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Original Research

Factors affecting the quality of rice seeds produced in selected seed farms in Talavera, Nueva Ecija in the Philippines

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ABSTRACT:

The study was conducted to describe the agricultural practices and determine the different factors that contribute to high-quality seeds of rice farmers in Talavera, Nueva Ecija. Five seed farms in the different barangays of Talavera with the corresponding seed producers were selected for the study. Laboratory analyses were conducted to determine the quality attributes of rice seeds. Collection of seed samples from each seed producer weighing a kilo were collected for the laboratory analysis. The data from the collected seed samples were analyzed in Completely Randomized Design (CRD) and further analyzed using the STAR: Statistical Tool for Agricultural Research and International Rice Research Institute (IRRI). Results of the study showed that the seed quality components of rice seed producers such as varietal purity, weed seed, inert matter, and other seed variety were found to be of high quality. The percentage germination and moisture content were found varied from one cultivator to another. However, such quality variations were within the seed standards set by the Bureau of Plant Industry. It is recommended that seed producers keep up the standard of rice seed quality for agricultural production towards profitability and sustainability.

Keywords:

Seed farms, Agriculture, Rice production, Seed quality, Seed producers.

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Journal of Research in Ecology

INTRODUCTION

Seed is considered as one of the most important inputs in crop production. Technology has also modernized much of the day to day farming operations for increase yield and sustain man's demands for food (Pascual *et al*., 2018) but without a steady supply of high-quality seeds, yield rice crop could greatly decrease. Better quality of seed could provide better yield and results. The quality of seeds cannot be undermined in the field of agricultural economics and rice production. Characteristics such as varietal purity, germination percentage, physical purity and moisture content are important to farmers. They are means to achieve and maintain high-quality seeds which in turn increase farm yield.

The rice producers encounter many problems in producing high-quality rice seeds (Peng *et al*., 2012). The problems include poor quality seeds of low vigor, poor germination and unstorable seeds which are generally mixed with other varieties and contaminated with weed seeds. Other factors such as harvesting and post-production practices like handling and processing affect the quality of seeds (Badawi, 2004). Talavera is one of the largest rice producing areas in the province of Nueva Ecija. It has a total of 53 barangays of which 46 are agricultural areas, and rice farming is the main livelihood (PSA, 2018) About 8,817 hectares are devoted to rice production with about 5000 farmers cultivating the said area. Further, according to the Municipal Agriculture Office of this municipality, there are about twenty-six active seed producers from the different barangays who are producing high-quality rice seeds, selling and distributing to the farmers of Talavera and other neighboring towns.

This study was conducted to benefit the agriculture stakeholders primarily the seed producers. It was intended to determine the different factors that may contribute to high-quality seeds, and to determine the factors that may affect the seed quality. Increasing rice production based on good quality seeds will redound to achieving the goal of the government for rice self-sufficiency program.

Objectives of the study

The study was intended to identify the factors affecting the quality of rice seeds produced in the selected seed farms of Talavera, Nueva Ecija in the Philippines. Specifically, the study aimed at:

1. describing the cultural practices of the seed producers of Talavera Nueva Ecija in terms of

1.1 seed class;

1.2 planting season;

1.3 source of water;

1.4 nutrient management;

1.5 pest and disease management;

1.6 weed management;

1.7 harvesting and post-harvest practices;

2. determining the quality of seeds in Talavera, Nueva Ecija based on:

2.1 varietal purity test

2.3 inert matter;

2.4 weed seed and other crop seeds;

2.5 other seed varieties;

2.6 germination test,

2.7 moisture content test.

3. Comparing the quality of seeds produced among the selected seed farms in Talavera, Nueva Ecija and the Bureau of Plant Industry.

4. Determining if there is a significant difference between the quality of the seeds produced among the selected seed farms of Talavera, Nueva Ecija based on their cultural practices

5. Providing recommendation on the production of quality seeds.

Conceptual framework

The conceptual framework of this study follows the Input-Process Output paradigm (Figure 1).

