BIBLIOGRAPHY

URBANO, RONILLO R. APRIL 2008. Evaluation of High Yielding Varieties of Rice Under Bugayong, Binalonan Pnagasinan Condition. Benguet State University, La Trinidad, Benguet.

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ABSTRACT

Seven different varieties of rice namely: PSB Rc 14 (Rio grande), PSB Rc 18 (Ala), PSB Rc 82 (Peñaronda), NSIC Rc 130 (Tubigan 3), NSIC Rc 138 (Tubigan 5) and PSB Rc 28 (check variety) were evaluated to test the performance of high yielding rice varieties in terms of its growth, grain yield and resistance to pests and diseases and which variety is best suited under Bugayong, Binalonan Pangasinan from October 2007 to February 2008.

Among the different varieties evaluated, NSIC Rc 138 and NSIC Rc 130 recorded the highest number of productive tillers, number of grains per panicle, total plant weight, highest grain yield (2066.66 kg) and (1960.42 kg), respectively and resistance to pests and diseases. Both varieties exhibited the highest return on cash expenses (ROCE) with 69.5% and 60.83% respectively.

Other varieties evaluated are not well adapted and accepted due to their short statue, low grain yield and having characteristics of shattering.

NSIC Rc 138 and NSIC Rc 130, therefore, are highly recommended under Bugayong, Binalonan Pangasinan.

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INTRODUCTION

Rice is the staple food of the Filipinos and the lifeblood of the nation. A semi-aquatic plant scientifically known as *Oryza sativa* Linn, it is one of the oryzoid groups of the grass family Graminae. It grows readily in areas of considerable warmth and moisture (PhilRice, 1993).

The rice plant usually takes 3-6 months from germination to maturity, depending on the variety and the environment under which is grown. During this period, rice completes basically two distinct sequential growth stages: vegetative and reproductive. The reproductive stage is subdivided into preheading and postheading periods. The latter is better known as the ripening period. Yield capacity, or the potential size of crop yield, is primarily determined during preheading (Yoshida, 1981).

In the Philippines, rice production is a main source of income for many farmers. Rice production is common in places like Isabela, Cagayan, Nueva Ecija, Nueva Viscaya, Pangasinan and others. Low yield of rice is however observed in these areas due to factors such as poor choice of variety, soil degradation, improper cultural management practices, and others. Continuos selection of rice varieties suited to a particular location is therefore important.

Based on the National statistic office, Philippine population in the year 2000 was already 73 m, and it was estimated that by the year 2020, the country's population shall pass the 100 m mark. The country's current rice consumption as food is 22,000 tons per day. Aside from this, some goes to waste, seed requirement, industries and other purposes (PhilRice, 2001).

Because of increasing population and the land intended for cropping is becoming smaller due to demand for other uses such as residential and commercial purposes, there is a need to use high yielding varieties and to adopt new techniques of production like the improvement of traditional agricultural practices, proper time of planting and mechanization.

The use of improved varieties of rice may permit two or three successive croppings per year. Varietal evaluation studies in other places revealed that improved varieties could produce more yields than the traditional ones. However, rice yield varies depending on the place of planting, kind of soil, temperature, fertilizer application, water and necessary care.

Variety evaluation is necessary due to the decreasing yield of existing varieties in localities, which have been used for a long time by the farmers. This is necessary to find outstanding on high yielding varieties to replace degenerated cultivars. The necessity of evaluating varieties to suit prevailing local conditions is made more important by the fact that expansion of land cultivated by farmers is not possible.

This study was conducted to test the performance of high yielding rice varieties in terms of its growth, grain yield and resistance to pests and diseases, and to determine which variety is best suited under Bugayong, Binalonan, Pangasinan condition.

This study was conducted at a farmer's field in Bugayong, Binalonan, Pangasinan from October 2007 to February 2008.

REVIEW OF LITERATURE

Varietal Evaluation

Improved rice varieties would vary according to the ecological conditions in which these are grown. Agronomic characters generally associated with high yield potential and nitrogen responsiveness in irrigated lowland varieties possess short or semi-dwarf stature, lodging resistance, high tillering ability, non-spreading culms, and relatively short erect leaves, strong seedling vigor, insensitivity to photoperiod, medium threshing ability and moderate grain dormancy and other available traits (UPLB, 1983).

Modern varieties have greater yield potential than traditional varieties even under the best conditions. Use of fertilizer and improved farming practices will increase grain yield more in modern varieties than in traditional ones. The use of improved varieties is the cheapest single innovation that has the built-in capability for increasing yield substantially (Vergara, 1992).

PCARRD (1981) stated that planting the right varieties that are suited to the specific locations would result to increase yield by 20 %.

Varieties maybe location- specific in accordance to prevailing environmental conditions. This is exemplified by the release of three rice varieties in specific parts of the country. Two of these varieties, Matatag 3 and Matatag 6, were recommended for comercial planting in tungro hot spot areas in the Visayas and in Mindanao. The third variety, Angelica, was recommended specially for the irrigated lowlands in Agusan del Norte where it has been identified to perform well even under unfavorable conditions such as nutrient deficient soils and low solar radiation (PhilRice, 2004).

Belino (1999) stated that since exports contribute much in the country's economy, the government through Agricultural Universities and Colleges like Benguet State University, and others, encourage rice varietal testing and experimentation to determine what variety will give more yields and thus be recommended to farmers.

Evaluating six different varieties of rice at Cadtay, Kapangan, Benguet, Holano (2001) found PSB Rc 56 and PSB Rc 34 registering the highest yield.

PhilRice news (2001) stated that two enterprising farmers took the challenge to try hybrid rice in rice production to earn more income and contribute to rice self-sufficiency program of the government. With hybrid rice, they earned more than what they usually get from inbred rice production.

According to Kush and Masajo (1983) agronomic and morphological traits needed in improved rice varieties would vary according to the ecological condition and in which these are grown. Characters generally associated with high yielding potential and nitrogen responsiveness in irrigated lowland varietis are short and semi dwarf feature, lodging resistant, high tillering ability, non-spreading culms, and relatively short and erect leaves.

