BIBLIOGRAPHY

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ABSTRACT

The study aimed to evaluate and compare fifteen entries of rice in terms of growth and gain yields, and resistance to insect pest (stemborer) and disease (neck rot blast) and determine which are suited to the conditions of BSU, La Trinidad, Benguet.

The different entries were: PSB Rc rice, IR rice and Pinidua selection.

Results showed that PR 34131-B-2-1 (5605.10 kg/ha) performed the best under BSU, La Trinidad condition in terms of plant height, grain yields, panicle exertion, spikelet fertility and resistance to insect pests (stem borer) and diseases (neck rot blast) and lodging.

PR 27137-CR 153 (4513.90 kg/ha) and PR34110-B-3-1 (4017.90 kg/ha) can be alternative to PR 34131-B-2-1 having obtained comparable grain yields and the other agronomic characteristics.

PR 34131-B-2-1, PR 27137-CR 153 and PR-34110-B-3-1, therefore are highly recommended under BSU, La Trinidad condition.

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INTRODUCTION

Rice (*Oryza sativa L.*) belongs to the family *Graminae*, which is an annual crop. Genus *Oryza* can adapt to a wide range of ecological diversity from rain fed-dry land to deep water flooded conditions. This crop is able to transport oxygen to the submerged roots from leaves where oxygen is released thru photosynthesis (Catling, 1992).

Rice is the main cereal crop of the Filipino and a staple food of more than 80% of the population, not only Philippines but in other Asian countries. Rice grains contain protein, fats, carbohydrates and sufficient amount of vitamins. Aside from this, it is a good source of flour; rice straw is also useful as a feed for animals, can be a culture bed for mushrooms and as a fertilizer to maintain soil condition (UPLB, 1982).

Shortage of food supply is a major problem today because of continuous increase in population while the production area is decreasing. In order to feed the population, there should be remedies for farmers to increase yield as well as to increase income. Selection and evaluation of high yielding varieties that have good eating quality, short maturity, resistant to pest and diseases, good adaptability and resistant to drought and flooding should be a continuing process.

This study was conducted to evaluate and compare the best promising rice entries in terms of growth, grain yields and resistance to insect pest (stemborer) and disease (neck rot blast) and determine which entries are best suited under BSU, La Trinidad condition.

This study was conducted at the Benguet State University (BSU) Experimental Farm, Cabanao, La Trinidad, Benguet from June 2005 to December 2005.

REVIEW OF LITERATURE

Varietal Evaluation

A varietal evaluation on high yielding varieties of rice was conducted at Tagudtod, Bagulin, La Union during the 1996 rainy season. Result show that PSB Rc 34 gave the highest number of tillers at maximum tillering stage and productive tillers. This variety gave the highest yield and had a soft grain when cooked while PSB Rc 28 gave the lowest yield (Itong, 1997).

A varietal trial conducted by Belino (2005) at Poblacion, Kibungan, Benguet condition showed that SN – 73 obtained a mean yield of 3 t/ha, while Balinsanga and PSB Rc 18 had 2.5 t/ha, respectively.

In the evaluation of eight varieties of rice in Bilis, Burgos, La Union, result showed that PSB Rc 96 had both the highest number of productive tillers and highest number of grains per panicle, hence had the highest grain per plot and per hectare, followed by PSB Rc 44 (Batani, 2004).

NCT rice was tested at Baoy, Poblacion, Bakun, Benguet from December 1998 to July 1999. Among the four varieties of National Cooperative Test rice tested, SN – 73 produced high yield followed by NCT 6, NCT 5 and PJ-2 had the lowest grain yield (Berry, 1999).

Amonte (1999) evaluated high yielding varieties of rice at Masla, Mountain Province. The result showed that NCT 5 out yielded the other varieties due to its high harvest index and yield. However, Gohang performed better in terms of the number of productive tillers, length of maturity, plant height, number of grain and filled grain per panicle and total plant weight.

Different high yielding varieties of rice were evaluated at Der-an, San Mateo, Isabela. PSB Rc 10 performed best in terms of yield, number of grams per panicle and number of productive tillers (Tegui-in, 1997).

Malondon (1997) reported that nine NCT entries were tested under BSU condition. Among the entries tested, NCT – 8 performed the best and produced the highest mean yield of 1.98 t/ha.

Under Cadtay, Kapangan, Benguet condition, Holanio (2001) found that PSB Rc 56 was the earliest to produced tillers, to produce heads and earliest to mature together with PSB Rc 34, while Bayabas (check variety) had the least tillers.

According to Balaso (1998), among the six different high yielding varieties of rice evaluated at Ekip, Bokod, Benguet. SN – 73 obtained the highest yield per plot. It was also resistant to whorl maggot infestation while Bungabong was moderately susceptible.

Among the high yielding varieties of rice tested and evaluated at Kayapa, Nueva, Viscaya condition, PSB Rc 58 and PSB Rc 54 were the first to recover at 10 days while PR 27137-CR 153 (SN-73) and PSB Rc 46 (Sumadel) were the latest with 13 days from the time transplanting (Eliseo, 2001).

Five cultivars were tested in Antadao, Sagada, Mountain Province. As to the result, *Monay* was the tallest with a mean height of 130.87 cm. while Kor-J was the shortest with the length of 52.33 cm. *Monay* variety had the longest panicle, 34.14 cm, and more resistant to rice and likewise had the highest yield (Salbino, 1997).

Chagwasi (1996) stated that the rate of recovery did not differ among the varieties evaluated at tillering stage. It was also observed that all the varieties produced tillers 25 days after transplanting. PSB Rc 10 produced the highest number of tillers followed by SM and IR-60. In terms of yield, PSB Rc 18 produced the highest yield.

An evaluation conducted at Nalbuan, Baay- Licuan, Abra by Valera (2003), showed that PSB Rc 46 had the highest number of productive tillers, longest length of panicle and had the highest grain yield. Hybrid-mestiso had the highest weight of 1,000 filed grains and its yield is comparable to inbreed PSB Rc 46.