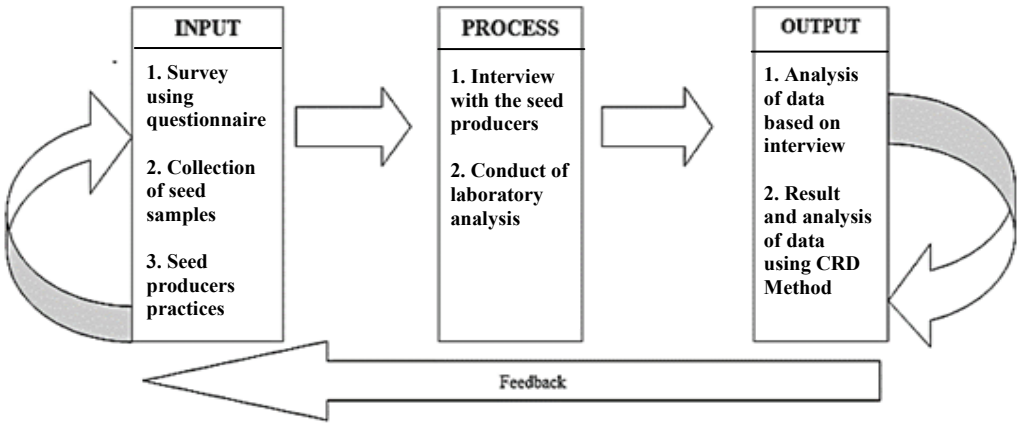

Figure 1. Conceptual framework of the study

METHODOLOGY

This study employed a combination of qualitative and experimental methods of research. Five selected seed farms in the different barangays of Talavera with the corresponding seed producers were identified as follows: David Macapagal of Tabacao, Luis Echenique of Tagaytay, Crispin Del Rosario of Homestead II, Alellie Caspillar of Baluga and Jose Echenique of Bulac. In employing the qualitative method of study, personal interview using survey questionnaires was used to describe the different cultural practices used by the selected seed producers of Talavera, Nueva Ecija. In the experimental method of study, laboratory analysis was required in determining the quality attributes of rice seeds. Collection of seed samples from each seed producer weighing a kilo was taken for laboratory analysis.

The resulted data from the collected seed samples were analyzed in Completely Randomized Design (CRD) and further analyzed using STAR: Statistical Tool for Agricultural Research of International Rice Research Institute (IRRI). The quality attributes of rice seeds were analyzed following the procedures contained in Administrative Order No. 16 Series of 2010 of the Department of Agriculture (DA, 2010).

The measurement used to determine qualities is (scaling) based on the seed standards for registered seeds set by the Department of Agriculture (Bureau of Plant Industry) Philippines.

For varietal purity

To determine varietal purity, samples from seed producers were used. Instruments to test purity of seeds were also used. The seed samples were segregated based on identified components such as: pure seed, other variety, inert matter and weed seed. The weight for the working samples were: for purity test were not less than 400 grams and varietal test was 500 grams. The varietal and purity tests were employed to determine the presence of weed seeds, inert matters and seeds of other crops.

For inert matter

Inert matter pertains to anything mixed to the seeds and made their way inside the seed bag. To determine the inert matter, scrutiny of seed samples and segregation were done. The seeds were classified depending on the seed genus and class.

Table 1. Standard for registered seeds

S. No	Factors	Standards for registered seeds
1	Purity %	98%
2	Weed	0.04
3	Inert matter	2
4	Other varieties/grains 500grams maximum	5
5	Germination	85
6	Moisture content (maximum %)	14

Table 2. 1. Seed class used on the selected farms of Talavera, Nueva Ecija by different seed producers

Seed producer	Seed class	Variety used
1	Registered seeds	NSIC Rc 222
2	Registered seeds	NSIC Rc 216
3	Registered seeds	NSIC Rc 10
4	Registered seeds	NSIC Rc 218
5	Registered seeds	NSIC Rc 238

For weed seeds

Seed bulblets or tuber of plants recognized by laws, official regulations or by general usage shall be considered as weed seeds. Weed seeds if there were any other than seed types and variety taken as samples were identified and collected.

Other crop seeds

Other crop seed refers to variety and genus of plant seeds other than the seed grown. Manual selection and identification were done.

Germination test

Germination test was done following the International Association of Seed Analyst Rules of Testing (IASA, 1976). The working samples were taken from the pure seed fraction of a purity test. The pure seed was mixed and 400 seeds count at random from the pure seed components were used. This was prepared in replicates of four with 100 seeds per replicate. Each replicate was placed in a moistened filter paper as a medium. Seeds were spaced 1.5 to 5 times the width or diameter of the seed. The seeds were germinated in an incubator. Daily application of water was done to avoid drying. Initial counting was done four to five days after setting-up of the experiment, and final counting was accomplished nine days after the initial counting. If the samples produced seedlings which cannot readily be evaluated, a test was done using sterile sand or good quality soil under favorable temperature, water supply, and light.

Seed germination was considered when the seed had developed to normal seedlings. To achieve uniformity in evaluating normal seedlings, they must conform to the following characteristics :

1. Seedlings which show the capacity for continued development into normal plants when grown in good soil, and under favorable condition of water supply, temperature, and light;
2. A well-developed root system;
3. A well-developed and intact hypocotyl and epicotyl without damage to the conducting tissues;
4. A well-developed primary leaf within or emerging through coleoptile; and
5. One cotyledon for seedlings of monocotyledons.

