This project created a test kit to study the pattern of alternating water discharge and break periods to flow water through 50 kilograms of paddy within a 200-litre tank. Using the flow-through water principle, a cycle of irrigation flowing through the grain is created for a period of time interspersed with optimal breaks (Figure 3.1 shows the sketch and components of the machine), which discusses how to conduct the study to determine the optimal conditions for germination.



1	Cover and nozzle
2	Hopper
3	Automatic control unit
4	Water return pipe
5	Filter
6	Pump
7	Water tank

Figure 1 Sketch of test kits used for the study.

In this study, the factors affecting seed germination were examined, namely the effect of water (moisture), with 3 levels of water spray duration of 20, 40 and 60 min and 3 levels of rest duration of 20, 60 and 100 min . Details of how the study will be conducted are as follows.

1. Take the Jasmine rice paddy variety 50 kg of rice, there was impurities have been sorted. It is loaded into an experimental tank. As shown in Figure 2 (left)

2. Rinse with water and place the rice in a random experiment bag. To look at the length of the roots according to the various locations determined according to the conditions. As shown in the figure.

3. Use the timer to adjust the pump operating time to control the level of water flow alternating with breaks: let water flow through the rice for 20, 40 and 60 min, together with breaks of 20, 60 and 100 min.

4. At the same time, the water flow rate is regulated at 2.64 liters per minute per kilogram of paddy. After every experiment, DO was randomly measured in paddy soaked water using a dissolved oxygen meter as shown in Figure 3.

Figure 2 Random bag of root length at different locations Inside the tank is filled with paddy.

Figure 3 OD measurement of water in a holding tank

Then record the temperature of the paddy layer in the tank 20 cm below the surface of the paddy every 5 min at each point according to the specified location with the data logger as shown in Figure 4.

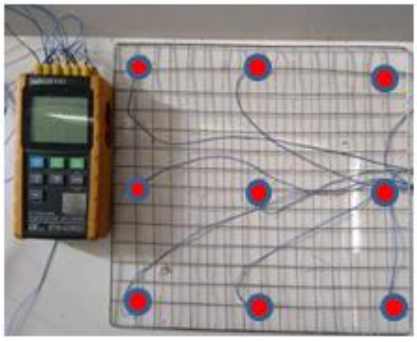


Figure 4 The temperature measurement positions at different points.

Random measurement of the indicators is divided into data during the test as follows: Germination percentage (randomly measured with a random set as shown in Figure 2, right f, rice layer temperature, water temperature. The sample preparation is carried out by taking each test paddy steamed and dried under the same conditions, i.e. each test of germinated paddy is steamed with hot steam in atmospheric pressure conditions for 30 minutes. Start the steaming timer when the water boils until steam is generated, and then dry before dehumidifying with a cylindrical tank dryer rotating with infrared radiation and hot air discharged at infrared lamp temperature. 750 °C, repeat for 2 cycles, then air dry in the shade until the paddy has an average moisture content of 12± 1%wb [4].

3. Results and Discussion

3.1 The effect of creating an accelerator for soaking and germinating grain

The machine accelerates the process of soaking and germinating the prototype seeds that have been created. Figure 5 consists of the main functional parts. The three parts are a tank and nozzle to spray water through the grain, a flow rate generator and reuse water circulation unit, an automatic operation control unit. Start the operation by feeding the cleaned grain and putting it in the drum. This serves as a container for soaking and germinating seeds. The upper part has an open-close lid and is equipped with a spray nozzle to allow water to flow through until it spreads widely. Tank Footer (4) It is an open-close tongue that stores water to flood high above the grain, which controls the closing time of the tongue. Water spraying by the automatic operation control system instructs the water pump to deliver water from the water collection container in the pipe to the solenoid valve installed in the upper part of the tank cap, which allows water to flow in the spray nozzle inlet pipe. The water will form a diffuse fuzz and flow evenly through the grain from the top down to the lower part. When the setting time has elapsed, the solenoid valve stops and the spray nozzle closes for the period that has been set. When the time is up, the solenoid valve opens again to spray the spray from the spray nozzle. The time can be adjusted as needed to reflect the germination of different types of seeds according to the physical and biochemical suitability of different seeds. This principle allows seeds to germinate faster than in previous methods, and allowing water to flow through the seeds does not cause fermentation of the seeds inside the tank. It has a good effect on not causing the seeds to smell musty. The water that flows through the seeds from the top down to the bottom of the barrel flows out through the bottom of the seed release basket. That looks like a drainage hole. The water in each tank is combined in a gutter, collecting water to flow into the water container throughout the operation. At the end of the process, the seeds can be removed from the hopper by opening the end cap of the basket, releasing the seeds into the container that is further taken for support.