Kush (1990) enumerated some strategies in increasing the yield potential of irrigated rice including modification of its plant type, since the short statured plant type with high tillering and dark green leaves developed in the 1960's has reached a yield Plateau, exploiting heterosis and increasing yield stability by incorporation of multiple resistance to disease and insect pests and tolerance to abiotic factors. For developing rice varieties for unfavorable environment there is a need to define and characterize the major unfavorable rice ecologies and identify the varietal characteristics suitable for each ecology.

Soil and Water Requirement

A productive soil is the first essential for profitable farming. Soil vary in their capacity to produced crops. Continued and successful production of crops requires maintenance of high fertility level of the soil. The depth of topsoil may vary from 18 to 22 cm and the pH may range from 4.5 to 7.5, which is slightly acidic to neutral (Worthen, 1984).

Water requirement varies from the stage of plant. During seedling period, only thin layer of water to cover the seed is needed. During the vegetative period, water is increase 3-5 cm as the productive stage begins. The depth of water is from 10 to 15 cm because reproductive stage of the rice is sensitive to drought. During the ripening stage, the water should be gradually removed from the field until two weeks before harvesting UPLB (1983).

While rice plant is still growing, water stress must be avoided to prevent retards on the growth and reduced tillers. Large amount of unfilled grains is due to lack of water. Insufficient water results in wilting, thus reducing the capacity of the plant to produced and transport its food (PhilRice, 2001).

Fertilizer Requirement

IRRI (1986) noted that basal application of fertilizer combined with P and K helps early seedling vigor, stand establishment and rapid coverage of the field by rice foliage with consequent reduction in weed population. With availability of high yielding, early maturing varieties and prospects of adopting timely weed control, a level of 30 to 40 kg N and 15 to 20 kg of each of P_2O_5, and K_2O help early seedling vigor and consequent reduction of weed population.

Effect of Temperature

Temperature is the most important factor to consider in rice production. Rice can grow successfully in regions that have mean of 21^{o}C or above. Higher yield is obtained in warmer places, which may experience a low summer rainfall compared to the humid places (Martin and Leonard, 1970).

Within the critical low and high temperatures, temperature affects grain yield by affecting tillering, spikelet formation, and ripening. There is usually an optimum temperature for different physiological processes and these vary to some degree with variety. Therefore, the results of an experiment depend on the variety used and on whether the range of temperatures studied is above or below the optimum. Within a temperature range of 22°-31°C, the growth rate increases almost linearly with increasing temperatures (Yoshida, 1981).

Effect of Pest and Diseases

The major insect pests of rice in the Philippines are rice stem borer, leaf hopper, plant hopper, army worm and whorl maggots. Which cause 50 to 100 % reduction yield (UPLB, 1983).

Losses of rice yield due to pests and diseases are estimated at 10 % to 12 % respectively. Although the loss on any single field can be catastrophic, most disease control measures include planting resistant varieties and using remedial cultural practices.

However, new technique include the use of foliar fungicides are extremely effective (Encyclopedia Americana, 1980).

Ingram (1995) as cited by Agungan (2000) noted that diseases and insect problems are common in rainfed lowland rice. However, for successful production of both rice crops, rice cultivars which are planted should be resistant to insect and diseases like brown plant hoppers, stem borers and rice bugs which are the most common insect pests. Blast, bacterial blight and brown spot are the common diseases

Harvesting and Threshing

When 80 to 85 % of the grains at the upper portion of the panicle are yellow or straw colored, and those at the base are in the hard dough stage, it is time to harvest PhilRice (1993).

According to PCARRD (1993), ripened grains may drop from the panicle most specially under low temperature when harvesting is delayed. Delayed harvesting may also result to cracking and low milling recovery.

After harvesting, the crop is then ready for threshing (process of separating the grains from the rest of the plant). The farmers may thresh the grains by beating the panicles against a slatted bamboo screen, letting the grains fall between the slats. Some farmers put the bundles of rice through a gasoline-powered thresher. In some areas, farm animals walk over the bundles to thresh the grain (Teason, 1994).

PhilRice (1993) stated that sun drying is the most common post harvest practice of Filipino farmers. In solar drying, the cleaned *palay* is spread in a layer 2.4 cm thick on various surfaces such as straw mat, fish net, canvass, threshing floor or on the road. The *palay* is stirred to allow uniform drying.

MATERIALS AND METHODS

This experiment used seven different high rice yielding varieties which was assigned to individual treatments as follows:

CODE	VARIETIES	SOURCE
V_1	PSB Rc 14 (Rio grande)	BPI-NSQCS
V_2	PSB Rc 18 (Ala)	BPI-NSQCS
V_3	PSB Rc 82 (Peñaronda)	BPI-NSQCS
V_4	NSIC Rc 130 (Tubigan 3)	BPI-NSQCS
V_5	NSIC Rc 138 (Tubigan 5)	BPI-NSQCS
V_6	IR 64	BPI-NSQCS
V_7	PSB Rc 28 (Agno, check)	Bugayong

Seedbed and Land Preparation

Seven seedbeds, measuring 50cm x 100cm each was prepared for the seven different varieties. One variety was sown in each seedbed to avoid mixture. Necessary label was placed on each seedbed for proper identification.

An experimental area of 336 m^2 was prepared, and divided into 21 plots with a dimension of 1.6m x 10m each. Before transplanting, the land was prepared thoroughly. The soil was puddled and leveled for easy transplanting.

The land was irrigated after it has been prepared to hasten the decomposition of weeds. During the leveling and final harrowing, the required N-P-K fertilizer at the rate of 60-30-30 kg/ha was incorporated. Five days before panicle initiation urea was top-dressed at the rate of 30-0-0 kg NPK per hectare.

Lay-outing and Transplanting

After land preparation, the experimental plots were laid out and labeled accordingly. Seedlings were transplanted on the designated plot for each following the Randomized Complete Block Design (RCBD) in three replication. Each of the seven varieties was planted with two seedlings per hill on a straight row at a distance of 20cm x 20cm.