Another variety trial of high yielding varieties of rice was conducted in Tubo, Abra. PSB Rc 74 was the first to ripen, had the longest panicle and had the highest number of filled grains per panicle (Mateo, 2000).

Seven varieties of rice were evaluated at Kadayakan, Maria Aurora. Results showed that NSIC Rc 110 was the earliest to mature and had the tallest plants among the deferent varieties. However this NSIC 110 did not obtain the highest yield (Siteng, 2005).

Cayomba (2004) found out that PSB Rc 60 was resistant to lodging and stem borer but not suited or adaptable as shown by their few number of grains per panicle and low production per hectare under Manubo, Abra conditions.

Space and Depth of Planting

PhilRice (1992) reported that the rice spacing should be 20cm x 20 cm and 15cm x 20 cm, depending on the variety to be planted, soil fertility and the season of planting. However, too far spacing, lessen the plant population needed to produce maximum yield. Transplant two or three seedlings per hill at a depth of two to three centimeters during the wet season.

Effect of Pest and Diseases

In the Philippines, the diseases that causes serious damage to rice crop includes rice blast, bacterial blight, rugged stunt and smut. The most important insect pest is the brown plant hopper, leafhoppers and stemborer. Several outbreaks of the fungal disease,

rugged stunt, rice blast, and brown plant hopper have occurred in recent years. Sheath blight had also become a major disease problem, particularly for rice in the upland areas (UPLB, 1983) as cited by Belino (2005).

Rice blast is the most important fungal disease of rice. It inflicts as much as 50% loss in areas where severe outbreaks occur. This disease produces spots on the lesions on leaves, nodes, and parts of the panicle and grains. Infected nodes turn black and break easily. However, rice blast is controlled by planting resistant varieties integrated with some cultural management procedures which include: raising seedlings in wetland condition avoid excess nitrogen fertilization and split applications of fertilizers containing nitrogen (UPLB, 1982).

Harvesting and Threshing

PhilRice (1993) as cited by Agungan (2000) started that when 80-85% of the grains at the upper portion of the panicle are yellow or straw colored, and those at the base are at the hard dough stage it is time to harvest.

In order to produce maximum yield of high milling quality, rice should be harvested when moisture content of the grains of standing rice has dropped to 18-27%. At that moisture, the grains in the lower heads are in the hard dough stage, while those in the upper portion of the head are ripe (Martin and Leonard, 1975).

PhilRice (1993) cited that after harvesting, the rice is threshed immediately. Threshing can be done manually or mechanically. The manual methods are threshing by feet, frail threshing and beating against tubs; another is the "*Hampasan Method*" in which harvested rice is beaten against a solid object.

PCARRD (1981) proposed that to reach the maximum rice yield with high milling quality, rice grains are to be harvested 30 days after flowering or when at least, 80-95%

of the grains of the middle portions of the panicle turn yellow.

Soil and Water Requirement

Soil that have clay content of 40-60%; a 2:1 type clay mineral, a medium organic content that have degree of humification but not extensive drainage is good for rice. The depth topsoil may vary from 18-22 cm (UPLB, 1960) as cited by Chagwasi (1996).

Irrigation will be done three days after transplanting at a depth of 2-3 cm if wet bed seedlings and 1 cm. for "dapog" seedlings. At the initial stage of the vegetative phase, water is increased from 3-10 cm. As the reproductive stage begins, the depth of 5-10 cm. is maintained. Severe water stress causes high percentage of sterility, thereby reducing grain yield (IRRI, 1986) as stated by Belino (2005).

Fertilizer Requirement

Navora (1997) concluded that application of 100% pure inorganic fertilizer would give more income than fertilizer application. However, in terms of soil improvement and conservation, organic fertilizer is still advisable to decrease acidity as cited by Agungan (2000).

Sung-ag (1997) as cited by Agungan (2000) stated that the use of chicken manure, pig manure and cow manure as source of organic fertilizer in HYV rice can be an effective and efficient substitute with chemical fertilizers. Among these, chicken manure was the best which favored growth and development of HYV rice resulting to increased yields and has the highest return.

Effects of Temperature/ Moisture

Low temperature often causes low rice yields. An examination of rainfall patterns of some upland rice growing areas using 200 mm/ month as the baseline, it appears that

varieties that mature in less than 100 days would be desirable for the unimodal pattern. It was found out in Bukidnon, Philippines that the rainfall pattern is also unimodal but duration is longer and varieties that mature in 100-150 days should perform well (De Datta, 1981).

Furthermore, he mentioned that temperature regime greatly influences not only the growth durations but also the growth pattern of the rice plant. During the growing seasons, the mean temperature, and the temperature sum, range distribution patterns, and diurnal changes, and a combination of these, may be highly correlated with grain yields.

MATERIALS AND METHODS

Aside from the two Philippine Seed Board (PSB) varieties serving as a check, the research used thirteen (13) different National Cooperative Test (NCT) entries of rice which were assigned as treatments:

ENTRY	RACE
PSB Rc 96 (check)	Indica
PSB Rc 46 (check)	Indica
IR 72509 – B-44-3-1-1	Indica
IR 72509- B- 55-3-3-1	Indica
IR 72507-B-16-1-1-2	Indica
PR 30756-2-2	Indica
PR 28703-2B-2	Japonica
PR 28669-2B-7	Japonica
Pinidua Selection	Tropical Japonica
PR 26383- 4B-1-1-20-5-3-2-1	Japonica
PR 29814-B-5-3-1-1	Japonica
PR 27981- M-1-1-3	Japonica
PR 34110-B-3-1	Japonica
PR 27137-CR 153 (SN-73)	Japonica
PR 34131- B-2-1	Japonica

The entries PSB Rc 96 and PSB Rc 46 (Philippine Seed Board Rice) are check varieties. *Pinidua* selection is an entry which was selected twice by breeders at PhilRice. All entries were acquired from PhilRice.

Indica varieties are short or dwarf while Japonica varieties are tall.

Seed Bed and Land Preparation

Fifteen seedbeds were prepared for the fifteen different entries. One entry was sown in each seedbed measuring 1m x 1m for each entry to avoid mixtures of the different entries with necessary label placed for proper identification.

