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Analysis of Factors Influencing Seed Breeder's Decisions to Certify Rice Seeds in North Sumatra Province, Indonesia

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Abstract. The number of breeding rice seeds in North Sumatra Province is decreasing every year. This will have an impact on the availability of rice seeds for farmers. Meanwhile, a certification process is needed to produce quality rice seeds. The aim of this research is to analyze how the differences in factors such as level of education, knowledge of certifying seeds, experience as a seed breeder, seed selling price, land area, and rice seed production costs can influence the seed breeder's decision to certify the rice seeds produced. The method used is the Average Difference Test with Analysis of Variance (ANOVA) Test with sample determination using saturated samples (census) totaling 44 seed breeder groups. The results of the analysis show that the variables of knowledge, experience, selling price, and production costs differ significantly for each decision taken by seed breeders in rice seed certification activities. While the variables of education level and land area are not significantly different, this is because the education level of the seed breeder group is almost the same, namely an average of high school / vocational high school graduates, while the area of land controlled by the seed breeder group is also not significantly different between the 3 groups, the average land area of the Non-Seed Certification group is 16.25 ha, the average land area of the Unfinished Seed Certification group is 17.42 ha, and the average land area for the Seed Certification group is 27.35 ha.

Keywords: group decision; mean difference test; rice seed certification

INTRODUCTION

Technology can be a key to promoting rice production and ensuring sustainable development in the rice sector. However, experiencing shocks from climate change can make farmers change their behaviour in the adoption of technology, such as chemical fertiliser, improved seeds, and organic fertilizer (Nguyen et al., 2025). Rice is the most important food crop in the world, with nearly half of the world's population relying on it for sustenance every day. It is the main staple food across a number of. Given the importance of rice as a major food staple and a source of income for farmers worldwide, a key challenge is to find strategies that would maintain or improve rice productivity in the presence of climate change (Wang et al., 2022). Six important input variables (labour, seed, pesticides, fertilizers, irrigation, and machinery). The unit of labour is the work days inputted in production. The output, seed input, pesticide, and fertilizer were all measured by the total quantity of inputs (Zhang, 2008). Seeds are one of the production factors that determine agricultural output. Increasing productivity and quality of crop yields is greatly influenced by the quality and quantity of seeds, followed by the application of other cultivation technologies, such as balanced fertilizers, which have a real influence on productivity, production, and quality of food crop products and are used consistently by farmers in every farming effort.

Rice is a principal food crop, which occupies nearly one-fourth of the gross irrigated area. A serious concern has been raised about the long-term sustainability of the productivity effects of Green Revolution technologies under an irrigated ecosystem due to the degradation of the natural resource base (Chatterjee & Gupta, 2013). Improved seed adoption can increase yield, enhance food security, improve livelihoods, and

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reduce poverty. Although many governments in the global South use seed subsidies to achieve these outcomes, the success and efficiency of input subsidies are subject to debate. (Gautam et al., 2024). Given the importance of seeds in agribusiness activities and increasing food security, it is necessary to create a seed condition that can support the availability of seeds to meet farmers' needs. According to Mugnisjah (2008), the target of food crop seed activities is to provide superior quality seeds with six right conditions, namely (1) right variety, namely the variety is by the conditions of the place that requires it; (2) right quantity, namely the amount is in accordance with needs; (3) right quality, namely good quality; (4) right time, namely available when needed; (5) right location, namely available in places that require it, and (6) right price, namely the price is affordable for farmers. Achieving these targets is expected to support government policies in increasing food production.

The problems with seed cultivation are: (1) seed production still depends on the existence of seed farmer groups; (2) the source of community livelihood; (3) rice productivity still depends on the quality of the source seeds; (4) sustainability of production with appropriate technological innovation; (5) weak supervision of superior seed distribution in the regions; (6) increasing the capacity of seed farmer groups and farmers is not yet sustainable; (7) the focus of seed cultivation programs is more on innovation in cultivation technology, while the institutions and capacity of seed breeders are not yet optimal (Amiruddin et al., 2016).

The main seed security challenges relating to availability were the lack of adequate and/or timely supply of certified seeds. Certified seeds produced by the public sector were insufficient or distributed late, and certified seed use was limited to small quantities (Mulesa et al., 2021). Because the availability of rice seeds still depends on the existence of seed breeders, the current condition faced in North Sumatra Province is the lack of interest of seed breeders to certify their seeds, especially rice seeds, as indicated by the decline in certified rice seed production each year. This can be seen in Table 1.