Weeds, Insect Pests and Disease Control

Hand weeding was done when necessary after transplanting. Insect pests and diseases was controlled and monitored to reduce economic losses. Other recommended cultural management practices was followed to ensure better yield.

The data to be gathered are the following:

1. Height of seedling before transplanting (cm). The height of rice seedlings was measured from the base to the longest leaf before transplanting using 10 sample hills per plot.

2. Number of days from transplanting to tillering. This was recorded when at least 50 % of the total plants started producing tillers.

3. Number of tillers at maximum tillering stage. The numbers of tillers when the flag leaf would have emerged were counted using 10 hills per plot.

4. Number of productive tillers per hill. The number of productive tillers were counted using 10 sample hills per plot selected at random. Only rice plants which produced panicles was counted and considered.

5. Number of days from transplanting to booting. This was taken when at least 50 % of the total plants in a plot have booted.

6. Number of days from booting to heading. This was taken when at least 50 % of the total plants have produced heads.

7. Number of days from transplanting to heading. This was recorded when at least 50 % of the grain in the panicle have ripened or turned yellow.

8. Number of days from heading to ripening. This was taken when at least 80 % of the grains in the panicle have ripened.

9. Final height at harvest (cm). This was measured from the soil surface to the tip of the longest panicle of rice plant taken at ripening stage.

10. Length of panicle at harvest (cm). This was measured from panicle base to panicle tip of the rice plants taken at harvest using 10 panicles per plot.

11. Number of grains per panicle. This was taken using 10 plants per plot selected at random.

12. Stemborer. Field rating for rice was based on actual percentage of dead hearts and white heads using the three middle rows of the plot as sampling area. Ten sample hills were selected at random where dead hearts were counted 35 and 45 days after transplanting, respectively, while white heads were counted, also using ten sample hills taken at random. The following standard scales used (PhilRice, 1996).

Stemborer

RATING INDEX	DESCRIPTION	%DEAD HEARTS	%WHITE HEADS
1	R	1-10	1-5
3	MR	11-20	6-10
5	I	21-30	11-15
7	MS	31-60	16-25
9	S	60 and above	25 and above

13. Blast (Neckrot). Evaluation on the severity of rice blast was taken from the plant at the center rows. Ten hills taken at random were used. The following standard was used (PhilRice, 1996).

INDEX	% BLAST	Rating
1	0-5 %	Resistant
2	6-25 %	Intermediate
3	25 and above	Susceptible

14. Total plant weight (kg). This was taken by weighing the whole plant including the grains after drying using 10 samples taken at random per treatment.

15. Harvest Index. This was taken by using the formula.

$$\text{Harvest Index} = \frac{\text{Economic yield}}{\text{Botanical yield}}$$

16. Yield per plot. After the harvest, the grains were dried to approximately 14 % moisture content. The filled grains were separated from the unfilled grains by winnowing. Only the filled grains were used to obtain the grain weight or yield per plot.

17. Yield per hectare. This was taken by converting the grains per plot

into hectare using ratio and proportion; where:

$$\text{Yield per hectare} = \frac{\text{Yield}}{1.6\text{m} \times 10\text{ m}} \times \frac{x}{10{,}000\text{ m}^2}$$

18. Cost and Return Analysis. All production cost were recorded and net profit Was obtained. Return on cash expenses were computed using the formula.

$$\text{Return On Cash Expense (ROCE)} = \frac{\text{Net Income}}{\text{Total Cost of Production}} \times 100$$

Data Analysis

All the quantitative data were analyzed using the analysis of variance (ANOVA) for Randomized Complete Block Design (RCBD). The significance of difference among the treatment means was tested using Duncan's Multiple Range Test (DMRT).

Figure 1. Overview of the area after cleaning and seed germination.

RESULTS AND DISCUSSION

Height of Seedling Before Transplanting

Comparative seedling height of seven varieties of rice before transplanting is shown in Table 1. It was observed that IR 64 was significantly taller than the check variety but not with the rest of the test varieties. The significant differences among treatments could be attributed to their varietal characteristics.

Table 1. Height of seedling before transplanting of seven rice varieties

VARIETY	HEIGHT OF SEEDLING (cm)
PSB Rc 14	24.95[ab]
PSB Rc 18	25.66[ab]
PSB Rc 82	26.24[ab]
NSIC Rc 130	25.81[ab]
NSIC Rc 138	27.02[ab]
IR 64	27.93[a]
PSB Rc 28 (check)	24.53[b]
C.V. (%)	6.53

*Means with the same letters are not significantly different at 0.05 level by DMRT

Number of Days from Transplanting to Tillering

Table 2 shows the number of days from transplanting to tillering. It was observed that NSIC Rc 138 produced tillers in 22 days which was 1-4 days earlier than the other varieties. It was followed by PSB Rc 14, PSB Rc 82 and NSIC Rc 130 in 23 days. Such significant result could be attributed to the adaptability of the four varieties to Bugayong, Binalonan Pangasinan condition.

The vegetative stage is characterized by active tillering, gradual increase in plant height, and leaf emergence at regular intervals. Active tillering refers to a stage when tillering rate – the increase in tiller number per unit of time – is high (Yoshida, 1981).

Table 2. Number of days from transplanting to tillering of seven rice varieties

VARIETY	DAYS TO TILLERING
PSB Rc 14	23[c]
PSB Rc 18	26[a]
PSB Rc 82	23[c]
NSIC Rc 130	23[c]
NSIC Rc 138	22[d]
IR 64	25[b]
PSB Rc 28 (check)	25[b]
C.V. (%)	0

*Means with the same letters are not significantly different at 0.05 level by DMRT

<u>Number of Tillers at Maximum Tillering Stage</u>

NSIC Rc 138 produced the highest number of tillers with a mean of 15.93 (Table 3). It was followed by IR 64 (15.70), PSB Rc 28 (check variety) (15.66) and NSIC Rc 130 (15.20). PSB Rc 14 and PSB Rc 18 recorded the lowest number of tillers with a mean of 12.93 and 12.66, respectively. These significant differences among treatments could be attributed to their varietal differences. IRRI (1992) stated that modern varieties have more tillers than old variety and varieties differ in tillering ability Spacing the plants far apart gives maximum tillering.