Abnormal seedlings of monocotyledons were those which aid the capacity for continued development into normal plants when grown in good quality soil, under the favorable condition of water supply, temperature, and light.

Moisture content test

Seed moisture determination was done using the universal moisture tester (IRRI, 2018). Sample seeds of fifty grams were weighed and placed in the moisture tester. Two trials were made to get the average moisture content.

RESULTS AND DISCUSSION

Talavera is basically known as a farming community. Its Population has a modest number of commer-

Table 2. 2. Planting season and source of water used by different seed producers in selected farms of Talavera

Seed producer	Planting season	Water source
1	Dry season	National Irrigation Administration (NIA)
2	Dry season	National Irrigation Administration
3	Dry season	National Irrigation Administration
4	Dry season	National Irrigation Administration
5	Dry season	National Irrigation Administration

Table 2. 3. Nutrient Management applied in the selected farm of Talavera, Nueva Ecija

Seed Producer	Fertilizer Used		
	Kind	Bags / Ha.	Timing
1	Inorganic fertilizer	10	10 DAT, 21 DAT, 35 DAT
2	Inorganic fertilizer	14	12 DAT, 22 DAT
3	Inorganic fertilizer	8.5	7 DAT, 15 DAT, 35 DAT
4	Inorganic fertilizer	10	12 DAT, 22 DAT
5	Inorganic fertilizer	9	10 DAT, 21 DAT

cial and industrial establishments. The main livelihood of the majority of its people is farming for both consumption and commercial purposes (Virmani and Kumar 2004). There are farmers who are producing seeds for commercial purposes and are called seed producers or seed growers. According to the Municipal Agriculture Office (MAO) of Talavera, Nueva Ecija, there are 20 active seed producers in the different barangays of Talavera producing registered and certified seeds. About 300 hectares of registered and certified seeds are being planted every season for seed production purposes. The various seed farms, and the corresponding seed producers were: David Macapagal of Tabacao, Jose Echenique of Tagaytay, Crispin Del Rosario of Homestead II, Alleli Capillar of Baluga and Luis Echenique of Bulac.

Table 2 shows the results of the survey on different cultural practices used by the seed producers at the selected farms of Talavera, Nueva Ecija. Table 2.1 shows the seed class used in the selected farms of Talavera, Nueva Ecija by different seed producers.

The seed class produced in the selected farms of Talavera, Nueva Ecija by Seed Producers 1,2,3,4 and 5 are of the same class but of different varieties. Seed producer 1 uses NSIC Rc 222, seed producer 2 uses NSIC Rc 216, Seed Producer 3 uses NSIC Rc 10, seed producer four use NSIC Rc 218, and seed producer 5 uses NSIC Rc 238. All the seed varieties are registered seeds and taken from registered seed producers with technical assistance from the municipal agriculturist office. The different varieties of seeds chosen by the producers is because of the different qualities and characteristics per variety. NSIC 216,218 AND 238 are known for having good eating quality. The NSIC 222 is a high yielding variety while NSIC Rc 216 for its high market value. The NSIC Rc10 is proven to have an early maturing type of seed. It is also observed that producers chose registered seeds because of its competitive price.

During the field research it was also observed that the use of hybrid rice technology is also gaining popularity among seed producers. After its development in China, the International Rice Research Institute (IRRI) developed and introduced the technology to some Southeast Asian Countries including India. Hybrid seed is known for its resilience to biotic stresses and economy (Wiel *et al.,* 2014). It produces 1 to 1.5 tons per hectare. At present it is produced and marketed by around 60 companies, both public and private. Table 2.2 shows the planting season and the source of water used

Table 2. 4. Pest and disease management practices by different seed producers of Talavera, Nueva Ecija

Seed producer	Control measures
1	Biological control
2	Chemical control
3	Chemical control
4	Chemical control
5	Chemical control

Table 2. 5. Weed management / rouging used by the different seed producers Talavera, Nueva Ecija

Seed producer	Control measures	Rouging frequency
1	Combination of water and chemical control	Two times (during flowering and before harvesting)
2	Chemical control	Two times (during flowering and before harvesting)
3	Chemical control	Two times (during flowering and before harvesting)
4	Chemical control	Two times (during flowering and before harvesting)
5	Chemical control	Two times (during flowering and before harvesting)

by different seed producers in selected farms of Talavera, Nueva Ecija.

Table 2.2 shows the planting season and source of water of the different seed producers of Talavera, Nueva Ecija. The table shows that seed producers 1,2,3,4 and 5 planted their seeds during the dry season and their source of agricultural water is supplied by the National Irrigation Administration (NIA) canals. It is noted that seeds are planted during the dry season and during this season, there were no calamity like typhoons and floods that destroy or damage the seeds and are planted in the selected farms. Further, adequate supply of water administered by the National Irrigation Administration (NIA, 2017) favored the production of seeds in the study area. Meanwhile Table 2.3 shows the nutrient management applied in the selected farms of Talavera, Nueva Ecija.

