BIBLIOGRAPHY

GUERZON, NEMIE REX S. APRIL 2012. Growth and Yield of Promising Rice Entries Under Cool, Elevated Condition. Benguet State University, La Trinidad, Benguet.

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ABSTRACT

The study aimed to evaluate and compare the growth and yield performance of the different rice entries and to determine which entry is more adapted and suitable under cool-elevated areas like La Trinidad, Benguet.

The fourteen entries evaluated were Ketnel (Local check), IR81551-2-1-3-3-2-PR, PR34126-B-10, NSIC Rc 104, IR82187-17-3-2-1-2, PR34110-B-4-3-1, IR81528- 15- 3-2-2-PR, PR34131-B-21-1, PR34126- B-2, IR82737-B-B-B-B-182, PSBRC 46, IR83140- B-11- B, PR34131-B-20-1 and IR83140-B-28-B.

Results showed that NSIC Rc 104 and PSBRc 46 had good growth performance and yield. These varieties showed significant differences on rate of recovery, tiller number, number of productive tillers per hill, length of panicle, number of grains per panicle, number of filled grains per panicle, grain yield per plot, weight of 1000 grains and computed grain yield per hectare.

In addition, all entries need further evaluation for more a stable result under cool, elevated condition and within other seasons.

INTRODUCTION

Rice *Oryza sativa* belongs to the Graminae family and is clearly one of the most important food crops in the world. It feeds almost 40% of the world's population (De Datta1981).

In the Philippines, rice is planted in different distinct ecological zones- irrigated, lowland, rain fed lowland and upland. However, only 1% of rice are grown in the uplands (Dalrympe, 1986). Most of the upland rice farmers are still growing traditional cultivars that are low yielding and late maturing. Rice in the uplands is often used for fermentation or production of wine locally known as "tapuey", aside from consumption as a staple food (Tadao, 1994).

Previous studies on rice varietal evaluation observed that rice production in the highlands is increasing due to higher demand.The growing demand of rice has encouraged some farmers to go into commercial production of various modern varieties in the different provinces of the Cordillera region. In fact, modern varieties like IR 3941 had already been introduced in the higher altitudes of the region. With the increasing demand of modern rice varieties in the world market and a buying price of Php. 35-40 per kilo, it could be a substantial income for the Cordillera farmers (IRRI, 1986).

Thus, it is essential to develop and discover rice varieties which are suitable to cool elevated areas.The result of the study could be used as a guide by the farmers for a better rice yield and profit.

The objectives of the study were to determine the growth and yield of promising rice entries and to identify the best suited variety under cool-elevated condition.

The experiment was conducted at La Trinidad, Benguet from October 2011 to January 2012.

REVIEW OF LITERATURE

Importance of Rice to Household and Economy

Rice production and consumption are positively associated with low income and poverty of the 23 countries in the world that produce more than one million tons of rice. Almost half have a per capita income of less than 500 dollars. These are countries categorized by the World Bank as the least developed. Rice is one of the cheapest sources food energy and their main source of protein. As income increases, people demand relatively by higher quality food, and resources are shifted from production of rice production of other food and non farm goods with high income elasticity demand. The importance of rice to national economy further dwindles as agriculture's shares in the national income decline with a faster growth in non farm incomes. Increasing productivity of rice sector however is an important means of raising the purchasing capacity of the poor and alleviation of poverty in low income countries (Evenson *et al*., 1996).

Rice has always been one of the most important foods in the world. It is estimated that 40 percent of the world population takes rice as a major sources of food; 1.6 Billion people in Asia takes rice as their mainstay food. Rice is produced in 111 countries in the world. The region with high population density and the most rapid population growth produce and consume the most rice. Furthermore, rice is the staple food for more than half of the world's population in Asia alone. Most of the consumers who depend on rice as their primary food live less developed countries. It is foreseen that the world's population may exceed 8 billion by 2025 and will need about 765 million tons of rice, 70 percent than what we consume today (Nanda, 2000).

Problems in Rice Production

The world population would increase by 35 percent from 3.5 billion 1990 to 7 billion by 2015. The population increase ill more than 45 percent in developing countries. The Unites Nations recent population projected indicates that each year almost 80 million people are likely to be added to the world's population during the next quarter century. Over the period, the absolute population increases will be at highest in Asia, but the relative increased will be greatest in Africa, where population is expected to almost double (Evenson *et al*., 1996).

About 70 percent of the additional production will have to come from irrigated upland cool elevated areas of Asia and 20 percent from the favorable rain-fed lowland which was already extensively cultivated. Currently, Asian rice production increase at an annual rate of only 1.4 percent, which is below the population growth rate. By the year 2025, we need to produce about 60 percent more rice than what we produced today to meet the growing demand. Further, intensification of their riceland must be pursued against the backdrop of shrinking land area and decreasing availability and increasing cost of production input, water, fertilizer, chemical, labor and energy (Balasubramanian, 1999).