The higher tillering capacity of NSIC Rc 138, NSIC Rc 130, and IR 64 could be indicative of their higher yield potential compared to the other varieties.

Number of Productive Tillers per Hill

The number of productive tillers per hill show some significant differences among the varieties (Table 3). PSB Rc 14 produced greater number of productive tillers (9.33) than PSB Rc 18 which had the least number of productive tillers (7.03). No other marked differences among varieties were noted.

According to UPLB (1992), not all the tillers produce heads; some tillers die, others remain at the vegetative stage since there is competition among the tillers for nutrient and light. Thus, the production of tillers may not be a good gauge of the yield potential of rice.

Table 3. Number of tillers at maximum tillering stage and number of productive tillers per hill of seven rice varieties

VARIETY	NUMBER OF TILLERS AT MAXIMUM TILLERING STAGE	NUMBER OF PRODUCTIVE TILLERS PER HILL
PSB Rc 14	12.93[b]	9.33[a]
PSB Rc 18	12.66[b]	7.03[b]
PSB Rc 82	13.43[b]	7.26[ab]
NSIC Rc 130	15.20[a]	8.86[ab]
NSIC Rc 138	15.93[a]	8.36[ab]
IR 64	15.70[a]	8.16[ab]
PSB Rc 28 (check)	15.66[a]	7.96[ab]
C.V. (%)	6.34	12.52

*Means with the same letters are not significantly different at 0.05 level by DMRT

Number of Days from Transplanting to Booting

The average number of days from transplanting to booting is shown in Table 4. PSB Rc 82 was the earliest to boot in 51 days, which was 1-4 days earlier than the other varieties. It appears that PSB Rc 14, PSB Rc 18, IR 64 and PSB Rc 28 (check variety) are later maturing compared to the 3 other varieties. This is due to varietal characteristics.

Numbers of Days from Booting to Heading

Table 4 also shows the number of days from booting to heading. PSB Rc 82 was the earliest to produce head with a mean of 13 days from booting. It was followed closely by NSIC Rc 138 in 14 days, while PSB Rc 28 (check variety) was the latest to produce heads. The reaction of varieties from booting to heading may not always be due to genetic factors but also temperature – influenced. For example low temperature have been known to delay booting. Also, spikelet sterility appears to be affected by both night and day temperatures (Yoshida, 1981).

Number of Days from Transplanting to Heading

Table 4 shows the number of days from transplanting to heading. PSB Rc 82 was the earliest to produce heads with a mean of 74 days, which was 1-8 days earlier than the other varieties. Check variety PSB Rc 28 was the last to produce heads in 82 days after transplanting. Significant differences could be attributed to their varietal characteristics. It seems that variety PSB Rc 82 belonged to early maturing varieties which resulted to its early heading.

Table 4. Number of days from transplanting to booting, booting to heading and transplanting to heading of seven rice varieties

	NUMBER OF DAYS FROM		
VARIETY	TRANSPLANTING TO BOOTING	BOOTING TO HEADING	TRANSPLANTING TO HEADING
PSB Rc 14	55[a]	16[c]	75[d]
PSB Rc 18	55[a]	18[b]	80[b]
PSB Rc 82	51[c]	13[e]	74[e]
NSIC Rc 130	53[b]	18[b]	76[c]
NSIC Rc 138	53[b]	14[d]	75[d]
IR 64	55[a]	16[c]	75[d]
PSB Rc 28 (check)	55[a]	20[a]	82[a]
C.V. (%)	0	0	0

*Means with the same letters are not significantly different at 0.05 level by DMRT

Number of Days from Heading to Ripening

The number of days from heading to ripening is shown in Table 5. Highly significant differences were observed among the varieties in which PSB Rc 82 significantly ripened earlier in 11 days which was 1-6 days earlier than the rest. It was followed by variety PSB Rc 18 and PSB Rc 28 (check variety) with means of 12 days. Variety IR 64 was the latest to ripen in 17 days. Significant differences could be attributed to their varietal characteristic. This shows that different varieties differ in their performance and adaptability to the locality.

Final Height at Harvest

Plant height at harvest is shown in Table 5. It was observed that PSB Rc 18 was significantly taller than the other varieties with a mean of 69 cm followed by variety NSIC Rc 130 (63.06 cm), PSB Rc 82 (62.23 cm) and NSIC Rc 138 with a mean of 60. 53. The shortest among the varieties evaluated was PSB Rc 14 with a mean of 57.o3 cm. The difference is about 11.97 cm. Taller plant may have an increased ability to compete with weeds but it may also cause spacing problems. Yield reductions due to weeds decrease with increasing plant height (Yoshida, 1981).

Table 5. Number of days from heading to ripening and final height at harvest of seven rice varieties

VARIETY	NUMBER OF DAYS FROM HEADING TO RIPENING	FINAL HEIGHT AT HARVEST (cm)
PSB Rc 14	15[c]	57.03[b]
PSB Rc 18	12[d]	69.00[a]
PSB Rc 82	11[e]	62.23[b]
NSIC Rc 130	16[b]	63.06[b]
NSIC Rc 138	15[c]	60.53[b]
IR 64	17[a]	58.06[b]
PSB Rc 28 (check)	12[d]	58.90[b]
CV (%)	0	5.25

*Means with the same letters are not significantly different at 0.05 level by DMRT

Length of Panicle at Harvest

Table 6 shows the length of panicles of rice plants at harvest. Among the varieties evaluated, it was noted that PSB Rc 18 had the longest panicle (49.66 cm). It was followed by NSIC Rc 138 (46.41 cm). IR 64 had the shortest panicle with a mean of 41.75 cm. The difference between the highest and lowest panicle length at harvest is about 7.91 cm, a substantial length which could translate into more grains per panicle. The significant differences could be due to their genetic make up.