An experimental area of 432.0 square meters was prepared for the fifteen different entries which were replicated three times. Each plot measures 1.6m x 6 m.

Before transplanting, the area 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 60-30-30kg/ha was incorporated. Five days before panicle initiation urea was top-dressed at the rate of 30-0-0 kg NPK per hectare.

Layout and Transplanting

After land preparation, the experimental plots were laid-out and labelled accordingly. Seedlings were planted in the designated plots for each entry following the Randomized complete Block Design (RCBD).

Each of the fifteen entries was planted at two seedlings per hill in a straight row spaced at 20 cm x 20 cm between hills and rows.

Weeds, Insect Pests and Disease Control

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

The data gathered were:

A. Agronomic Characteristics

All ratings used were the rating scale by PhilRice (1996).

1. Seedling color. This was observed before the seedlings were transplanted using this following scale:

SCALE	DESCRIPTION (Seedlings)
1	Dark Green
3	Light Green
5	Yellow
7	Brown
9	Dead

2. Seedling vigor. This was taken before transplanting using the following scale:

SCALE	DESCRIPTION	REMARKS
1	Majority of the seedlings have 5 or more leaves with 2-3 tillers.	Very Vigorous
3	Majority of the seedlings have 1-5 leaves with 1-2 tillers	Vigorous
5	Most of the seedlings have 4 leaves without tiller	Normal
7	Most of the seedlings have 3-4 leaves without tiller	Weak
9	Most of the seedlings turned yellow and thin	Very Weak

3. Days from transplanting to heading. This was taken when 50% of the plants produced heads as observed.

4. Productive tillers. The productive tillers produced was taken from ten random sample hills per treatment a week before harvest. Only those that produced panicles were

counted and considered.

5. Panicle length (cm). This was measured from the panicle base to the tip of the panicle excluding the awn using 10 sample panicles taken at random at harvest.

6. Final plant height (cm). The final height of the plant was measured from the soil surface to the tip of the tallest panicle excluding the awn.

7. Panicle exertion. This was taken using this scale as follows:

SCALE	DESCRIPTION	REMARKS
1	Panicles are well exerted	well exerted
3	Panicles are moderately exerted	moderately exerted
5	Panicles are just exerted	Just exerted
7	Panicles are partly exerted	Partly exerted
9	Panicles are enclosed	Enclosed

8. Panicle threshability. This was recorded during harvest using the following scale:

SCALE	DESCRIPTION	REMARKS
1	Grains are difficult to thresh (less then 1%)	Difficult
3	Grains are moderately difficult to thresh (1-5%)	Moderately difficult
5	Grains are less difficult to thresh (6-25%)	Intermediate
7	Grains are easily thresh (26-50%)	Loose
9	Grains are very easy to thresh (51- 100 %)	Easy

9. Spikelet fertility. Spikelet fertility was taken using the following scale. Ten panicles taken at random were examined as follows:

SCALE	DESCRIPTION	REMARKS
1	More than 80 % of the grains in a panicle are fertile	Highly fertile
3	More than 61-80% of the grains in a panicle are fertile	Moderately fertile
5	More than 41- 60 % of the grains in a panicle are fertile	Intermediate
7	More than 11- 40% of the grains in a panicle are fertile	Moderately Unfertile
9	Les than 11% of the gains in a panicle are fertile	Unfertile

10. Lodging resistance. Lodging incidence was recorded at two weeks after heading and at maturity using the following scale:

SCALE	DESCRIPTION	REMARKS
1	All plants are erect	Resistant
3	Plants are leaning at an angle of 70^0, about 70 % of the population are affected	Moderately resistant
5	Plants are leaning at an angle of 45^0, more than 50% of the population are affected	Intermediate
7	Plants are leaning at an angle 30^0 , more than 50% of the population are affected	Moderately susceptible
9	All plants are fallen on the ground	Susceptible

11. Blast resistance (neck rot). Evaluation of the severity of rice blast was taken from the plant at the center rows at hills 4-21. Ten sample hills were taken at random.

Computation on percent infection was done using the formula (PhilRice, 1996).

$$\% \text{ Infection} = \frac{\text{No. of panicle Infected}}{\text{Total number of Panicles}} \times 100$$

SCALE INDEX	DESCRIPTION	RATING
1	0-5% are affected by blast	Resistant
2	6-25% are affected by blast	Intermediate
3	26% and above are affected by blast	Susceptible

12. Stemborer damage evaluation (white heads). Field rating was based on actual number of panicles affected using the three middle rows of the plot as sampling area. Ten sample hills were selected at random where white heads were counted ten days before harvest. The following standard scale was used:

SCALE	DESCRIPTION	RATING
1	1-5 White heads/10 sample hills	R
3	6-10 White heads/10 sample hills	MR
5	11-15 White heads/10 sample hills	I
7	16-25 White heads/10 sample hills	MS
9	25 and above	S

Where:

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

B. Yield

1. Yield per plot (6.72 sq.m) (kg). Grain yield per plot was taken after threshing and drying at 14% moisture content (MC) then weighed.

2. Computed yield per hectare (kg). This was taken by converting grain yield per treatment into yield per hectare using ratio and proportion.

$$\text{Yield/ ha} = \frac{\text{Yield per plot (kg)}}{\text{6.72 sq m}} \times \frac{\text{x}}{\text{10,000 sq m}}$$

3. Weight of 1,000 filled grain (kg). One thousand seeds selected at random after free drying at about 14% moisture content were counted then weighed.

4. Yield per plant (kg). Yield of 4 hills after 5 days continuous sun drying. Plants were cut from the soil surface then dried after which the whole plant shall be weighed, grains and straw.

C. Meteorological data. The temperature, relative humidity (RH), total bright sunshine and rainfall during the conduct of the study were obtained from BSU-PAG-ASA Office based at BSU, La Trinidad, Benguet. The elevation of BSU, La Trinidad was also obtained.