Table 1. Certified rice seed production data in North Sumatra Province, period 2019 – September 2024

Year	Rice Seed Production (Ton)	
	Superior Rice	Local Rice
2019	6,231.07	524.85
2020	4,666.03	587.6
2021	4,231.14	17.6
2022	4,191.96	20.48
2023	3,486.42	252.2
Sep-24	3,858.16	-

Source: Report of Regional Technical Implementation Unit for Food Crop and Horticultural Seed Certification of North Sumatra Province (UPTD. Sertifikasi Benih TPH)

Meanwhile, the number of seed breeders who produce rice seeds can be seen in Table 2. Information from Table 1 and Table 2 shows that there has been a decrease in rice seed production and the number of rice seed breeders. According to (Suprayogi, 2023) seeds are not post-harvest objects because seeds are pre-planting commodities. Therefore, if in producing seeds, only pay attention to the post-harvest process, then high seed quality will not be obtained. Quality seeds can be produced if the entire series of seed production procedures can be carried out properly, namely starting from land preparation that is free from genetic contamination, procurement of quality source seeds, controlled planting conditions for prospective seeds and post-harvest

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processing and handling to users (farmers). The procedures for rice seed certification are shown in Figure 1.

Table 2. Number of rice seed breeders in North Sumatra Province for the period 2019 – September 2024

Year	Number of Rice Seed Breeders		Number of Rice Seed Breeders Who Certified Seeds		Number of Rice Seed Breeders Who Did Not Certified Seeds	
	Company/ Institutions	Breeder's Group	Company/ Institutions	Breeder's Group	Company/ Institutions	Breeder's Group
2019	20	108	14	63	6	45
2020	22	120	13	50	9	70
2021	19	51	11	29	8	22
2022	20	59	13	25	7	34
2023	16	44	12	31	4	13
Sep-24	11	34	10	18	1	16

Source: Report of Regional Technical Implementation Unit for Food Crop and Horticultural Seed Certification of North Sumatra Province (UPTD. Sertifikasi Benih TPH)

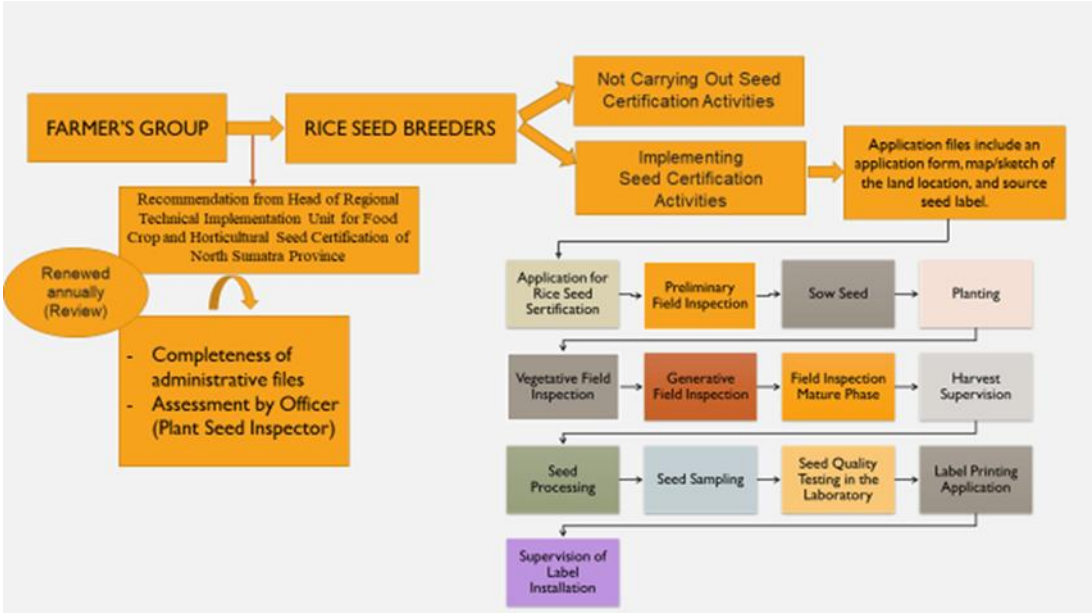

Figure 1. Procedures for rice seed certification

Source: Regional Technical Implementation Unit for Food Crop and Horticultural Seed Certification of North Sumatra Province (UPTD. Sertifikasi Benih TPH)

Data from the (BPS-Statistics Sumatera Utara Province, 2024) shows that the area of rice harvest in 2023 in North Sumatra Province is 404,472.52 ha. From these results, the percentage of certified seed use in North Sumatra Province can be calculated, by calculating the number of certified rice seeds produced by seed breeders in North Sumatra of 3738.62 tons, and based on data from the Food Crops Division of the Food Security, Food Crops and Horticulture Department of North Sumatra Province, seeds from outside North Sumatra amounted to 636.95 tons, so that the total certified rice seeds planted in North Sumatra amounted to 4375.57 tons. The need for rice seeds is 25 kg per hectare, so it can be estimated that the area of rice planting using certified seeds in North

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Sumatra is 175,022.8 ha. So the percentage of certified seed use in North Sumatra can be calculated at around 43.3%.