Number of Grains per Panicle

The number of grains per panicle is shown in Table 6. It was observed that NSIC Rc 138 gained the highest number of grains per panicle with a mean of 97.17. It was followed by NSIC Rc 130 with a mean of 96.20, PSB Rc 28 (check variety) with a mean of 92.13 and PSB Rc 14 (91.33). IR 64 had the lowest number of grains per panicle with a mean of 76.20. The difference between the number of grains per panicle is about 20.97. Such, significant differences are due to the compactness of grains in the panicle.

According to Yoshida (1981) the number of panicles per square meter is largely dependent on tillering performance, which is largely determined 10 days after the number of tillers at maximum tillering stage.

Table 6. Length of panicle at harvest and number of grains per panicle of seven rice varieties

VARIETY	LENGTH OF PANICLE AT HARVEST (cm)	NUMBER OF GRAINS PER PANICLE
PSB Rc 14	42.31[c]	91.33
PSB Rc 18	49.66[a]	89.50
PSB Rc 82	43.06[bc]	89.86
NSIC Rc 130	42.77[bc]	96.20
NSIC Rc 138	46.41[ab]	97.16
IR 64	41.75[c]	76.20
PSB Rc 28 (check)	42.47[bc]	92.13
C.V. (%)	4.69	5.87

*Means with the same letters are not significantly different at 0.05 level by DMRT

Reaction to Insect Pest

Evaluation of stemborer expressed as dead hearts and white heads was done before booting and heading, respectively. IR 64 was moderately field-resistant to dead heart. The rest of the variety treatment was found to be resistant. On white heads evaluation, PSB Rc 14, PSB Rc 28 (check variety) and IR 64 was rated moderately resistant. Other entries had high yielding potential resistance to insect pests.

Table 7. Reaction to insect pests of seven rice varieties

VARIETY	DEAD – HEARTS	DESCRIPTION	WHITE – HEADS	DESCRIPTION
PSB Rc 14	1	R	3	MR
PSB Rc 18	1	R	1	R
PSB Rc 82	1	R	1	R
NSIC Rc 130	1	R	1	R
NSIC Rc 138	1	R	1	R
IR 64	3	MR	3	MR
PSB Rc 28 (check)	1	R	3	MR
C.V. (%)	66.60		66.60	

R – Resistant; MR – Moderately Resistant; I – Intermediate; MS – Moderately Susceptible; S – Susceptible

<u>Rice Blast (Neck Rot)</u>

Rice blast disease evaluation was taken at harvest. It was observed that IR 64 was the only rated with intermediate resistance to rice blast. The rest of the entries were found to be resistant (Table 8).

Table 8. Rice Blast (neck rot) of seven rice varieties

VARIETY	BLAST (NECK ROT)	DESCRIPTION
PSB Rc 14	1	RESISTANT
PSB Rc 18	1	RESISTANT
PSB Rc 82	1	RESISTANT
NSIC Rc 130	1	RESISTANT
NSIC Rc 138	1	RESISTANT
IR 64	2	INTERMEDIATE
PSB Rc 28 (check)	1	RESISTANT
C.V. (%)	43.28	

*Means with the same letters are not significantly different at 0.05 level by DMR

Total Plant Weight

Table 9 shows that among the varieties evaluated NSIC Rc 138 had the highest total plant weight with a mean of 1.16 kg followed by NSIC Rc 130 with a mean of 1.06 kg and PSB Rc 28 (check variety) had the lowest total plant weight with a mean of 0.95 kg. Significant differences are due to the structure of each variety which include plant height, number of tillers, length of panicles, number of grains per panicle and leaf characteristics.

Harvest Index

Table 9 shows the harvest index of rice plant. PSB Rc 28, NSIC Rc 130, and IR 64 show the highest harvest index (0.46), followed by PSB Rc 14 and NSIC Rc 138 with a mean of 0.44 and the lowest were PSB Rc 82 and PSB Rc 18 with a mean of 0.43. Such numerical differences among the varieties are due to their varietal differences.

Table 9. Total plant weight and harvest index of seven rice varieties

VARIETY	TOTAL PLANT WEIGHT (cm)	HARVEST INDEX
PSB Rc 14	0.95	0.44
PSB Rc 18	0.99	0.43
PSB Rc 82	0.99	0.43
NSIC Rc 130	1.06	0.46
NSIC Rc 138	1.15	0.44
R 64	0.96	0.46
PSB Rc 28 (check)	0.95	0.46
C.V. (%)	10.36	20.80

*Means with the same letters are not significantly different at 0.05 level by DMRT

<u>Yield per Plot and per Hectare</u>

Grain yield per plot and per hectare is shown in Table 10 and Figure 2-5. No marked differences were observed although NSIC Rc 138, numerically had the highest mean yield of 3.31 kg/plot or 2.06 t/ha which is 0.460 kg higher than the check PSB Rc 28. It is interesting to note that NSIC Rc 138 are preferred by the farmers because it will also generate more income.

Table 10. Yield per plot and per hectare of seven rice varieties

VARIETY	YIELD PER PLOT ($kg/16m^2$)	YIELD PER HECTARE (ton/ha)
PSB Rc 14	2.94	1.84
PSB Rc 18	2.92	1.83
PSB Rc 82	2.60	1.63
NSIC Rc 130	3.14	1.96
NSIC Rc 138	3.31	2.06
IR 64	2.96	1.85
PSB Rc 28 (check)	2.56	1.60
C.V. (%)	22.23	22.23

*Means with the same letters are not significantly different at 0.05 level by DMRT

Cost and Return Analysis

The return on cash expenses (ROCE) of rice varieties is shown in Table 11. NSIC Rc 138 had the highest (69.53 %) ROCE while PSB Rc 28 (check variety) had the lowest ROCE (30.09%). All the varieties had a positive ROCE. These results indicate that the variety is used could be profitably grown in locations like Bugayong, Binalonan Pangasinan. It appears though that NSIC Rc 138 and NSIC Rc 130 are the best since both had a ROCE which was more than double that of the check variety.