RESULTS AND DISCUSSION

Seedling Color

Seedlings were observed before transplanting. It is shown in Table 1 that most of the entries were dark green in color except PSB Rc 46 and PR 2703-2B-2 that were light green in color.

Seedling Vigor

Table 1 shows the seedling vigor. It was observed that PSB Rc 96, IR 72509-B-44-3-1-1 and IR 72507-B-16-1-1-2 were vigorous as compared with the other entries. On the other hand PSB Rc 46, PR 34131-B-2-1 and PR 34110-B-3-1 were rated weak.

Table 1. Seedling color and seedling vigor of the different promising rice entries

ENTRY	COLOR	VIGOR
PSB Rc 96 (check)	Dark green	Vigorous
P 46(check)	Light green	Weak
IR 72509 – B-44-3-1-1	Dark green	Vigorous
IR 72509-B-55-3-3-1	Dark green	Vigorous
IR 72507-B-16-1-1-2	Dark green	Normal
PR 30756-2-2	Dark green	Normal
PR 28703-2B-2	Light green	Normal
PR 8669-2B-7	Dark green	Normal
Pinidua Selection	Dark green	Normal
PR 26383-4B-1-1-20-5-3-2-1	Dark green	Normal
PR 29814-B-5-3-1-1	Dark green	Normal
PR 27981-M-1-1-3	Dark green	Normal
PR 34110-B-3-1	Dark green	Weak
PR 27137-CR 153 (SN-73)	Dark green	Normal
PR 34131-B-2-1	Dark green	Weak

Days from Transplanting to Heading

Days from transplanting to heading of rice is shown in Table 3. Among the promising entries, PR 30756-2-2 significantly produced heads earlier than the other entries including the two check entries with a mean of 62 days. PR 30756-2-2 could be classified as an early maturing variety which resulted to its early heading.

Table 2. Days from transplanting to heading and productive tillers of the different promising rice entries

ENTRY	DAYS	PRODUCTIVE TILLERS
PSB Rc 96 (check)	77^{c}	21^{a}
PSB Rc 46 (check)	88^{h}	13^{cde}
IR 72509 – B-44-3-1-1	79^{d}	15^{bed}
IR 72509-B-55-3-3-1	85^{g}	21^{a}
IR 72507-B-16-1-1-2	82^{f}	13^{cde}
PR 30756-2-2	62^{a}	6^{g}
PR 28703-2B-2	70^{b}	8^{fg}
PR 8669-2B-7	82^{f}	17^{b}
Pinidua Selection	70^{b}	12de
PR 26383-4B-1-1-20-5-3-2-1	80^{e}	13^{cde}
PR 29814-B-5-3-1-1	77^{c}	14^{cd}
PR 27981-M-1-1-3	93^{i}	10^{ef}
PR 34110-B-3-1	88^{h}	12^{dc}
PR 27137-CR 153 (SN-73)	82^{f}	14^{cd}
PR 34131-B-2-1	82^{f}	16^{bc}
CV (%)	1.16	12.03

Means with common letters are not significantly different at 5% level of significance using DMRT

Productive Tillers Per Hill

Table 2 shows the productive tillers per hill. Among the treatments, PSB Rc 96 and IR 72509-B-55-3-3-1 recorded the highest number of productive tillers per hill with the same mean of 21, while PR 30756-2-2 recorded the least number of productive tillers per hill with a mean of 6. Such significant differences among entries could be attributed to their varietal characteristics.

Panicle Length

The length of panicle at harvest is shown in Table 3. Among the promising entries evaluated, PR 2798-M-1-1-3, with a mean of 26.00 cm significantly had the longest panicle among the promising rice entries including the two checks. PR 8669-2B-7 had the shortest panicle with the mean of 17.60 cm. Such differences could be attributed by their varietal characteristics.

Final Plant Height

Final plant height at harvest is shown in Table 3. Analysis shows that PR34110-B-3-1 was significantly taller than the other promising entries including the two checks with a mean of 112.70 cm. The shortest among the entries evaluated was IR 72507-B-16-1-1-2 with a mean of 67.80 cm. Significant difference in height could be due to their varietal characteristics.

Table 3. Panicle length and final height of the different promising rice entries

ENTRY	PANICLE LENGHT (cm)	PLANT HEIGHT (cm)
PSB Rc 96 (check)	22.00^{bc}	85.20^{e}
PSB Rc 46 (check)	20.50^{cde}	87.80^{de}
IR 72509 – B-44-3-1-1	20.60^{cde}	74.80^{f}
IR 72509-B-55-3-3-1	19.50^{def}	68.80^{g}
IR 72507-B-16-1-1-2	19.50^{def}	67.80^{g}
PR 30756-2-2	18.20^{f}	85.10^{e}
PR 28703-2B-2	19.60^{def}	100.90^{b}
PR 8669-2B-7	17.60^{f}	110.60^{a}
Pinidua Selection	21.40^{bed}	101.90^{b}
PR 26383-4B-1-1-20-5-3-2-1	22.00^{bc}	76.30^{f}
PR 29814-B-5-3-1-1	23.00^{b}	107.50^{a}
PR 27981-M-1-1-3	26.00^{a}	92.10^{cd}
PR 34110-B-3-1	20.80^{cde}	112.70^{a}
PR 27137-CR 153 (SN-73)	18.80^{ef}	93.90^{c}
PR 34131-B-2-1	20.90^{cde}	108.70^{a}
CV (%)	5.83	3.24

Means with common letters are not significantly at 5% level of significance using DMRT

Panicle Exertion

Table 4 shows the panicle of the different entries. It was observed that PR 27137-CR153 (SN-73) and PR 34131-B-2-1 were well exerted. On the other hand PSB Rc 46, IR 72509-B-44-3-1-1, IR 72509-B-55-3-3-1, IR 72507-B-16-1-1-2 and PR 26383-4B-1-1-20-5-3-2-1 were enclosed. Panicle exertion characteristics may have differences on the number of grains in a panicle and important in harvesting most especially on manual harvesting that well exerted is recommendable for those practicing “ani” system in harvesting. Differences could be attributed to their varietal characteristics.