According to (Sulaiman et al., 2018) the level of certified rice seed use in Indonesia, which averages 44.17%, is relatively higher in Southeast Asia. For comparison, the use of certified rice seeds in Myanmar is 10% (Moali, 2016 in Sulaiman et al., 2018), 44.7% in the Philippines (Sombilla and Quilloy, 2014 in Sulaiman et al., 2018), 52% in Thailand (AgCon Asia, 2017 in Sulaiman et al., 2018), and 30% in Vietnam (Mau Dung, 2014 in Sulaiman et al., 2018) of the total rice seed requirements in each of these countries.

Decision-making in a group context forms an essential foundation in the dynamics of cooperation and collaboration. The success of a group is determined not only by the individuals involved but also by the group's ability to overcome challenges and make appropriate decisions. This process involves complex stages, from problem identification to decision implementation, in which interactions between group members and leadership policies play a key role. Decision-making in groups reflects not only collective capabilities but also the extent to which this process can shape the unique characteristics of a group (Ahmad Muktamar, Yulistira Sari, Naldi Wiradana, 2023).

Based on the above considerations, the researcher is interested in conducting research on why seed breeders decide to carry out rice seed certification. There are also breeders who have not completed certification activities, and there are seed breeders who choose not to carry out rice seed certification in 2023. Therefore, the researcher raised the research title Analysis of Factors Influencing Seed Breeder Decisions to Certify Rice Seeds in North Sumatra Province. For this reason, it is necessary to analyze how the influence of factors such as education level, knowledge of seed certification, experience as a seed breeder, seed selling price, land area, and seed production costs can influence farmers' decisions to certify the rice seeds they produce.

The purpose of this study is to examine the profile of rice seed breeders in North Sumatra who provide quality seeds and to analyze the differences in factors that influence seed breeder decisions in certifying rice seeds in North Sumatra Province.

METHODS

The technique used for sample determination is Non-Probability Sampling. The definition of non probability sampling is a sampling technique that does not provide equal opportunities for each element or member of the population to be selected as a sample. The type of non-probability sampling used in this study is saturated sampling, or often called a census. The definition of saturated sampling is a sampling technique in which all members of the population are sampled (Sugiyono, 2013). Sampling was carried out on registered seed breeders in 2023, so from 44 rice seed breeder groups, a total of 44 seed breeder groups will be sampled, with three decision categories which are 31 seed breeder groups that have certified rice seeds until finished, seven seed breeder groups that certified rice seeds not yet/not completed and six seed breeder groups that have not certified rice seeds in year 2023.

The data used in this study consists of primary data and secondary data. Primary data collection was carried out through interview techniques using structured questionnaires to the head of the seed breeder group who carried out seed certification, and the head of the seed breeder group who did not carry out seed certification. Secondary data was obtained from various literature supporting the research and data published by the Department of Agriculture and the Central Statistics Agency in the province and district.

The research area is spread across several regencies and cities in North Sumatra Province, totaling 16 regencies/cities. They are Deli Serdang, Serdang Bedagai, Batubara, Asahan, Simalungun, Karo,

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Tapanuli Utara, Tapanuli Tengah, Tapanuli Selatan, Langkat, Nias Barat, Padang Lawas, Mandailing Natal, Tebing Tinggi and Padangsidimpuan.

The number of samples in this study was 44 samples. A related (and important) question is, how small is too small? Certainly samples that are small enough that otherwise acceptable data from a single case can have disproportionate influence on parameter estimates and tests given the analytic method are too small (Fok et al., in press). The remaining strategies suggested by Hansen and Collins (1994) concern increasing the size of the observed effect (i.e., difference between groups). Given the standard equation for computing effect size, which is a ratio of the effect of interest (e.g., difference between means, regression coefficient) and the population variance (expressed as standard deviation), there are two categories of approaches that, given a fixed sample size, would increase statistical power by increasing effect size: (1) increase the effect of interest, (2) decrease the population variance (Cameron R. Hopkin, Rick H. Hoyle, 2015).

To solve this research problem using descriptive analysis, it is analyzed using Mean Difference Test with Analysis of Variance (ANOVA) Test using SPSS version 30. ANOVA is a procedure used for comparative tests of means between several groups of data. ANOVA is an extension of the t-test so that it can be used to test the differences in three or more population means at once. There are several prerequisites that must be met when conducting a variance analysis, including sampling taken randomly from the population, and the data taken is interval or ratio scale data, the data must meet the requirements of normal distribution, and the data in the variables to be analyzed must have homogeneous characteristics (Aziza et al., 2024).