Seed producers 1, 2, 3, 4 and 5 used inorganic fertilizers in their farms to supply the nutrients needed by the plants but with different practices in the timing of application and the amount of fertilizers used. Seed producer 1 used 10 bags of inorganic fertilizer. Three split application of fertilizer is done that is, 10 Days After Transplanting (DAT), 21 DAT and 35 DAT. Seed producer 2 used inorganic fertilizer at the rate of 14 bags and applied 12 DAT and 22 DAT only. Seed producer 3 used inorganic fertilizer and applied three times that is 7 DAT, 15 DAT, and 35 DAT. Two split applications were practiced by seed producer 4 and 5 using 10 and nine bags of inorganic fertilizer and applied 12 DAT and 22 DAT, 10 DAT, and 21 DAT respectively. Differences in the use of fertilizer, timing, and rate of fertilizer used by seed producers are based on the recommendation of soil analysis result. Conventional or farmer's practices are the basis of applying different rates of fertilizer used, timing and amount by seed producers 2, 3, 4 and 5. Table 2.4 shows the pest and disease management practices in the selected farms of Talavera, Nueva Ecija by different seed producers.

The different control measures used by the different seed producers in the selected farms of Talavera, Nueva Ecija, are shown in Table 2.4. The seed producer 1 uses biological control. It is the use of organisms to control pests in the farms (IPM, 2012). This practice is adapted by seed producer 1 to preserve the beneficial insects and to protect the environment. In contrast, seed

Table 2. 6. Harvesting and post - harvest practices employed by different seed producers

Seed producer	Harvesting methods	Harvesting time	Drying methods	Seed cleaning methods
1	Mechanical	80 - 85 % maturity	Solar drying	Mechanical seed cleaner
2	Mechanical	80 - 85 % maturity	Solar drying	Mechanical seed cleaner
3	Mechanical	80 - 85 % maturity	Solar drying	Mechanical seed cleaner
4	Mechanical	80 - 85 % maturity	Solar drying	Mechanical seed cleaner
5	Mechanical	80 - 85 % maturity	Solar drying	Mechanical seed cleaner

Table 3. 1. Varietal purity of seed producers as compared to BPI seed standard

Seed producer	Seed class	Varietal purity				Mean ±SD	BPI seed standard (%)
		R I	R II	R III	R IV		
1	Registered seed	99.4	99.22	99.5	99.1	99.4±0.18	98
2	Registered seed	99.3	99.3	99.3	99.4	99.3±0.05	98
3	Registered seed	99.8	99.9	99.7	99.9	99.8+0.10	98
4	Registered seed	99.9	99.9	99.9	99.9	99.9±0.00	98
5	Registered seed	99.2	99.9	99.6	99.7	99.6±0.29	98

Table 3. 1a Analysis for response

Variable: Varietal. purity

Summary Information

Factor	No. of levels	Levels
Treatment	5	1,2,3,4,5
Number of observations read and used: 20		

ANOVA Table

Response variable: varietal purity

Source	DF	Sum of square	Mean square	F value	Pr(>F)
Treatment	4	1.0820	0.2705	9.07	0.0006
Error	15	0.4475	0.0298		
Total	19	1.5295			

Summary statistics

CV (%)	:	0.1734
Varietal. purity mean	:	99.61Standard Errors
Effects	:	StdErr
Treatment	:	0.1221

Pairwise mean comparison of treatment

Least Significant Difference (LSD) test

Alpha	0.05
Error degrees of freedom	15
Error mean square	0.0298
Critical value	2.1314
Test statistics	0.2603

Treatment	Means	N Group
99.40	4	Cd
99.30	4	D
99.83	4	Ab
99.90	4	A
99.60	4	bc

Means with the same letter are not significantly different

producers 2,3,4 and 5 used the chemical control in managing pests and diseases because according to them, chemical control measures in the production of rice seeds is the easiest and effective way of preventing harmful pests and in controlling diseases. Table 2.5 shows the weed management and frequency of rouging used by the different seed producers in the selected farms of Talavera, Nueva Ecija.

Rouging is the removal of weeds or other plants in the seed production area. Seed producer 1 used a combination of water and chemical control. Seed producer 1 used this practice as was discussed during his interview that water management practice in controlling weeds is cheaper to use than chemicals. He only used the chemical if there is a bad need to use or when there are abundant weeds on the farm. Seed producer 1 practiced rouging two times or during flowering and before harvesting, while seed producers 2, 3, 4 and 5 use the chemical control in managing the weeds on their farm. They practice the same rouging frequency that is two times, during flowering and before harvesting. According to them, weeds, when not controlled earlier, will reduce production because they compete with the nutrients supplied for the crops. Furthermore, presence of weed seed will affect the purity of seed (UCDANR, 2018). Table 1.6 shows the harvesting and post-harvest practices employed by the different seed producers.