Table 4. Panicle exertion of the different promising rice entries

ENTRY	PANICLE EXERTION
PSB Rc 96 (check)	Partly exerted
PSB Rc 46 (check)	Enclosed
IR 72509 – B-44-3-1-1	Enclosed
IR 72509-B-55-3-3-1	Enclosed
IR 72507-B-16-1-1-2	Enclosed
PR 30756-2-2	Partly exerted
PR 28703-2B-2	Well exerted
PR 8669-2B-7	Moderately exerted
Pinidua Selection	Just exerted
PR 26383-4B-1-1-20-5-3-2-1	Enclosed
PR 29814-B-5-3-1-1	Moderately exerted
PR 27981-M-1-1-3	Moderately exerted
PR 34110-B-3-1	Moderately exerted
PR 27137-CR 153 (SN-73)	Well exerted
PR 34131-B-2-1	Well exerted

Panicle Threshability

Panicle threshability was based on seed shattering during threshing as shown in Table 5. It was observed that Indica varieties were loose while Japonica varieties were characteristically difficult to thresh. Non-shattering varieties are preferred by farmers who practice the "*ani*" system of harvesting and those who practice the use of mortar and pestle as a way of producing milled rice. Variation in the threshability could be attributed to their varietal characteristics.

Table 5. Panicle threshability of the different promising rice entries

ENTRY	PANICLE THRESHABILITY
PSB Rc 96 (check)	Loose
PSB Rc 46 (check)	Loose
IR 72509 – B-44-3-1-1	Loose
IR 72509-B-55-3-3-1	Loose
IR 72507-B-16-1-1-2	Loose
PR 30756-2-2	Loose
PR28703-2B-2	Moderately difficult
PR8669-2B-7	Moderately difficult
Pinidua Selection	Moderately difficult
PR 26383-4B-1-1-20-5-3-2-1	Moderately difficult
PR 29814-B-5-3-1-1	Moderately difficult
PR 27981-M-1-1-3	Moderately difficult
PR 34110-B-3-1	Moderately difficult
PR 27137-CR 153 (SN-73)	Intermediate
PR 34131-B-2-1	Intermediate

Spikelet Fertility

Table 6 shows that PR 26383-4B-1-120-5-3-2-1, PR 27981-B-1-1-3 PR 34110-B-3-1, PR 27137-CR 153 (SN-73) and IR 34131-B-2-1 were highly fertile. It was observed that PSB Rc 96, PSB Rc 46, *Pinidua* Selection, IR 72509-B-55-3-3-1, IR 72507-B-16-1-1-2 and PR 30756-2-2 were unfertile. The rest of the entries are either moderately unfertile to intermediate. Fertility of rice could be affected by the environment particularly temperature during the conduct of the study. Temperature affects the plant at all stages of growth especially during the stage of panicle initiation. Temperature lower than 17^{o}C during panicle initiation stage will cause severe spikelet sterility (UPLB, 1983).

IRRI (1983) stated that the percentage of filled spikelets of a rice crop is affected by such factors as climate, soil, variety, and nitrogen fertilization. Low percentages of filled spikelets usually indicate adverse climates at the reduction division stage, at flowering and during the ripening period.

Lodging Resistance

Lodging resistance was recorded two weeks after heading and at maturity. It was observed that most of the entries were resistant to lodging except PR 29814-B-5-3-1-1 and PR 34131-B-2-1 which were moderately resistant to lodging.

Table 6. Spikelet fertility of the different promising rice entries

ENTRY	SPIKELET FERTILITY
PSB Rc 96 (check)	Unfertile
PSB Rc 46 (check)	Unfertile
IR 72509 – B-44-3-1-1	Moderately unfertile
IR 72509-B-55-3-3-1	Unfertile
IR 72507-B-16-1-1-2	Unfertile
PR 30756-2-2	Unfertile
PR 28703-2B-2	Moderately unfertile
PR 8669-2B-7	Moderately unfertile
Pinidua Selection	Unfertile
PR 26383-4B-1-1-20-5-3-2-1	Highly fertile
PR 29814-B-5-3-1-1	Intermediate
PR 27981-M-1-1-3	Highly fertile
PR 34110-B-3-1	Highly fertile
PR 27137-CR 153	Highly fertile
PR 34131-B-2-1	Highly fertile

Blast Resistance (Neck rot)

Table 7 shows the blast resistance of the different promising rice entries. It was observed that most of the promising entries are resistant with one intermediate (PR 2703-2B-2), one moderately susceptible (IR 72507-B-16-1-1-2) and one susceptible (PR 30756-2-2) compared to the two checks which are both moderately susceptible. Resistance to blast, a major disease concern among Cordillera rice farmers, is a major consideration in developing rice varieties for the cool elevated areas of Cordillera.

Stemborer Damage Evaluation (white heads)

Stemborer damage evaluation was observed ten days before harvest. It was observed that no occurrence of stemborer in all the entries evaluated.

Table 7. Blast resistance (Neck rot) of the different promising rice entries

ENTRY	RESISTANCE RATING
PSB Rc 96 (check)	Moderately Susceptible
PSB Rc 46 (check)	Moderately Susceptible
IR 72509 – B-44-3-1-1	Resistant
IR 72509-B-55-3-3-1	Resistant
IR 72507-B-16-1-1-2	Moderately Susceptible
PR 30756-2-2	Susceptible
PR 28703-2B-2	Intermediate
PR 8669-2B-7	Resistant
Pinidua Selection	Resistant
PR 26383-4B-1-1-20-5-3-2-1	Resistant
PR 29814-B-5-3-1-1	Resistant
PR 27981-M-1-1-3	Resistant
PR 34110-B-3-1	Resistant
PR 27137-CR 153 (SN-73)	Resistant
PR 34131-B-2-1	Resistant

Yield Per Plot (6.72 sq m) (kg)

Yield per plot was taken by winnowing the grain after drying at approximately 14% moisture content to separate unfilled grains and other debris then weighed. Table 8 shows that PR 34131-B-2-1 significantly obtained the highest grain yield with a mean of 3.80 kg but comparable to PR 27137-CR 153 (SN-73) and PR 34110-B-3-1 with mean of 3.03 kg and 2.70 kg, respectively. This is because of varietal differences such as number of productive tillers, length of panicles, and spikelet fertility.