Normality Test

According to (Nuryadi et al., 2017) the normality test is used to determine whether the data obtained is normally distributed or not. The basis for decision making is if the Lvalue > Ltable then H_0 is rejected, and if the Lvalue < Ltable then H_0 is accepted. The statistical hypothesis used:

H_0: normally distributed sample

H_1: non-normally distributed data sample

There are several methods that can be used in data normality analysis, namely, the Lilliefors, Kolmogorov-Smirnov, chi-square, and so on.

The Output Test of Normality section in SPSS will test whether a data distribution is normal or not. Decision-making guidelines:

- Sig. value or significance or probability value <0.05 then the distribution is not normal.
- Sig. value or significance or probability value >0.05 then the distribution is normal.

After the normality test is carried out, and if the results of the data are normally distributed, then it can be continued by conducting a homogeneity test, then the data can be processed using the Average Difference Test with the Analysis of Variance (ANOVA) Test. However, according to (Nuryadi et al., 2017) if the data is not normally distributed, or the number of samples is small and the data type is nominal or ordinal, then the method used is non-parametric statistics. This study uses the Kruskal-Wallis Test.

Homogeneity Test

Homogeneity test is a statistical test procedure intended to show that two or more sample data groups come from populations with the same variance. The homogeneity test aims to determine whether several groups of research data have the same variance. In other words, homogeneity means that our study data set has the same characteristics. Homogeneity testing is also intended to provide confidence that a set of data manipulated in a series of analyzes does indeed come from a population that is not much different in diversity. Homogeneity test calculations can be done in various ways and methods, some of which are quite popular and

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often used include: Harley, Cochran, Levene and Barlett tests. Homogeneity test calculations with Levene's test are carried out using SPSS software. The way to interpret the Levene test is, if the Levene Statistic value> 0.05 then it can be said that the data variation is homogeneous (Nuryadi et al., 2017).

Hypothesis Testing

Hypothesis Testing In Analysis of Variance

1. Hypothesis
   $Ho: \sigma_1^2 = \sigma_2^2 = \sigma_3^2 = \sigma_4^2 = \cdots = \sigma_\alpha^2$
   $H_\alpha: \exists \alpha_i^2 \neq \alpha_{i'}^2, i \neq i', i = 1,2,3,4, \ldots, \alpha$
2. Significance level: α and confidence level = 1 - α
3. Determining the F statistical test (in the sense of F_hit)
4. Significance test
   $F_{hit} > F_{tab} = H_0$ rejected means there is something different from several variants
   $F_{hit} < F_{tab} = H_0$ accepted means all the variances are the same
   Sig < 0,05 : H_0 is rejected
   Sig > 0,05 : H_0 is accepted

(Nuryadi et al., 2017).

The Anova value or F value (F_{hit}) is

$$F_{hitung} = \frac{V_A}{V_D} = \frac{KR_A}{KR_D} = \frac{JK_A/db_A}{JK_D/db_D} = \frac{Varian\ between\ grup}{Varian\ within\ grup}$$

(Bustami et al., 2014).

RESULTS AND DISCUSSION

The profile of rice seed breeders in North Sumatra Province

According to the Plant Cultivation System Law, supervision of seed procurement and distribution is in the hands of the government. Given that the implementation of seed certification can also be carried out by individuals or legal entities with government permission, this means that supervision of seeds produced and distributed can be carried out by both the government and individuals or legal entities that have obtained such permission. Before the issuance of government regulations on the implementation of the above law, BPSB (UPTD. Sertifikasi Benih TPH) was a government institution that still carried out this supervisory function. Its activities include external supervision (field and laboratory supervision throughout the seed procurement subsystem chain). The target of its activities is the implementation of seed certification (Wahju Qamara Mugnisjah, n.d).

The respondents in this research are Group Leaders of rice seed breeders who have recommendations as seed producers issued by the Regional Technical Implementation Unit for Food Crop and Horticultural Seed Certification of North Sumatra Province and are still active until the end of December 2023.

Table 3. Education Level of Respondent

Level of Education	Number of Respondents	Percentage
Elementary School	1	2.27%
Junior High School	8	18.18%
Senior High School	24	54.55%
Diploma	1	2.27%
Bachelor Degree	9	20.45%
Master's Degree	1	2.27%
Total	**44**	**100%**

Source: Primary Data, Processed Data 2025

The level of education in this study explains whether the group leader understands the benefits of using certified seeds in increasing rice production, and understands how to run a rice seed breeding business. Based on Table 3, it was found that as many as 24 group

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leaders had a high school/vocational high school education background, followed by 9 people with a Bachelor's degree (S1). This level of education shows that most of the group leaders of breeders in North Sumatra understand that one of the factors that can increase production is the use of superior seeds, so that group leaders can see opportunities in rice seed breeding businesses to produce certified rice seeds.