Based on the survey, the same method and time of harvesting, drying and method of seed cleaning are employed by seed producers 1, 2, 3, 4 and 5 in the

3. 2. Percentage of inert matter of different seed producers in the selected farms of Talavera, Nueva Ecija as compared to the BPI seed standard

Seed producer	Seed class	Inert matter (%)				Mean ±SD	BPI seed standard (%)
		I	II	III	IV		
1	Registered seed	2	3	1	2	2± 0.82	2
2	Registered seed	1	1	1	1	1± 0.00	2
3	Registered seed	2	0	1	1	1± 0.82	2
4	Registered seed	1	1	2	0	1 ± 0.82	2
5	Registered seed	3	2	2	1	2 ± 0.82	2

Statistical Tool for Agricultural Research (STAR)

Analysis of variance

Completely randomized design

Table 3. 2a Analysis for response

Variable: Inert matter

Summary information

Factor	No. of levels	Levels
Treatment	5	1,2,3,4,5
Number of observations read and used: 20		

ANOVA Table

Response variable: inert matter

Source	DF	Sum of square	Mean square	F value	Pr (>F)
Treatment	4	1.2000	2.25	0.1123	
Error	15	8.0000		0.5333	
Total	19	12.8000			

Summary statistics		
CV(%)	:	52.16
Inert. matter mean	:	1.40
Standard errors		
Effects	:	Std Err
Treatment	:	0.516

selected farms of Talavera, Nueva Ecija. The seed producers used a mechanical method of drying using combined harvester. They harvested their seeds when 80-85 percent of the grains are already matured. They also use solar drying method since solar drying is cheaper than any other drying methods. Mechanical seed cleaner had been used by the seed producers 1, 2, 3, 4 and 5 for cleaning their seeds.

The quality of seeds producers 1,2,3,4 and five as compared to the Bureau of Plant Industry (BPI) seed standards

The varietal purity of seed producers at Talavera, Nueva Ecija as compared to Bureau of Plant Industry based on the varietal purity as shown in Table 3.1. Seeds with the highest percentage of varietal purity were obtained by seed producer 4 with an average of 99.9 percent, followed by seed producer 3 with 99.8 percent. seed producer 5, seed producer 1 and seed producer 2 obtained an average of 99.6, 99.4 and 99.3 percent respectively. It also shows in the table that seeds produced by seed producers 1, 2, 3, 4 and 5 satisfies the standard set by the Bureau of Plant Industry. Table 3.1 shows the percent varietal purity of seed producers 1, 2, 3, 4 and five as compared to BPI Seed Standard.

Analysis of variance as computed using Statistics for Agricultural Research (STAR) shows that there is a significant difference in the varietal purity of different seed producers. Least Significant Difference (LSD) test showed that seed producers 1 and 2, seed producers 3 and 4, seed producer 3 and 5 and seed producers 1 and 5 are not significantly different with each other. The other relations are significantly different, or the varietal purity is affected by whom the seed producer is. Cultural practices such as using the same variety in the same area, rouging, method of threshing are some of the fac-

Table 3. 3. Percent weed seed of the different seed producers in the selected farms of Talavera, Nueva Ecija

Seed producer	Seed class	Weed seed (%)				Mean SD	BPI seed standard (%)
		I	II	III	IV		
1	Registered seed	0.04	0.03	0.05	0.04	0.04	0.04
2	Registered seed	0.03	0.03	0.04	0.02	0.03	0.04
3	Registered seed	0.02	0.02	0.02	0.02	0.02	0.04
4	Registered seed	0.03	0.05	0.04	0.04	0.04	0.04
5	Registered seed	0.01	0.03	0.02	0.02	0.02	0.04

Table 3. 3a. Analysis for response

Variable: Weed seed

Summary Information

Factor	No. of levels	Levels
Treatment	5	1,2,3,4,5

Number of observations read and used: 20

Summary of the result:

Treatment	Means	N Group
0.0400	4	A
0.0300	4	Ab
0.0200	4	B
0.0400	4	A
0.0200	4	b

Means with the same letter are not significantly different

ANOVA Table

Response variable: weed, seed

Source	DF	Sum of square	Mean square	F value	Pr(>F)
Treatment	4	0.0016	0.0004	7.50	0.0016
Error	15	0.0008	0.0001		
Total	19	0.0024			

Summary statistics

CV(%) : 24.34

Weed. seed mean : 0.0300

Standard errors

Effects : StdErr

Treatment : 0.0052

Pairwise mean comparison of treatment

Least Significant Difference (LSD) test

Alpha	0.05
Error degrees of freedom	15
Error mean square	0.0001
Critical value	2.1314
Test statistics	0.0110

tors that favour seed mixture thus affecting the purity of the seeds. According to Fernandez and Dimaporo (2007), farmers' ways and indigenous practices bring about sustainable agriculture but also provide the mechanism for mitigating climate variation (Gabriel and Mangahas, 2017).