Table 11. Cost and return analysis of rice production ROCE using seven varieties ($16m^2$)

VARIETIES	GRAIN YIELD PER PLOT ($kg/16m^2$)	GROSS INCOME (Php)	COST OF PRODUCTION (Php)	NET INCOME (Php)	ROCE
PSB Rc 14	2.95	73.75	48.81	24.94	51.09
PSB Rc 18	2.92	73.00	48.81	24.19	49.56
PSB Rc 82	2.60	65.00	48.81	16.19	33.17
NSIC Rc 130	3.14	78.50	48.81	29.69	60.83
NSIC Rc 138	3.31	82.75	48.81	33.94	69.53
IR 64	2.96	74.00	48.81	25.19	51.61
PSB Rc 28 (check)	2.54	63.50	48.81	14.69	30.09

Note: The selling price of rice grains is based on P 25.00/kilo.

Figure 2. Overview of PSB Rc 14 and PSB Rc 18.

Figure 3. Overview of PSB Rc 82 and NSIC Rc 130.

Figure 4. Overview of NSIC Rc 138 and IR 64.

Figure 5. Overview of PSB Rc 28 (check variety).

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

Seven varieties of rice were planted and evaluated in Bugayong, Binalonan Pangasinan from October 2007 to February 2008. The different varieties were: PSB Rc 14, PSB Rc 18, PSB Rc 82, NSIC Rc 130, NSIC Rc 138, IR 64 and PSB Rc 28 (check variety).

The study was conducted to test the performance of high yielding rice varieties in terms of its growth, grain yield and resistance to pests and diseases which among the varieties are best adapted in Bugayong, Binalonan Pangasinan.

Highly significant differences were observed among the varieties. NSIC Rc 138 produced tillers in 22 days, recorded the greatest number of productive tillers and gained the highest number of grains per panicle.

PSB Rc 82 was the earliest to mature, the earliest to reach booting period, the earliest to form heads and also the earliest to ripen at about 85 days after transplanting. PSB Rc 28 (check variety) was the latest to reach the booting and heading.

Significant differences in height were observed among the varieties. PSB Rc 18 was the tallest followed by NSIC Rc 130, PSB Rc 82 and PSB Rc 14 are the shortest. PSB Rc 18 had the longest length of panicle followed by NSIC Rc 138, while IR 64 was the shortest length of panicle.

NSIC Rc 138 obtained the highest grain yield for both per plot and per hectare (3.31 kg to 2.06 ton). While NSIC Rc 130 was the second (3.14 kg to 1.96 ton).

On the dead hearts evaluation, all varieties were resistant except IR 64 which was rated moderately resistant and on white heads evaluation, PSB Rc 14, PSB Rc 28 and IR

64 was rated moderately resistant. On blast evaluation, all varieties were resistant except IR 64 which was rated intermediate.

Conclusion

Result showed that initially, all the varieties performed well which indicate that they were adapted in the locality. Although PSB Rc 82 had greater number of productive tillers and earlier maturity it had relatively lower yield and return on cash expenses compared to the other test varieties. NSIC Rc 138 and NSIC Rc 130 showed good potential as they outyielded the check variety and were found resistant to insect pests and diseases. Both varieties exhibited the highest return on cash expenses (ROCE) with 69.5% and 60.83% respectively.

Recommendation

Based on the results of the study, NSIC Rc 138 and NSIC Rc 130 are recommended due to their relatively higher yield and return on cash expenses. They were also found to be resistant to stemborer and rice blast.

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APPENDICES

APPENDIX TABLE 1. Height of seedling before transplanting (cm)

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	23.81	25.29	25.76	74.86	24.95
PSB Rc 18	25.33	26.63	25.04	77.0	25.66
PSB Rc 82	26.87	26.36	25.49	78.72	26.24
NSIC Rc 130	23.38	28.31	25.74	77.43	25.81
NSIC Rc 138	26.23	27.04	27.79	81.06	27.02
IR 64	29.26	27.44	27.09	83.79	27.93
PSB Rc 28 (check)	20.69	25.58	27.34	73.61	24.54
TOTAL	175.57	186.65	184.25	546.47	26.021

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	TABULAR F 1%
Treatment	6	24.6104	4.1017	1.42^{ns}	3.00	4.82
Block	2	9.7080	4.8540			
Error	12	34.6070	2.8839			
TOTAL	20	68.9254				

CV = 6.53 %, ns – not significant

Standard Error = 0.9805

APENDIX TABLE 2. Number of days from transplanting to tillering

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	23	23	23	69	23
PSB Rc 18	26	26	26	78	26
PSB Rc 82	23	23	23	69	23
NSIC Rc 130	23	23	23	69	23
NSIC Rc 138	22	22	22	66	22
IR 64	25	25	25	75	25
PSB Rc 28 (check)	25	25	25	75	25
TOTAL	167	167	167	501	23.86

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 0.05%	0.01%
Treatment	6	38.5714	6.4286	α^{**}	3.00	4.82
Block	2	0				
Error	12	0				
TOTAL	20	38.5714				

CV = 0%, ** - highly significant

Standard Error = 0

APPENDIX TABLE 3. Number of tillers at maximum tillering stage

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	12.6	13.2	13.0	38.8	12.93
PSB Rc 18	13.0	12.9	12.1	38.0	12.67
PSB Rc 82	12.9	13.2	14.2	40.3	13.43
NSIC Rc 130	13.4	15.4	16.8	46.0	15.2
NSIC Rc 138	16.4	15.9	15.5	47.8	15.93
IR 64	15.0	14.9	17.2	47.1	15.7
PSB Rc 28 (check)	14.5	15.3	17.2	47.0	15.67
TOTAL	97.8	100.8	106	305	14.50

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	1%
Treatment	6	36.8962	6.1494	7.27**	3.00	4.82
Block	2	4.9181	2.4590			
Error	12	10.1552	1.0389			
TOTAL	20	51.9695				