Table 4. Knowledge of Seed Certification

Knowledge Level of Group Leader	Number of Breeder Groups	Percentage
Understand	29	65.91%
Not Enough Understand	5	11.36%
Don't Understand	10	22.73%
Total	**44**	**100%**

Source: Primary Data, Processed Data 2025

From Table 4, it can be seen that the number of seed breeder group leaders who do not understand the seed certification procedure is quite large, which is 10 people. This is because the seed breeder group is still relatively new in the rice seed breeding business, which is around 1-2 years as a seed breeder, so the group leader does not yet understand the rice seed certification procedure. For seed breeders who do not understand the seed certification procedure, the certification process is assisted by a Seed Inspector (a government officer) on duty in the district/city work area.

Table 5. The Experience of the Breeder Group

Experience (Year)	Number of Breeder Groups	Percentage
≤ 5	19	43.18%
$5 < E \leq 10$	14	31.82%
$10 < E \leq 15$	6	13.64%
$15 < E \leq 20$	5	11.36%
Total	**44**	**100%**

Source: Primary Data, Processed Data 2025

The group's experience as a seed breeder is calculated from the first time the seed breeder group applies for rice seed certification. Table 5 shows that most of the breeder groups have experience of less than or equal to 5 years. Lack of experience affects the ability and skills of farmer groups in managing farming businesses (Jaya, 2023).

The selling price of Foundation Seed and Stock Seed in Table 6 is the selling price of inhybrid wetland rice seeds for sale at stalls or direct to consumers. Meanwhile, the Stock Seed sold at a price of IDR 40,000/kg are dryland rice seeds whose varieties have been released by the Indonesian Ministry of Agriculture. For Extension Seed at a price of IDR 9,000/kg, there are local dryland rice seeds. Meanwhile, broadcast seeds at a price of IDR 9,700/kg are the selling price with seed companies, where the company applies to seed testing and seed labeling and seed packaging. So that the seed label will state the company's name as the seed producer, not the seed breeder group's name, which is referred to as production cooperation. In production cooperation, the seed breeder group produces seeds only up to the stage of managing the candidate seeds. When the seeds are ready to be tested in the laboratory, the seed breeder group transfers the candidate seeds to the company, complete with a transfer report according to the price agreed upon by both parties. All payments are made when the seeds are transferred. Another cooperation is

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marketing cooperation or partnership, this cooperation is a cooperation carried out by the seed breeder group with the company, where the company only markets seeds produced by the seed breeder group, for the selling price of the Stock Seeds in this cooperation is IDR 10,500 - IDR 11,500 per kilogram, where the company provides the seed packaging. So the seed breeder group continues the certification process from the initial stage until the label is issued. So that on the seed label, the seed breeder group's name remains the seed producer. However, the seed packaging states that it is produced by the seed breeder group and marketed under the company's name. Where payments are made according to agreement, such as the company providing an advance payment, then the payment is settled according to the seeds that have been distributed. Agriculturalists are inclined to adopt innovative technologies when the benefits outweigh the drawbacks. Acknowledging these enduring advantages can catalyse the exploration of alternatives. Despite abundant literature addressing various agricultural practices that enhance farmers' well-being (Sunny et al., 2024).

Table 6. Selling Price of Products Produced by the Breeder Group

Decision Category	Product	Selling Price (Rp)/kg	Number of Breeder Groups	Percentage
Certified Until Finished	Foundation Seed	15,000 – 16,000	4	9.09%
	Stock Seed	12,500 – 14,000	20	45.45%
		40,000	1	2.27%
	Extension Seed	9,000	1	2.27%
		9,700	1	2.27%
		12,000 – 13,000	4	9.09%
Certification is not complete	Dry Grain Harvest (GKP)	5,000 – 6,000	5	11.36%
	Dry Grain Milled (GKG)	7,500	1	2.27%
	Rice	-	1	2.27%
Not certified	Dry Grain Harvest (GKP)	5,000 – 6,000	1	2.27%
		> 6,000	4	9.09%
	Rice	-	1	2.27%
Jumlah			**44**	**100%**

Source: Primary Data, Processed Data 2025

Furthermore, a free market is a sustainable strategy for selling seeds. The main challenges for seed rice production and distribution in Indonesia include encouraging appropriate resource management and planning (human, infrastructure, and financial) in the seed sector and increasing the linkage of seed stakeholders, such as research institutions, seed certification agencies, producers, and the government. A rapid and appropriate response to these challenges can increase seed availability for producers (Qadir et al., 2024)

Table 7 shows that the dominant farmer groups have rice field areas of 5 - 10 hectares and 16 - 20 hectares. Land area below 5 hectares is owned by 2 individual breeders, and 1 breeder is a soybean seed breeder, so the area for rice seed breeding is only around 1 hectare. For land area above 50 hectares owned by gapoktan (farmer group association) breeders.