Figure 5 A prototype seed soaking and germination accelerator has been built for the study of suitable conditions and practical application in the area.

3.2 Factors suitable for the operation of the accelerator of the process of soaking and germinating seeds

Results of the study of temperature and water spray time through rice that affect the germination of paddy when using paddy of the Jasmine rice variety based on the principle of spraying water through rice. When testing at a water flow rate of 2.64 l/min. When using jasmine rice paddy as shown in Table 1 and Figure 6, the water spray duration was 20 min and the rest period was 60 min, with the paddy starting to have root buttons after about 24 h (Figure 7), and at 36 h, it was found that the paddy pierced the roots by about 0.5-1 mm (Figure 8 shows the time with germination). The results of the DO level in the water at the end of the soaking and germination process for at least 36 h, the value obtained is 4.26 or higher, which is considered to be in the clean water threshold.

The paddy is germinated and steamed, as the study method mentioned above, measuring the amount of GABA. It was found that the condition of spray time of 20 min and rest of 60 min was a condition in which the amount of GABA was detected as high as 1384 mg/100g, this is very high compared to previous research, such as: Experiments using weakly acidized water pH 5.6 Soak the rice for 36 h. GABA 25.695 mg/100g and when germinated for another 16 h, the amount of substance was found. GABA 11.208 mg/100g. Adding bio-fermentation in the immersion process in an accelerator-to-weight ratio of 1:100 at a temperature of 40 °C Soak for 24 h, then germinate for another 24 h. GABA 448.79 mg/100g [4]. Immersion in water temperature 30 °C. It uses water circulation through the grain with a flow rate of 3 l/min/kg of paddy. Proportion of 1 part water to 10 parts paddy [5]. The soaking period is 32 hours, in which there is no germination. GABA 34 mg/100g [6]. During curing, water is sprayed to rinse the rice every 4-6 h, the total processing time is 24 h, and then the moisture content of the rice is reduced by baking it at 130 °C- 24 h found that the amount of substance GABA 77.91 mg/kg [7].

Table 1 Paddy germination tests at different levels of study factors When there is control when controlling the flow rate of water flowing through the rice paddy, 2.64 l/min

Spray time (min)	Spray break time (min)	Paddy layer temperature (^{O}C)	Root length (mm)	Total time (h)	DO value of water.	GABA content (mg/100g)
20	20	31.84	0.54	39	n/a	n/a
	60	31.65	0.57	36	n/a	1384
	100	30.98	0.51	56	4.46	n/a
40	20	30.69	0.51	50	4.26	n/a
	60	26.46	0.71	58	4.33	281
	100	31.67	0.53	42	4.21	n/a
60	20	31.83	0.56	42	4.54	n/a
	60	31.67	0.51	42	4.24	ND
	100	Spray time	Spray Break Time	Paddy layer temperature	Root Length	Total Time
DO value				20	20	31.84

Note: *n/a means unmeasured value and DO value below 3 means polluted water, ND means GABA content not detected.
Reference rice is a traditional germination method by soaking in water for 48 hours and germinating for 24 hours, for a total of 72 hours.