In relation to this finding is the observation of all seed producers that using combined harvesters (as shown in Table 2.6.) causes high varietal mixture as compared to the use of manual threshing. On the other hand a possible cause that contributes to the high varietal purity is the practice of using the same varieties in the same area. In terms of percentage of inert matter in selected farms of Talavera Nueva Ecia, Table 3.2 shows the results of the survey.

The highest amount of inert matter is obtained from seed producer 1 and seed producer 5 with the same mean of 2.0 percent whereas seed producers with the lowest inert matter is obtained by seed producer 2. Seed producer 3 and seed producer 4 have the same average of 1.0 percent.

An inert matter such as unfilled grains, chaffs, broken seeds, stems, leaves, and soil particles are other factors that affect the quality of seeds. In Sierra Leone, farmers also considered quality seeds as being free from inert materials. They believe that quality seeds are of a uniform variety and that which is tolerant to pest, diseases and adverse climatic conditions. Others think that

Table 3. 4. Other variety grains /500grams (max) of the different seed producers of Talavera, Nueva Ecija as compared to BPI seed standard

Seed producer	Seed class	Other varieties grains/500 grams, Max.				Mean ±SD	BPI seed standard (%)
		RI	RII	RIII	RIV		
1	Registered seed	2	3	1	2	2 ± 0.82	5
2	Registered seed	1	1	1	1	1 ± 0.00	5
3	Registered seed	2	0	1	1	1 ± 0.82	5
4	Registered seed	1	1	2	0	1 ± 0.82	5
5	Registered seed	3	2	2	1	2 ± 0.82	5

Statistical Tool for Agricultural Research (STAR)

Analysis of variance

Completely randomized design

Table 3 .4a. Analysis for response

Variable: Other varietal grains

Summary Information

Factor	No. of Levels	Levels
Treatment	5	1,2,3,4,5
Number of observations read and used: 20		

ANOVA TABLE

Response variable: Other varietal grains

Source	DF	Sum of square	Mean square	F value	Pr (>F)
Treatment	4	4.8000	1.2000	2.25	0.1123
Error	15	8.0000	0.5333		
Total	19	12.8000			

Summary statistics

CV(%) : 52.16

Inert. matter mean : 1.40

Standard errors

Effects : StdErr

Treatment : 0.5164

Table of means

Treatment	Inert matter means
1	1
2	0
3	0
4	0
5	1

quality seeds have high germination percentage (Kamara, 2015). Below is the statistical computation of the percentage of presence of inert matter in the sample seeds using STAR:

Analysis of Variance as computed in STAR shows that there was no significant difference on the percentage of inert matter of different seed producers. It is implied that the result from different seed producers were not significantly different when it comes to the percentage of inert matter present in the seeds. Results showed that the inert matter differed but not that significant among individual seed producers.

This could be attributed to the differences in farming technology like harvesting, and post-harvest handling procedures, and cleaning of seeds (IRRI, 2018). Based on the interview conducted as shown in Table 2.6, all of the seed producers used the mechanical method in harvesting like using combined harvester and mechanical seed cleaner in cleaning their seeds that resulted to the minimal percent of inert matter. Table 2.3 shows the percent weed seed of the different seed producers in the selected farms of Talavera, Nueva Ecija.

The highest average of 0.04 percent was produced by seed producer 1 and seed producer 4. seed producer 2 obtained 0.03 percent while seed producers 3 and 5 have the same lowest average of 0.02 percent respectively. The presence of weed seed in the seed samples is

Table 3. 5. Percent Germination test of the different seed producers in the selected farms of Talavera, Nueva Ecija

Seed producer	Seed class	Percent germination				Mean ±SD	BPI seed standard (%)
		RI	RII	RIII	RIV		
1	Registered seed	95	97	96	96	96 ± 0.82	85
2	Registered seed	95	94	94	95	95 ± 0.58	85
3	Registered seed	95	93	95	95	95 ± 1.00	85
4	Registered seed	98	92	94	92	94 ± 2.83	85
5	Registered seed	92	94	92	98	94 ± 2.83	85

Table 3. 5a. Analysis for response

Variable: Percent germination

Summary information

Factor	No. of levels	Levels
Treatment	5	1,2,3,4,5

Number of observations read and used: 20

ANOVA TABLE

Response variable: Other varietal grains

Source	DF	Sum of square	Mean square	F value	Pr (>F)
Treatment	4	10.8000	2.7000	0.75	0.5732
Error	15	54.0000	3.6000		
Total	19	64.8000			

Summary Statistics

CV(%)	:	2.01
Percent.Germination Mean	:	94.60

Standard Errors

Effects	:	StdErr
Treatment	:	1.34

Table of Means

Treatment	Percent. germination means
1	96.00
2	94.50
3	94.50
4	94.00
5	94.00

due to improper handling and caring of farm area where the seeds are produced and developed. According to some seed producers, the presence of weed seeds in the seed samples is attributed to inappropriate handling and mistreatment of weeds during farm production. The use of mechanical combined harvester is also pinpointed as providing greater chances of the weed seed to mix with the sample seeds.