Table 8 shows that rice seed certification activities spend the most dominant cost of IDR 15,000,000 – IDR 20,000,000. Seed production costs above IDR 25,000,000 are production costs accompanied by land rental costs. Based on the interview results, 2 respondents included land rental costs in production costs.

The Differences in Factors That Influence

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Seed Breeders Decisions In Certifying Rice Seeds In North Sumatra Province

Education Level

From the result of the Normality Test, the sig. value < 0.05 means that the data on the education level variable is not normally distributed, therefore a nonparametric test is carried out, namely the Kruskal-Wallis test. And the results of the Kruskal-Wallis Test, the Asymp. Sig. value was obtained as 0.712, indicating that the value > 0.05, then there is no significant difference for the education level variable between the group of breeders who completed certification, the group who have not completed certification and the group of breeders who did not complete seed certification at all. This is because based on the interview results, respondents with elementary, junior high, and high school education levels or equivalent are respondents who have a main job as a seed farmer, while respondents with a Diploma or Bachelor's education level, work as a seed farmer is a side job. This is in line with research by (Abdi et al., 2019) which states that farmers who decide to produce rice seeds have a higher level of education than ordinary rice farmers, where the average farmer who decides to produce rice seeds is a high school graduate and the average rice farmer is an elementary school graduate.

Table 7. Area of Land Used for Rice Seed Breeding

Land Area for Breeding (Ha)	Number of Breeder Groups	Percentage
< 5	3	6.82%
5 - 10	9	20.45%
11 - 15	4	9.09%
16 - 20	12	27.27%
21 - 25	5	11.36%
26 - 30	4	9.09%
31 - 35	1	2.27%
36 - 40	2	4.55%
41 - 45	1	2.27%
46 - 50	2	4.55%
> 50	1	2.27%
Total	**44**	**100%**

Source: Primary Data, Processed Data 2025

Table 8. Rice Seed Production Cost per Hectare

Decision Category	Seed Production Cost (Rp) / Ha	Number of Breeder Groups	Percentage
Certified until finished	10,000,000 < C ≤ 15,000,000	4	9.09%
	15,000,000 < C ≤ 20,000,000	20	45.45%
	20,000,000 < C ≤ 25,000,000	5	11.36%
	> 25,000,000	2	4.55%
Certification is not complete	≤ 10,000,000	0	0.00%
	10,000,000 < C ≤ 15,000,000	7	15.91%
Not certified	≤ 10,000,000	2	4.55%
	10,000,000 < C ≤ 15,000,000	4	9.09%
Jumlah		**44**	**100%**

Source: Primary Data, Processed Data 2025

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The categories of education level are 1 = Elementary School; 2 = Junior High School; 3 = Senior High School; 4 = Diploma; 5 = Bachelor Degree; 6 = Master's Degree. Descriptive analysis in Table 9 shows that the average value (mean) is not much different. Based on the categorization, the value is the level of education of high school graduates because high school graduates or equivalent are included in category 3.

Knowledge of Seed Certification

Based on the Normality Test, the sig. value < 0.05 means that the knowledge variable data is not normally distributed; therefore, a nonparametric test is carried out, namely the Kruskal-Wallis test. And the results of the Kruskal-Wallis Test, the Asymp. Sig. value of 0.001 indicates that the value is <0.05, so there is a significant difference in the knowledge variable between the groups of breeders. This is because by knowing the seed certification process, seed breeders will be motivated to carry out rice seed certification activities, knowledge related to seed certification is obtained by breeders from Seed Inspector in the Regency/City of North Sumatra Province, or through socialization organized by the Regency/City Agriculture Departement or the Provincial Agriculture Departement, which is attended by the head of the breeder group. The role of the head of the farmer group in conveying innovation to group members is important; active participation from farmer group members is a driving factor for farmers in adopting farming technology (Indraningsih, 2011). A better level of understanding can encourage farmers to make decisions through strategies to reduce impacts and risks (Hasibuan, 2025).