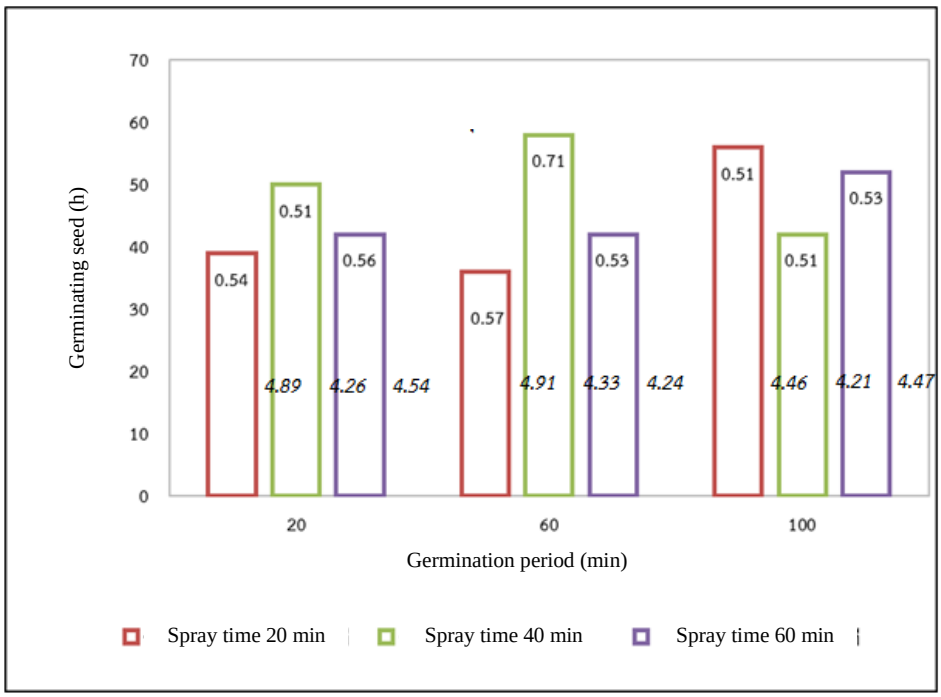


Figure 6 Germination period root length and DO value at the end of the process

Rice begins to pierce the roots, germinates after 24 hours. The roots are very long than needed at 40 hours.

Figure 7 Root germination characteristics of paddy that has undergone soaking and germination process using a prototype built

Figure 8 shows the relationship of time after germination at 24 h onwards, it can be seen that when the husk starts to split at 24-26 h, the roots of the paddy grow rapidly, and in Figure 9 shows the temperature behavior of the paddy layer in the tank when it starts working, during 0-180 min (3 h of operation) with the initial paddy layer temperature equal to the environment. After that, the temperature of the paddy layer decreases and changes slightly by an average of 31.5 ^{O}C and tends to increase gradually until after 24 h the germination period reaches 32-33 ^{O}C and the temperature of the paddy grain continues to drop until the end of the test.

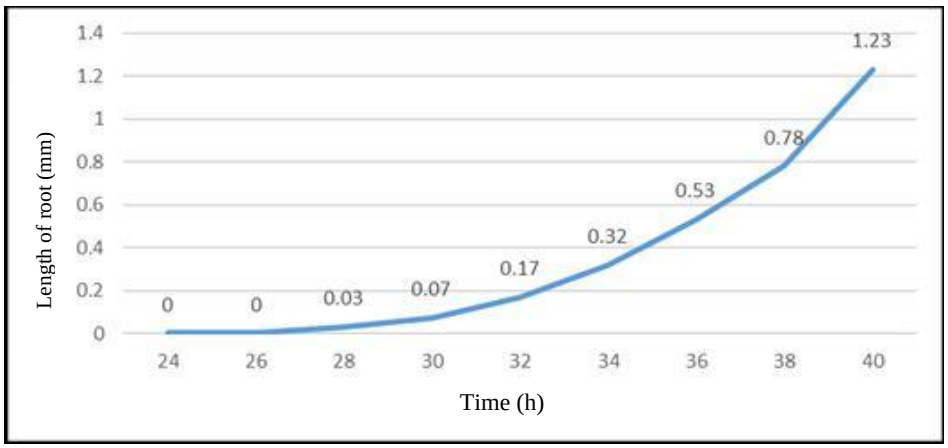


Figure 8 The graph shows the relationship between germination period and root length of conditions. Let the water flow through the rice for 20 min and germination for 60 min

Note: Measuring the root length, when a root is observed pricked out of the bark, has a clear length. Although it began to be noticed that the paddy grain had tubercles, roots and the husks began to crumble from the 20th to 26th hour, this range measured in length in 0 mm.