Analysis of variance as computed in STAR showed that there was a significant difference on the percent of weed seed at different seed producers. Least Significant Difference (LSD) test showed that the seed producers 1, 2 and 4, and seed producers 2, 3 and 5 are not significantly different from each other. The other relation is the significant difference, or the percent weed seed was affected based on the seed producer. The table for weed seed is shown below:

Weed control is one of the most important cultural operations which will determine in part the overall quality of seeds to be produced (Ahmed *et al*., 2014). It is then necessary that rouging of weeds should be done at the proper time. Any differences on weed seed component of the produce by the various seed producers reflect their varying weed control procedures.

Results of the interview shown in Table 2.5 under weed management appeared that most of the seed producers used chemical in controlling weeds except seed producer 1 who used a combination of chemical and water management in controlling weeds. However, it should be pointed out that the levels of weed seed in

Table 3. 6. Percent moisture content

Seed producer	Percent moisture content				Mean ± SD	BPI seed standard (%)
	RI	RII	RIII	RIV		
1	11.0	12.0	11.5	12.7	11.8 ± 0.73	14
2	13.7	13.9	12.5	12.7	13.2 ± 0.70	14
3	12.5	13.5	12.4	13.2	12.9 ± 0.54	14
4	12.2	13.2	12.5	12.9	12.7 ± 0.44	14
5	12.4	13.5	13.4	13.5	13.2 ± 0.54	14

Statistical Tool for Agricultural Research (STAR)

Analysis of variance

Completely randomized design

Table 3. 6a Analysis for response variable

Moisture content

Summary Information

Factor	No. of levels	Levels
Treatment	5	1,2,3,4,5
Number of observations read and used: 20		

ANOVA Table

Response variable: Moisture content

Source	DF	Sum of square	Mean square	F value	Pr(>F)
Treatment	4	5.3280	1.3320	3.73	0.0268
Error	15	5.3600	0.3573		
Total	19	10.6880			

Summary statistics

CV(%)	:	4.68
Moisture content mean	:	12.76

Standard errors

Effects	:	StdErr
Treatment	:	0.4227

Pair wise mean comparison of treatment

Least Significant Difference (LSD) test

Alpha	0.05
Error degrees of freedom	15
Error mean square	0.3573
Critical value	2.1314
Test statistics	0.9009

Summary of the result

Treatment	Means	N Group
11.80	4	B
13.20	4	A
12.90	4	A
12.70	4	Ab
13.20	4	A

Means with the same letter are not significantly different.

the various seed farms are within the tolerable level as compared to the seed standards set by the Bureau of Plant Industry. Table 3.4 shows the other variety of grains /500 grams of the different seed producers in the selected farms of Talavera, Nueva Ecija as compared to BPI seed standard.

Seed producer 1 and seed producer 5 attained the highest amount of other seed varieties with the same average of 2 grains/500 grams, followed by seed producer 2, seed producer 3 and seed producer 4 with the same average of 1 grain per 500 grams in the sample.

Analysis of variance as computed in STAR showed that there was no significant difference on the percentage of other variety grains of different seed producers. It is implied that the result from different seed producers were not significantly different when it comes to the percentage of other variety of grains present in the seeds.

Results showed that the number of other seed variety of seed producers is almost the same. These could be attributed to the same cultural practices in the

frequency of rouging which is during flowering and before harvesting. Timely and intensive removal of off-types can reduce the number of other variety, thereby increasing seed purity. The practice of off-types removal was religiously followed by seed producers as shown in Table 2.5 and Table 3.5 shows the percent germination of the different seed producers in the selected farms of Talavera, Nueva Ecija.

The percentage germination of seed producers in selected farms of Talavera is shown in Table 3.5. Results showed that rice seeds produced having the highest percentage germination of 96 percent was obtained by seed producer 1 with a mean of 96 percent. It was followed by seed producer 2, and seed producer 3 with the same average of 95 percent. The lowest percentage with an average of 94 percent was attained by seed producers 4 and seed producer 5. A weighted mean average of 94.8 is arrived at showing higher result for percentage germination in selected seed producers in the study area.