Table 8. Yield per plot and computed yield per hectare of the different promising rice entries

ENTRY	YIELD PER PLOT (kg/6.72 sq.m)	COMPUTED YIELD PER HECTARE (kg/ha)
PSB Rc 96 (check)	0.22^{d}	327.40^{d}
PSB Rc 46 (check)	0.23^{d}	342.30^{d}
IR 72509 – B-44-3-1-1	0.70^{d}	685.50^{d}
IR 72509-B-55-3-3-1	1.20^{cd}	1780.80^{cd}
IR 72507-B-16-1-1-2	0.22^{d}	327.40^{d}
PR 30756-2-2	0.14^{d}	213.30^{d}
PR 28703-2B-2	1.67^{bcd}	2485.10^{bcd}
PR 8669-2B-7	1.93^{cd}	2877.00^{bcd}
Pinidua Selection	0.30^{d}	451.40^{d}
PR 26383-4B-1-1-20-5-3-2-1	0.50^{d}	709.30^{d}
PR 29814-B-5-3-1-1	1.60^{bcd}	2381.00^{bcd}
PR 27981-M-1-1-3	1.60^{bcd}	2351.20^{bcd}
PR 34110-B-3-1	2.70^{abc}	4017.90^{abc}
PR 27137-CR 153 (SN-73)	3.03^{ab}	4513.90^{ab}
PR 34131-B-2-1	3.80^{a}	5605.10^{a}
CV (%)	19.14	27.09

Means with common letters are not significantly different at 5% level of significance using DMRT

Computed Yield Per Hectare

Table 8 also shows the computed yield per hectare of the different promising entries. Results followed the same pattern in the grain yield per plot.

Table 9. Weight of 1,000 filled grains of the different promising rice entries

ENTRY	WT. OF 1,000 FILLED GRAINS (g)
PSB Rc 96 (check)	26[ab]
PSB Rc 46 (check)	24[bc]
IR 72509 – B-44-3-1-1	23[bc]
IR 72509-B-55-3-3-1	31[a]
IR 72507-B-16-1-1-2	19[c]
PR 30756-2-2	24[bc]
PR 28703-2B-2	21[bc]
PR 8669-2B-7	25[abc]
Pinidua Selection	22[bc]
PR 26383-4B-1-1-20-5-3-2-1	27[ab]
PR 29814-B-5-3-1-1	27[ab]
PR 27981-M-1-1-3	24[bc]
PR 34110-B-3-1	23[bc]
PR 27137-CR 153 (SN-73)	26[ab]
PR 34131-B-2-1	26[ab]
CV (%)	13.89

Means with common letters are not significantly different at 5% level of significance using DMRT

Weight of 1,000 Filled Grains

The weight of 1,000 filled grains is shown in Table 9. Among the fifteen entries evaluated, it was observed that IR 72509-B-55-3-31 with a mean of 31g gave the highest weight of 1,000 filled grains which is significantly different with other entries. IR 72507-B-16-1-1-2 obtained the lowest weight of 1,000 filled grains with a mean of 19g.

Meteorological Data

Mean monthly temperature, sunshine duration, relative humidity, and rainfall throughout the conduct of the study are shown in Table 10.

Maximum temperature (24.0) was highest during the month of June, while, the minimum temperature (14.6) was lowest in the month of December.

Total bright sunshine ranged from 298.2 to 180.0 minutes. Relative humidity ranged from 79 to 88%, minimum rainfall amount occurred from November to December.

Table 10. Meteological data gathered during the conduct of the study

MONTH	TEMPERATU (^{0}C) MAX	MIN	RH (%)	TOTAL RAINFALL AMOUNT (mm)	TOTAL LIGHT DURATION (min.)
JUNE	24.0	18.4	85	16.3	228.4
JULY	23.4	17.2	84	12.9	264.1
AUGUST	22.8	17.2	88	23.7	144.7
SEPTEMBER	22.6	17.1	87	22.6	180.0
OCTOBER	23.3	16.0	81	8.2	298.2
NOVEMBER	23.6	15.6	80	1.5	322.8
DECEMBER	22.5	14.6	79	1.6	242.3

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

Thirteen NCT entries which were supposed to be high yielding entries of rice and two PSB varieties serving as checks were planted and evaluated at BSU experimental area, La Trinidad, Benguet from June 2005 to December 2005. There were three IR entries, nine PR entries and a *Pinidua* Selection by PhilRice and two check varieties (PSB Rc 46 and PSB Rc 96).

The study aimed to evaluate and compare the best promising rice entries in terms of growth, grain yields and resistance to insect pest (stemborer) and disease (neck rot blast) and to determine which entries are best suited under BSU, La Trinidad condition.

Seedling color was observed before transplanting, all the entries were dark green except PSB Rc 46 and IR 72507-B-16-1-1-2 which were light green in color.

As to vigor it was observed that most of the entries were normal and vigorous except PR 34131-B-2-1, PR 34110-B-3-1 and PSB Rc 46 which were weak.

PR 30756-2-2 was the earliest to produce panicles, however it was susceptible to blast that resulted to low yield. IR 72509-B-55-3-3-1 had produced the highest number of productive tillers.

The panicle length at the time of harvest showed that PR 27981-M-1-1-3 had the longest with a mean of 26.0 cm compared to PR 30756-2-2 which had the shortest panicle length of 18.20 cm. PR 34110-B-3-1 was the tallest among the entries with a mean height of 112.70 cm compared to IR 72507-B-16-1-1-2 which was the shortest (67.80 cm).

The computed yield per hectare showed that PR 34131-B-2-1 had the highest production of 5,605.10 kg per hectare. The same entry had good characteristics of well

exerted panicle, fertile spikelet, resistant to insert pest (stemborer), disease (neck rot blast) and lodging.

All the entries evaluated were resistant to stem borer and lodging.