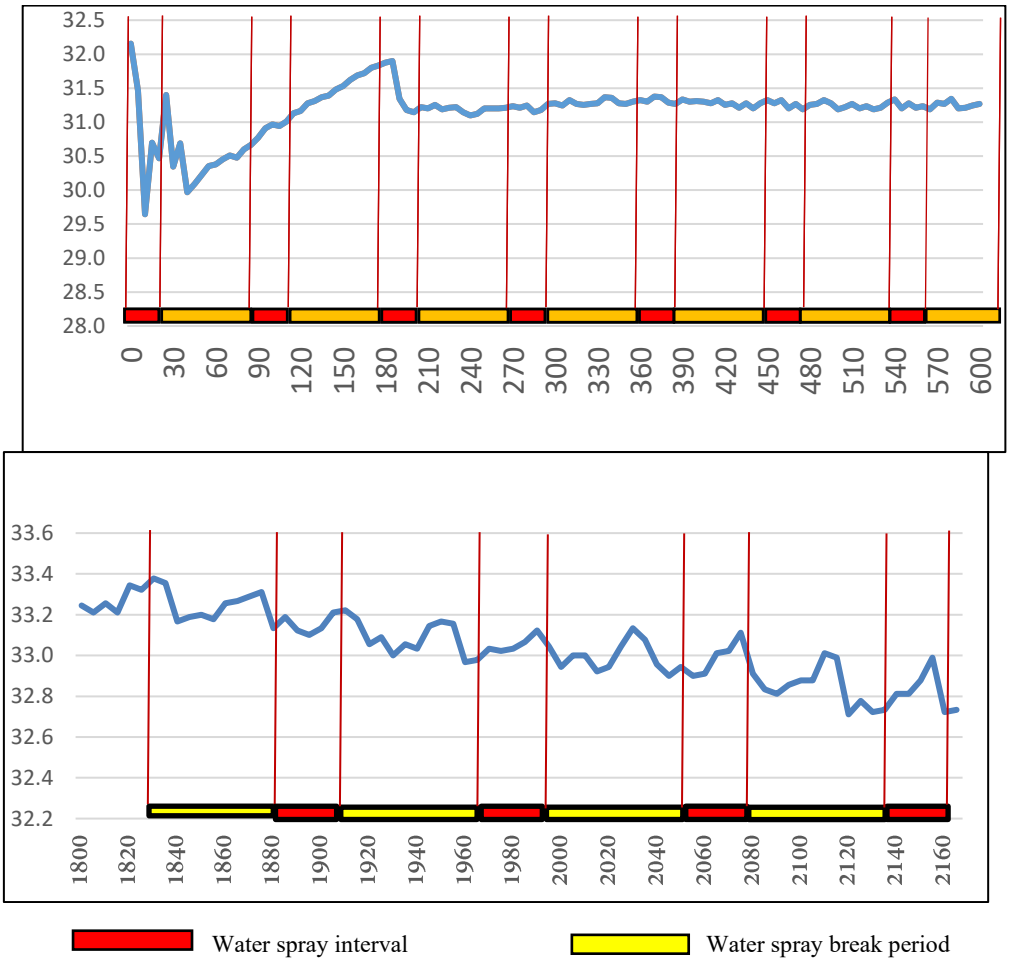


Figure 9 Graph showing the relationship between temperature and experimental period

In this project, an accelerator was created for the process of soaking and germinating seeds. It has been applied to many community enterprises and has been able to upgrade the traditional production process that takes almost 3-4 days to work in less than 24 hours or just 1 day.Germination is more uniform than before. The processed rice does not produce a musty smell at all. From monitoring water quality by measuring DO (Dissolved Oxygen) Compared with traditional methods of immersion, it was found that the value DO Of the traditional soaking method, when the time to soak the rice for about 6 hours will be valuable. OD About 2.5 and after 12 h, it was found that the soaking water was foaming and smelled rotten. DO 0.7, which is considered to be in the sewage threshold, while the prototype installed for community enterprises has actually been used. It was found that the value DO The water in the tank contains a volume of 700 liters before soaking rice, it is worth 5.5. DO According to the observations, the process is a nebulization of water which is exposed to oxygen gas. The water passing through the paddy in the tank is constantly circulating and when passing through the bottom of the soaking tank, the water is in contact with the surrounding air again as well, thus resulting in an increased oxygen content of the water.

4. Conclusions

The scheme alternates the water discharge period and water break period to flow through 50 kg of paddy. Inside the tank 200 liters. There are 3 levels of water release duration 20, 40 and 60 min, and 3 levels of rest duration 20, 60 and 100 min. It regulates the water flow rate at 2.64 l/min/kg of paddy. The study found that the water release duration was 20 min and the break duration was 60 min. Paddy begins to root after about 24 h and is found at 36 h. It was found that the paddy pierced the roots by about 0.5-1 mm. During the test, it was integrated with environmental engineering students to measure the level. DO in water at the end of the soaking and germination process for at least 36 h. The resulting value is 4.26 or higher, which is considered to be in the clean water threshold, where dirty water has a DO value of less than 3 or lower.

5. Acknowledgements

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