Analysis of variance as computed in STAR showed that there is no significant difference on the percentage of germination in different seed producers. It is implied that the result from different seed producers is not significantly different when it comes to the percentage of germination in the sample seeds. The statistical computation is shown below:

Percentage germination is the best index that will determine the longevity of seeds in storage (Hussain *et al*., 2015). Based on the study, factors such as time of harvesting, drying of seeds, storage temperature and moisture content are the controlling factors that affected the viability of producer's rice seeds. It can be noted that all of the seed producers harvested their seeds on time that resulted in high germination percentage.

Another factor that could affect percentage germination of rice producers' seeds is drying (De Datta, 1981). It can also be noted that all of the seed producers of selected farms in Talavera dry their seeds properly that resulted in high germination percentage stated that in general 4 to 5 days of sun drying are required to reduce the grain moisture content to an acceptable level.

It can also be noted that the average percentage germination of rice seeds produced in Talavera by the selected seed producers is within the quality standards set by the Bureau of Plant Industry. Table 3.6 shows the percent moisture content of the different seed producers in the selected farms of Talavera, Nueva Ecija.

Percent moisture content

The seeds produced in Talavera by the selected seed producers that attained the highest percentage moisture content was produced by seed producer 2 and seed producer 5 with the same average of 13.2 percent followed by seed producer 3, seed producer 4 and seed producer 1 with a descending average of 12.9, 12.7 and 11.8 percent respectively.

Analysis of variance as computed in STAR showed that there is significant difference on the percent of moisture content in different seed producers. The Least Significant Difference (LSD) test showed that seed producers 2, 3, 4 and 5, and seed producers 1 and 4 are not significantly different with each other. The other relations are significantly different, or the percent moisture content was affected based on the seed producer.

Generally, one of the factors that suppressed biological deterioration of rice seed producers is moisture content (Jyoti and Malik, 2003). Based on the result, the moisture content of rice seeds varied from a grower to another. However, values of seed moisture at different farms are within the tolerable limit as compared to the Philippine seed standards of the Bureau of Plant Industry.

Significant differences between the quality of seeds produced among the selected seed farms in Talavera, Nueva Ecija based on their cultural practices.

The quality of seeds produced among selected farms in Talavera, Nueva Ecija based on their cultural

practices and as computed using the STAR show that there are significant differences among the means of the data when it comes to varietal purity, percent weed seed, and moisture content. It is implied that procedures done by different seed producers in cleaning and drying the seeds might affect the qualities of the seeds thus affecting its qualities (FAO, 2018).

On the other hand, the results from the following qualities, percent inert matter, other variety grains and percent germination, revealed non-significant differences among means of seed samples from different seed producers. It is implied that the procedures done by different seed producers in cleaning and drying the seeds might not affect the said qualities of the seeds.

CONCLUSION AND RECOMMENDATIONS

Results showed that the seed quality components of rice seed producers such as varietal purity, weed seed, inert matter, and other seed variety are found to be of high quality. Percentage germination and moisture content varied from one grower to another. However, such quality variations are within the seed standards set by the Bureau of Plant Industry. On the other hand, the results of the interview on the different cultural practices employed by the different seed producers correlate with the significant results of seeds they produced.

Based on the statistical analysis done, it showed that producers or the growers significantly affect the following qualities of the seed: varietal purity, percent weed seed, and moisture content. While on the other qualities, percent inert matter, other variety grains and percent germination, producers almost got the same result. Furthermore, based on the results of the study, the produce of all the seed producers who used registered seeds are classified as certified seeds.

As they all passed the set standards, it is recommended that to all seed producers keep improving their production procedures and maintain the observance of cultural practices favorable to producing high quality seeds.

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APPENDIX

Survey Questionnaire

I. Demographic Profile (optional)

Name (optional) _____ Age: _____ Sex: _____ Civil Status: _____

Province: _____ Municipality: _____ Barangay: _____

Number of years in seed growing: _____

Farm size (ha.):_____

Variety of seed used : _____ Harvest per hectare in terms of cavans: _____

II. Quality of Seeds

A. Seed Class: ( ) Foundation Seed ( ) Registered seeds ( ) Certified Seeds

B. Planting Season: ( ) Wet Season ( ) Dry Season

C. Source of water: ( ) Subscription ( ) Water Pump

D1.Nutrient management

Volume use: _____ Method use: _____

Type of fertilizer: _____

Season to fertilize: _____

D2. Pest and disease management :

( ) Biological Control ( ) Chemical Control ( ) Manual

D3. Weed Management ( ) Manual ( ) Chemical Control ( ) Water Management

E. Harvesting and post harvest practices:

E1.Method of harvest: ( ) Manual ( ) Mechanical

E2. Manner of drying seeds: ( ) Manual ( ) Mechanical

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