Table 9. Descriptive Analysis Data of Education Level

Decision category	N	Mean	Median	Std. Deviation	Min	Max
Not Certified	6	3.50	3.00	1.225	3	6
Certification is not complete	7	3.43	3.00	1.134	2	5
Certified until finished	31	3.19	3.00	1.138	1	5

Source: Output SPSS, Processed Data 2025

Table 10. Descriptive Analysis Data of Knowledge

Decision category	N	Mean	Median	Std. Deviation	Min	Max
Not Certified	6	1.67	1.00	1.033	1	3
Certification is not complete	7	1.57	1.00	0.787	1	3
Certified until finished	31	2.81	3.00	0.477	1	3

Source: Output SPSS, Processed Data 2025

The categories of knowledge level are 1 = don't understand; 2 = not really understand; 3 = really understand about procedures of seed certification. Based on Table 10 the average value (mean) obtained is quite different between the Not Certified and Certification is not complete groups with the Finished Certification group. The group that carried out seed certification had an average value (mean) of 2.81, and this number is almost close to 3, where the number 3 is included in the category of understanding the rice seed certification procedure. The innovation decision process involves five steps: (1) knowledge, (2) persuasion, (3) decision making, (4) implementation, and (5) confirmation. So the initial stage needed in decision making is knowledge (Rogers, 2006).

Experience as Seed Breeder

Based on the Normality Test, there is one group where the sig. value < 0.05, namely the Incomplete Certification breeder group of 0.002, so the experience variable data is not normally distributed, therefore a

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nonparametric test is carried out, namely the Kruskal-Wallis test.The results of the Kruskal-Wallis Test, the Asymp. Sig. value of 0.005 indicates that the value is <0.05, so there is a significant difference for the experience variable between the groups of breeders. Experienced seed breeder groups routinely extend their recommendations as seed producers every year, so that in the current year (2023) they can complete certification activities. Meanwhile, less experienced groups only extend their recommendations when they are going to carry out certification activities, and this is done towards the end of the year, so that seed certification applications are submitted at the end of the year. This is in line with research journal of (Amiruddin et al., 2016) which states that in general, the more experience farmers gain in managing their agricultural activities, the more their knowledge and insight in farming will increase, so that they can manage their agriculture effectively and efficiently.

Table 11. Descriptive Analysis Data of Experience

Decision category	N	Mean	Median	Std. Deviation	Min	Max
Not Certified	6	4.33	5.00	2.066	1	7
Certification is not complete	7	3.57	1.00	4.077	1	10
Certified until finished	31	9.00	9.00	4.973	2	20

Source: Output SPSS, Processed Data 2025

Based on Table 11, the group of breeders who decided to carry out the rice seed certification process until completion, they had an average experience of 9 years, while the other groups had an average experience of less than 5 years. This is in accordance with opinion of (Jaya, 2023) which states that low experience affects the ability and skills of farmer groups in managing farming businesses.

Seed Selling Price

The result of the Normality Test in groups that decided not to certify seeds have a Sig value of 0.201, but for the other 2 groups have a sig value <0.05. This shows that the data is still not normally distributed, for this reason the Kruskal-Wallis Test is carried out. Based on the Kruskal-Wallis Test, the Asymp. Sig. value of 0.001 indicates that the value is <0.05, so there is a significant difference in the selling price variable between the breeder groups. This is because for groups whose certification has not been completed and who do not carry out certification, the selling price used is the price of Dry Grain Harvest or Dry Grain Milled, this price is below the selling price of seeds for groups who carry out seed certification. For certified rice seeds, the selling price of rice seeds has been agreed upon by all seed breeders, so that there is no significant difference in price between one region and another. What differentiates the selling price is the seed class and type of rice seed. If the selling price of seeds increases, the demand for rice seeds will decrease, so that the decision of the rice seed breeder group to certify rice seeds will also decrease. This is in accordance with the law of demand in the book by (Dr. Mursyid., MSI Lamtana., 2007) which states that in essence the law of demand states that when the price of a product per unit increases, it will cause the amount of product demanded to decrease, and if the price of a product per unit decreases from its original price, it means that the amount of product demanded will increase. Effective community-based restoration arrangements should follow some principles: (i) seed production must be based on real market demand; (ii) nongovernmental and governmental organisations have a key role in supporting local organisation, legal requirements and selling processes; (iii) local ecological knowledge and labour should be valued, enabling local communities to promote large-scale seed production; (iv) applied research can help develop appropriate techniques and solve technical issues (Schmidt et al., 2019).

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Table 12 shows that descriptive analysis of the variable selling price of seeds shows differences between groups of breeders, this is because the products produced by these groups of breeders are different, so the selling price is also different.