Conclusion

Based on the results, PR 34131-B-2-1 performed best under La Trinidad condition in terms of height, grain yields, panicle exertion, spikelet fertility and resistance to insect pest (stemborer) and disease (neck rot blast) and lodging.

Recommendation

In view of the foregoing statements, PR 34131-B-2-1 is highly recommended under La Trinidad condition.

PR 30756-2-2 is not recommendable to farmers because of it's susceptibility to blast although an early maturing entry.

PR 27137-CR 153 and PR 34110-B-3-1 are also recommended as alternative to PR 34131-B-2-1 because they are comparable in grain yield and the other agronomic characteristics.

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APPENDICES

Appendix 1. Days from transplanting to heading of the different promising rice entries

TREATMENT	BLOCK			TOTAL	MEAN
	I	II	III		
PSB Rc 96 (check)	77	77	77	231	77
PSB Rc 46 (check)	88	88	88	264	88
IR 72509 – B-44-3-1-1	79	79	79	237	79
IR 72509-B-55-3-3-1	85	85	85	255	85
IR 72507-B-16-1-1-2	83	83	83	245	82
PR 30756-2-2	62	62	62	186	62
PR 28703-2B-2	70	70	70	210	70
PR 8669-2B-7	83	83	83	245	82
Pinidua Selection	70	70	70	210	70
PR 26383-4B-1-1-20-5-3-2-1	81	81	81	241	80
PR 29814-B-5-3-1-1	77	77	77	231	77
PR 27981-M-1-1-3	93	93	93	279	93
PR 34110-B-3-1	88	88	88	264	88
PR 27137-CR 153 (SN-73)	81	81	81	247	82
PR 34131-B-2-1	83	83	83	247	82
TOTAL	1200	1200	1200	3600	80

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM. OF SQUARES	COMPUTED F	TABULAR F	
				0.05	0.01
Treatment	14	2.643.244	188.803	221.91**	2.06
Block	2	2.511	2.756		2.80
Error	28	23.822	0.851		
TOTAL	44	2672.578			

** Highly significant

CV = 1.16

Appendix 2. Productive tillers per hill of the different promising rice entries

TREATMENT	BLOCK			TOTAL	MEAN
	I	II	III		
PSB Rc 96 (check)	21	23	20	64	21
PSB Rc 46 (check)	12	14	14	40	13
IR 72509 – B-44-3-1-1	14	15	17	46	15
IR 72509-B-55-3-3-1	20	21	21	62	21
IR 72507-B-16-1-1-2	13	13	13	39	13
PR 30756-2-2	5	6	7	18	68
PR 28703-2B-2	7	10	6	23	8
PR 8669-2B-7	16	14	21	51	17
Pinidua Selection	11	10	15	26	12
PR 26383-4B-1-1-20-5-3-2-1	12	14	13	39	13
PR 29814-B-5-3-1-1	15	14	14	43	14
PR 27981-M-1-1-3	9	11	9	29	10
PR 34110-B-3-1	10	12	13	35	12
PR 27137-CR 153 (SN-73)	13	13	15	41	14
PR 34131-B-2-1	18	17	14	49	16
TOTAL	196	207	212	605	18

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM. OF SQUARES	COMPUTED F	TABULAR F	
				0.05	0.01
Treatment	14	743.33	19.63**	2.06	2.80
Block	2	8.933			
Error	28	75.733			
TOTAL	44	828.000			

** Highly significant

CV% = 12.03

Appendix 3. Panicle length (cm) of the different promising rice entries

TREATMENT	BLOCK			TOTAL	MEAN
	I	II	III		
PSB Rc 96 (check)	21.60	22.00	22.70	66.30	22.00
PSB Rc 46 (check)	20.10	20.30	21.20	61.60	20.50
IR 72509 – B-44-3-1-1	21.40	22.00	18.30	61.70	20.60
IR 72509-B-55-3-3-1	19.70	19.60	19.10	58.40	19.50
IR 72507-B-16-1-1-2	19.10	19.90	19.30	58.30	19.50
PR 30756-2-2	18.80	17.60	18.20	54.60	18.20
PR 28703-2B-2	20.30	19.80	18.80	58.90	19.60
PR 8669-2B-7	18.50	16.00	18.20	52.70	17.60
Pinidua Selection	21.30	21.30	21.50	64.10	21.40
PR 26383-4B-1-1-20-5-3-2-1	19.60	21.60	24.80	66.00	22.00
PR 29814-B-5-3-1-1	23.30	23.20	22.50	69.00	23.00
PR 27981-M-1-1-3	25.80	25.80	26.50	78.10	26.00
PR 34110-B-3-1	20.50	21.20	20.70	62.40	20.80
PR 27137-CR 153 (SN-73)	18.80	18.50	19.10	56.40	18.80
PR 34131-B-2-1	23.50	20.20	19.00	62.70	20.90
TOTAL	312.30	309.00	309.90	931.20	20.70

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM. OF SQUARES	MOS	COMPUTED F	TABULAR F	
					0.05	0.01
Treatment	14	185.595	13.257	9.11**	2.06	2.80
Block	2	0.388	0.194			
Error	28	40.765	1.456			
TOTAL	44	226.748				

** Highly significant

CV = 1.83%

Appendix 4. Final plant height (cm) of the different promising rice entries

TREATMENT	BLOCK			TOTAL	MEAN
	I	II	III		
PSB Rc 96 (check)	84.70	85.20	85.60	255.50	85.20
PSB Rc 46 (check)	88.40	87.20	87.70	263.30	87.80
IR 72509 – B-44-3-1-1	76.00	73.60	74.90	224.50	74.80
IR 72509-B-55-3-3-1	68.70	69.30	68.30	206.30	68.80
IR 72507-B-16-1-1-2	67.40	67.50	68.40	203.30	67.80
PR 30756-2-2	85.00	85.40	85.00	255.40	85.10
PR 28703-2B-2	96.10	101.60	103.60	301.30	100.90
PR 8669-2B-7	110.40	114.00	107.30	331.70	110.60
Pinidua Selection	100.20	102.90	102.50	305.60	101.90
PR 26383-4B-1-1-20-5-3-2-1	71.40	85.10	72.30	228.80	76.30
PR 29814-B-5-3-1-1	104.90	107.20	110.30	322.40	107.50
PR 27981-M-1-1-3	96.70	95.60	94.10	276.40	92.10
PR 34110-B-3-1	112.60	113.30	112.30	338.20	112.70
PR 27137-CR 153 (SN-73)	87.60	94.20	93.90	281.70	93.90
PR 34131-B-2-1	106.60	110.30	109.10	326.00	108.70
TOTAL	1356.70	1392.40	1375.30	4120.40	91.57