CV = 6.34%, ** – highly significant

Standard Error = 0.5311

APPENDIX TABLE 4. Number of productive tillers per hill

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	8.1	10.3	9.6	28.0	9.3
PSB Rc 18	6.8	6.0	8.3	21.1	7.0
PSB Rc 82	6.9	7.1	7.8	21.8	7.27
NSIC Rc 130	7.0	8.8	10.8	26.6	8.87
NSIC Rc 138	8.7	6.7	9.7	25.1	8.37
IR 64	8.0	8.0	8.5	24.5	8.17
PSB Rc 28 (check)	6.8	9.1	8.0	23.9	7.97
TOTAL	52.3	56.0	62.7	171.0	8.136

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	1%
Treatment	6	12.0648	2.0108	1.94^{ns}	3.00	4.82
Block	2	7.9400	3.9700			
Error	12	12.4667	1.0389			
TOTAL	20	32.4714				

CV = 12.52 %, ns – not significant

Standard Error = 0.5885

APPENDIX TABLE 5. Number of days from transplanting to booting

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	55	55	55	165	55
PSB Rc 18	55	55	55	165	55
PSB Rc 82	51	51	51	153	51
NSIC Rc 130	53	53	53	159	53
NSIC Rc 138	53	53	53	159	53
IR 64	55	55	55	165	55
PSB Rc 28 (check)	55	55	55	165	55
TOTAL	377	377	377	1131	53.86

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	TABULAR F 1%
Treatment	6	44.5714	7.4286	α**	3.00	4.82
Block	2	0	0			
Error	12	0	0			
TOTAL	20	44.5714				

CV = 0%, ** - highly significant

Standard Error = 0

APPENDIX TABLE 6. Number of days from booting to heading

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	16	16	16	48	16
PSB Rc 18	18	18	18	54	18
PSB Rc 82	13	13	13	39	13
NSIC Rc 130	18	18	18	54	18
NSIC Rc 138	14	14	14	42	14
IR 64	16	16	16	48	16
PSB Rc 28 (check)	20	20	20	60	20
TOTAL	115	115	115	345	16.43

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	1%
Treatment	6	107.1429	17.8572	α**	3.00	4.82
Block	2	0	0			
Error	12	0	0			
TOTAL	20	107.1429				

CV = 0%, ** - highly significant

Standard Error = 0

APPENDIX TABLE 7. Number of days from transplanting to heading

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	75	75	75	225	75
PSB Rc 18	80	80	80	240	80
PSB Rc 82	74	74	74	222	74
NSIC Rc 130	76	76	76	228	76
NSIC Rc 138	75	75	75	225	75
IR 64	75	75	75	225	75
PSB Rc 28 (check)	82	82	82	246	82
TOTAL	537	537	537	1611	76.71

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	1%
Treatment	6	166.2857	27.7143	α**	3.00	4.82
Block	2	0	0			
Error	12	0	0			
TOTAL	20	166.2857				

CV = 0%, ** - highly significant

Standard Error = 0

APPENDIX TABLE 8. Number of days from heading to ripening

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	15	15	15	45	15
PSB Rc 18	12	12	12	36	12
PSB Rc 82	11	11	11	33	11
NSIC Rc 130	16	16	16	48	16
NSIC Rc 138	15	15	15	45	15
IR 64	17	17	17	51	17
PSB Rc 28 (check)	12	12	12	36	12
TOTAL	98	98	98	339	14

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	1%
Treatment	6	96.00	16.00	α**	3.00	4.82
Block	2	0	0			
Error	12	0	0			
TOTAL	20	96.00				

CV = 0%, ** - highly significant

Standard Error = 0

APPENDIX TABLE 9. Final height at harvest (cm)

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	57.5	56.2	57.4	171.1	57.03
PSB Rc 18	71.2	64.3	71.5	207.0	69.0
PSB Rc 82	69.0	62.0	55.7	186.7	62.23
NSIC Rc 130	62.0	63.0	64.2	189.2	63.1
NSIC Rc 138	62.0	60.1	59.5	181.6	60.53
IR 64	56.2	57.0	61.0	174.2	58.1
PSB Rc 28 (check)	59.0	58.3	59.4	176.7	58.9
TOTAL	436.9	420.9	428.7	1286.5	61.27

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	TABULAR F 1%
Treatment	6	294.8362	49.1394	4.75*	3.00	4.82
Block	2	18.2895	9.1448			
Error	12	124.1438	10.3453			
TOTAL	20	437.2695				

CV = 5.25%, * - significant

Standard Error = 1.8570

APPENDIX TABLE 10. Length of panicle at harvest (cm)

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	45.29	38.98	42.67	126.94	42.31
PSB Rc 18	51.18	48.12	49.7	149.0	49.67
PSB Rc 82	40.81	43.47	44.91	129.19	43.1
NSIC Rc 130	41.78	44.16	42.37	128.31	42.77
NSIC Rc 138	46.56	44.55	48.11	139.22	46.41
IR 64	44.73	39.85	40.69	125.27	41.76
PSB Rc 28 (check)	42.0	43.62	41.81	127.48	42.49
TOTAL	312.35	302.75	310.26	925.41	44.1

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	1%
Treatment	6	151.3859	25.2310	5.91**	3.00	4.82
Block	2	7.2823	3.6411			
Error	12	51.1901	4.2658			
TOTAL	20	209.8583				

CV = 4.69, * - significant

Standard Error = 1.1925

APPENDIX TABLE 11. Number of grains per panicle

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	95.9	93.2	84.9	273.9	91.3
PSB Rc 18	87.7	94.7	86.1	268.5	89.5
PSB Rc 82	94.3	88.9	86.4	269.6	89.87
NSIC Rc 130	102.1	95.9	90.6	288.6	96.2
NSIC Rc 138	90.6	100.5	100.4	291.5	97.2
IR 64	81.4	67.8	79.4	228.6	76.2
PSB Rc 28 (check)	92.7	94.7	89.0	276.4	92.13
TOTAL	644.7	635.8	616.8	1897.1	90.343

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	TABULAR F 1%
Treatment	6	858.0448	143.0075	5.08**	3.00	4.82
Block	2	57.9343	28.9671			
Error	12	337.7524	28.1460			
TOTAL	20	1253.7314				