Table 12. Descriptive Analysis Data of Selling Price

Decision category	N	Mean	Median	Std. Deviation	Min	Max
Not Certified	6	6,233.33	6,500.00	3,493.80	0	9,500
Certification is not complete	7	5,285.71	6,000.00	2,408.62	0	7,500
Certified until finished	31	13,506.45	12,500.00	5,150.85	9,000	40,000

Source: Output SPSS, Processed Data 2025

Land Area

The result of the Normality Test that the Sig value for the Uncertified and Certified Seed groups is <0.05, so the data is not normally distributed, further hypothesis testing can be carried out using the Kruskal-Wallis Test. From the results of the Kruskal-Wallis Test, the Asymp. Sig. value is 0.488 where this value is > 0.05, so the land area variable for the three decisions in the breeder group is not significantly different. Land area does not significantly affect the decision of the seed breeder group in certifying rice seeds, because the wider the land, the riskier the certification process will be, because the number of plant inspection samples will increase, in addition, the production costs required will also be greater for larger land. Based on the results of the study, the seed breeder group who decided not to carry out the seed certification process, because the planting was attacked by pests and diseases and disasters such as floods, so they did not pass the field inspection and the certification process could not be continued. This is in line with the research of (Effendi, 2014) that the use of land by rice farmer respondents can be applied by using minimal land to obtain more abundant results compared to becoming non-breeder farmers. Strategies used to maintain rice fields are incentive systems, marketing facilitation, agricultural facilities, infrastructure, increasing human resources, and strengthening agricultural sector policies (Saragih et al., 2024).

Table 13. Descriptive Analysis Data of Land Area

Decision category	N	Mean	Median	Std. Deviation	Min	Max
Not Certified	6	16.250	17.75	15.1517	1	30
Certification is not complete	7	17.429	20.00	8.4431	2	25
Certified until finished	31	27.355	20.00	25.5794	6	150

Source: Output SPSS, Processed Data 2025

Based on Table 13, the average (mean) value of land area in the three groups of breeders can be seen. Breeders who are not certified and those who have not completed certification have almost the same average land area value, while the Certification until finished group has an average land area value of 27.35 ha. The land owned by the seed breeder group is not entirely used for seed breeding, but is also used for planting rice for consumption.

Seed Production Cost

The results of the Normality Test indicate that the variable data of seed production costs are not normally distributed, as can be seen from the Sig value in the Unfinished Certification group of 0.035, which is <0.05. For this reason, the hypothesis is taken using the Kruskal-Wallis Test. And the results of the Kruskal-Wallis Test obtained an Asymp. Sig. value of 0.001 indicating that the value is <0.05, so there is a significant difference for the production cost variable. This is because the production costs for groups that are not seed certified and seed certification has not been completed are calculated up to the harvest and drying process, while for groups that are seed

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certified until finished, there are costs for seed management, packaging, and non-tax state revenue costs. Based on the results of the interview, 42 respondents did not record the costs incurred in the production process. Only 2 respondents had records of expenses for rice seed production costs. This is in line with research by (Aris Munandar et al., 2024) which states that members of farmer groups do not understand the importance or the right way to record accounting and financial analysis. Lack of understanding of the benefits that can be obtained from accounting practices can reduce motivation to engage in such activities. The role of farmer groups as production units has an influence on accounting activities, but is still not optimal in providing information to always record anything related to the farming efforts carried out such as input-output reports used. To find out descriptively the differences in production costs in seed breeder groups, this can be seen in Table 14.

Table 14. Descriptive Analysis Data of Seed Production Cost

Decision category	N	Mean	Median	Std. Deviation	Min	Max
Not Certified	6	10,524,916.67	10,825,000.00	1,336,328.94	8,765,000	11,885,000
Certification is not complete	7	12,726,071.43	11,680,000.00	1,665,654.59	10,870,000	14,598,000
Certified until finished	31	18,285,853.23	18,245,000.00	3,767,258.96	11,540,500	28,417,500

Source: Output SPSS, Processed Data 2025

CONCLUSION

The conclusions of this study are that rice seed breeders in North Sumatra in 2023 are spread across 16 regencies and 44 seed breeder groups. The education level of rice seed breeders in North Sumatra is dominated by high school graduates. There are still seed breeders who do not understand the rice seed certification procedure. Lack of experience as a rice seed breeder is one of the reasons why seed breeders do not carry out seed certification activities. The rice seeds marketed by seed breeder groups are non-hybrid rice seeds with foundation seed, stock seed, and extension seed classes. Not all of the area owned by seed breeder groups is used for rice seed breeding. The cost to produce rice seeds is between IDR 15,000,000 - IDR 20,000,000 per hectare. Variables of knowledge, experience, selling price and production costs significantly different to each decision taken by seed breeders in rice seed certification activities. While the variables of education level and land area are not significantly different, this is because the education level of the seed breeder group is almost the same, namely an average of senior high school graduates, while the area of land controlled by the seed breeder group is also not significantly different between the 3 decision categories.

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