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM. OF SQUARES	MOS	COMPUTED F	TABULAR F	
					0.05	0.01
Treatment	14	9726.360	694.740	7851**	2.06	2.80
Block	2	75.610	37.805			
Error	28	247.158	8.827			
TOTAL	44	10047.128				

** Highly significant

CV = 7.46%

Appendix 5. Yield per plot (kg) of the different promising rice entries

TREATMENT	BLOCK			TOTAL	MEAN
	I	II	III		
PSB Rc 96 (check)	0.32	0.22	0.12	0.66	0.22
PSB Rc 46 (check)	0.36	0.13	0.20	0.69	0.23
IR 72509 – B-44-3-1-1	0.72	0.90	0.41	2.03	0.70
IR 72509-B-55-3-3-1	1.90	0.79	0.90	3.59	1.20
IR 72507-B-16-1-1-2	0.40	0.15	0.11	0.66	0.22
PR 30756-2-2	0.18	0.10	0.15	0.43	0.14
PR 28703-2B-2	2.10	1.58	1.33	5.01	1.67
PR 8669-2B-7	1.80	2.50	1.50	5.80	1.93
Pinidua Selection	0.41	0.32	0.18	0.91	3.30
PR 26383-4B-1-1-20-5-3-2-1	0.64	0.38	0.41	1.43	0.50
PR 29814-B-5-3-1-1	1.70	1.70	1.40	4.80	1.60
PR 27981-M-1-1-3	1.74	2.00	1.00	4.74	1.60
PR 34110-B-3-1	2.70	2.70	2.70	8.10	2.70
PR 27137-CR 153 (SN-73)	2.80	3.10	3.20	9.10	3.03
PR 34131-B-2-1	1.40	2.40	7.50	11.30	3.80
TOTAL	19.17	18.97	21.11	59.25	19.75

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM. OF SQUARES	MOS	COMPUTED F	TABULAR F	
					0.05	0.01
Treatment	14	55.911	3.994	4.70**	2.06	2.80
Block	2	0.186	0.093			
Error	28	23.779	0.849			
TOTAL	44	79.877				

** Highly significant

CV = 19.14%

Appendix 6. Computed yield per hectare (kg) of the different promising rice entries

TREATMENT	BLOCK			TOTAL	MEAN
	I	II	III		
PSB Rc 96 (check)	476.20	327.40	178.60	982.20	327.40
PSB Rc 46 (check)	535.70	193.50	297.60	1026.80	342.30
IR 72509 – B-44-3-1-1	107.10	1339.30	610.10	2056.50	685.50
IR 72509-B-55-3-3-1	2827.40	1175.60	1339.30	5342.30	1780.80
IR 72507-B-16-1-1-2	595.20	223.20	163.70	982.10	327.40
PR 30756-2-2	267.90	148.80	223.20	639.90	213.30
PR 28703-2B-2	3125.00	2851.20	1979.20	7455.40	2485.10
PR 8669-2B-7	2678.60	3720.20	2232.10	8630.90	2877.00
Pinidua Selection	610.10	476.20	267.90	1354.00	451.40
PR 26383-4B-1-1-20-5-3-2-1	952.40	565.50	610.10	2128.00	709.30
PR 29814-B-5-3-1-1	2529.80	2529.80	2083.30	7142.90	2381.00
PR 27981-M-1-1-3	2589.30	2976.20	1488.10	7053.60	2351.20
PR 34110-B-3-1	4017.90	4017.90	4017.90	12053.70	4017.90
PR 27137-CR 153 (SN-73)	4166.70	4613.10	4761.90	13541.70	4513.90
PR 34131-B-2-1	2083.30	3571.40	11160.70	16815.40	5605.10
TOTAL	23395.00	28229.30	31413.70	80152.00	1937.91

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM. OF SQUARES	MOS	COMPUTED F	TABULAR F	
					0.05	0.01
Treatment	14	9726.360	694.740	7851**	2.06	2.80
Block	2	75.610	37.805			
Error	28	247.158	8.827			
TOTAL	44	10047.128				

** Highly significant

CV = 27.09%

Appendix 7. Weight of 1,000 filled grains (g) of the different promising rice entries

TREATMENT	BLOCK			TOTAL	MEAN
	I	II	III		
PSB Rc 96 (check)	18	29	31	78	26
PSB Rc 46 (check)	25	23	23	71	24
IR 72509 – B-44-3-1-1	23	21	24	68	23
IR 72509-B-55-3-3-1	30	30	32	92	31
IR 72507-B-16-1-1-2	21	24	12	57	19
PR 30756-2-2	23	23	26	72	24
PR 28703-2B-2	22	21	20	63	21
PR 8669-2B-7	28	23	25	76	25
Pinidua Selection	23	26	18	67	22
PR 26383-4B-1-1-20-5-3-2-1	30	24	27	81	27
PR 29814-B-5-3-1-1	29	24	29	82	27
PR 27981-M-1-1-3	22	26	24	72	24
PR 34110-B-3-1	24	24	21	69	23
PR 27137-CR 153 (SN-73)	26	27	24	78	26
PR 34131-B-2-1	26	22	30	78	26
TOTAL	371	367	366	1104	25

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM. OF SQUARES	MOS	COMPUTED F	TABULAR F	
					0.05	0.01
Treatment	14	9726.360	694.740	7851**	2.06	2.80
Block	2	75.610	37.805			
Error	28	247.158	8.827			
TOTAL	44	10047.128				

** Highly significant

CV = 13.89%