CV = 5.87%, ** - highly significant

Standard Error = 3.0630

APPENDIX TABLE 12a. Pest evaluation. Stemborer (Dead hearts)

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	1	2	1	4	1.33
PSB Rc 18	1	1	2	4	1.33
PSB Rc 82	1	3	1	5	1.66
NSIC Rc 130	2	1	1	4	1.33
NSIC Rc 138	1	1	1	3	1.0
IR 64	5	2	1	8	2.66
PSB Rc 28 (check)	1	2	2	5	1.66
TOTAL	12	12	9	33	1.57

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	1%
Block	6	5.1429	0.8571	0.78^{ns}	3.00	4.82
Treatment	2	0.8571	0.4286			
Error	12	13.1429	1.0952			
TOTAL	20	19.1429				

CV = 66.60%, ns = not significant

Standard Error = 0.6042

APPENDIX TABLE 12b Stemborer. (White heads)

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	2	3	3	8	2.66
PSB Rc 18	2	1	1	4	1.33
PSB Rc 82	2	2	1	5	1.66
NSIC Rc 130	1	2	1	4	1.33
NSIC Rc 138	1	1	2	4	1.33
IR 64	1	2	3	6	2.0
PSB Rc 28 (check)	2	2	2	6	2.0
TOTAL	11	13	13	37	1.76

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	1%
Treatment	6	4.4762	0.7460	1.81^{ns}	3.00	4.82
Block	2	0.3810	0.1905			
Error	12	4.9524	0.4127			
TOTAL	20	9.8095				

CV = 36.46%, ns – not significant

Standard Error = 0.3709

APPENDIX TABLE 13. Disease evaluation. Blast (Neckrot)

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	2	1	1	4	1.33
PSB Rc 18	1	1	2	4	1.33
PSB Rc 82	1	2	1	4	1.33
NSIC Rc 130	1	1	1	3	1.0
NSIC Rc 138	1	1	1	3	1.0
IR 64	3	1	2	6	2.0
PSB Rc 28 (check)	2	2	1	5	1.66
TOTAL	11	9	9	29	1.38

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	1%
Treatment	6	2.2857	0.3810	1.07^{ns}	3.00	4.82
Block	2	0.3810	0.1905			
Error	12	4.2857	0.3571			
TOTAL	20	6.9524				

CV = 43.28%, ns – not significant

Standard Error = 0.3450

APPENDIX TABLE 14. Total plant weight (kg)

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	0.84	1.05	0.98	2.87	0.96
PSB Rc 18	0.85	1.03	1.09	2.97	0.99
PSB Rc 82	1.01	1.01	0.95	2.97	0.99
NSIC Rc 130	1.03	1.03	1.14	3.2	1.10
NSIC Rc 138	1.23	1.12	1.12	3.47	1.17
IR 64	1.11	0.85	0.93	2.89	0.96
PSB Rc 28 (check)	0.92	0.84	1.10	2.86	0.95
TOTAL	6.99	6.93	7.31	21.23	1.02

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	1%
Treatment	6	0.1012	0.0169	1.54^{ns}	3.00	4.82
Block	2	0.0119	0.0060			
Error	12	0.1316	0.0110			
TOTAL	20	0.2448				

CV = 10.36%, ns – not significant

Standard Error = 0.0605

APPENDIX TABLE 15. Harvest Index

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	0.51	0.34	0.49	1.34	0.45
PSB Rc 18	0.60	0.41	0.30	1.31	0.44
PSB Rc 82	0.39	0.60	0.32	1.31	0.44
NSIC Rc 130	0.45	0.51	0.44	1.40	0.47
NSIC Rc 138	0.41	0.49	0.42	1.32	0.44
IR 64	0.490.	0.48	0.41	1.38	0.46
PSB Rc 28 (check)	0.40	0.51	0.49	1.40	0.47
TOTAL	3.25	3.34	2.87	9.16	0.453

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	TABULAR F 1%
Treatment	6	0.0034	0.0006	0.06^{ns}	3.00	4.82
Block	2	0.0178	0.0089			
Error	12	0.1054	0.0088			
TOTAL	20	0.1265				

CV = 20.80%, ns = not significant

Standard Error = 0.0541

APPENDIX TABLE 16. Yield per plot (kg)

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	3.14	2.6	3.1	8.84	2.95
PSB Rc 18	3.7	2.9	2.17	8.77	2.92
PSB Rc 82	2.10	3.7	2.0	7.8	2.6
NSIC Rc 130	3.14	3.15	3.12	9.41	3.14
NSIC Rc 138	3.3	3.5	3.12	9.92	3.31
IR 64	3.8	2.6	2.5	8.9	2.96
PSB Rc 28 (check)	2.17	2.13	3.4	7.7	2.56
TOTAL	21.35	20.58	16.29	61.34	2.92

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	1%
Treatment	6	1.2798	0.2133	0.51^{ns}	3.00	4.82
Block	2	0.2726	0.1363			
Error	12	5.0616	0.4218			
TOTAL	20	6.6140				

CV = 22.23%, ns - not significant

Standard Error = 0.3750

APPENDIX TABLE 17. Yield per hectare (ton)

VARIETIES	REPLICATION I	II	III	TOTAL	MEAN
PSB Rc 14	1.96	1.63	1.94	5.53	1.84
PSB Rc 18	2.31	1.81	1.36	5.48	1.83
PSB Rc 82	1.31	2.31	1.25	4.88	1.63
NSIC Rc 130	1.96	1.97	1.95	5.88	1.96
NSIC Rc 138	2.06	2.19	1.95	6.20	2.06
IR 64	2.38	1.63	1.56	5.56	1.85
PSB Rc 28 (check)	1.36	1.33	2.13	4.81	1.60
TOTAL	13.34	12.86	12.13	38.34	18.25

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN OF SQUARE	OBSERVED F	TABULAR F 5%	1%
Treatment	6	0.3705	0.0618	0.38^{ns}	3.00	4.82
Block	2	0.0272	0.0136			
Error	12	1.9650	0.1637			
TOTAL	20	2.9650				

CV = 21.83%, ns – not significant

Standard Error = 0.2336