Importance of Grain Quality of Rice

It is very difficult to define with precision as preferences for quality vary from country to country. Few people realize its complexity and various quality components are involved. The concept of quality varies according to the preparation for which the grains are to be used. Although some of the desired quality characteristics by grower; millers and consumers may be the same yet each may place different emphasis on various quality characteristics. For instance, the miller's basis of quality is dependent upon total recovery and proportion of the head and broken rice on milling. Consumers based their concept of quality on the grain appearance, size and shape of the grains, the behavior upon cooking, the taste, tenderness, and flavor of the cook rice (Singh and Khush, 2000).

Temperature Requirement

Cool temperature, little sunshine condition prevailing in the Cordillera generally results in low rice yield. Average rice yield in the region is currently placed at 2.1 tons per hectare. Planting during wet season usually results to sterility of the spikelet (CECAP and PhilRice, 2000).

Discoloration is the biggest problem of rice during the wet season in cool places of Cordillera like in Banaue, Ifugao, Philippines. In this case, it can be avoided by late maturity but it is disadvantageous for double cropping (Tadao, 1993).

Pest Control Management

Integrated Pest Management (IPM) can make a contribution to environmental sensitive farming. Using GM or conventional crops with resistance to pest are an important part of IPM. Rotation of modern rice cultivars with different patterns of resistance is necessary to manage pest damage at the farm.Sanitation and cleanliness must be observed to help control the infestation of disease. Using a resistant varieties are said to be the most considered factor in resisting infestation of diseases. (Sheely*et al.*, 2000).

Importance of Varietal Evaluation

Varietal evaluation is important to observe performance characters which yield, earliness, vigor, maturity and quality because varieties has a wide range of differences of a plant in size and yield performance (Work and Carew, 1995).Furthermore, PRRI (1993) stated that varietal evaluation is an important in agro-ecology that stabilize the yield at a higher level that facilitates the production of efficient qualities of seed recommended varieties and encourage further seed increase for the farmer use.

High yielding and improve cultivars are known to play an important role in boosting production. Large number of indigenous and exotic accessories of various plants is evaluated and the number of cultivars are selected and recommended for mass growing (Bitaga, 2002).

In La Trinidad, Benguet, fifteen rice cultivars were tested. Among these were, Bassat and Talloythat performed better and produced the highest grain yield. They had better adaptability and resistance than other cultivars evaluated under the weather conditions prevailed on the location where the study was conducted.Varietal trials of three promising rice selection were also studied in a few locations of Ifugao, Kalinga and Apayao (Cadatal and Pedro, 1993).

MATERIALS AND METHODS

An area of 403.2 square meters was thoroughly prepared and it was divided into three blocks. Each block consisted of 14 plots measuring 1.6 m x 6 m corresponding to the 14 treatments with three replications per block (Figure 1). The treatments were laid out following the Randomized Complete Block Design (RCBD).

Thirteen (13) promising rice varieties and Ketnel (check variety) were used. These promising varieties were developed by Philippine Rice Research Institute (PHILRICE). The recommended fertilizer rate was applied. Hill spacing was 20 cm between rows with 8 rows per plot and 30 hills per row. Three tillers were transplanted per hill (Figure 2).

All other cultural management practices necessary to the study such as irrigation, weeding, pest and disease control were strictly employed.

The entries that were used are the following:

V_1 = IR81551-2-1-3-3-2-PR

V_2 =PR34126-B-10

V_3 = NSIC Rc 104

V_4 =IR82187-17-3-2-1-2

V_5 = PR34110-B-4-3-1

V_6 = IR81528- 15- 3-2-2-PR

V_7 = PR34131-B-21-1

V_8 = PR34126- B-2

V_9 = IR82737-B-B-B-B-182

V_{10} = PSBRC 46

V_{11} = IR83140- B- 11- B

V_{12} = PR34131-B-20-1

V_{13} = IR83140-B-28-B

V_{14} = Ketnel (check variety)

Figure 1. Land preparation and lay-outing

Figure 2. Transplanting of the fourteen rice entries

The data gathered were the following:

1.Agro-meteorological data. Meteorological data such as temperature, rainfall, relative humidity and sunshine duration were obtained at Philippine Atmospheric Geographical and Service Administration (PAGASA) station at Benguet State University.

2. Height of seedling .The height of rice seedlings was measured from the base to the longest leaf before transplanting.

Scale	Remarks
1	Short (<30 cm)
2	Intermediate (~45 cm)
3	Tall (>60 cm)

3. Days of recovery. The number of days from transplanting to full recovery of seedling was recorded when the rice plants in the paddies were almost dark green in color.

4. Days from transplanting to tillering. This was gathered when at least 50% of the rice plants produced tillers.

5. Tiller number. The average number of tillers at maximum tillering was recorded from ten random samples per treatment.

6. Days from transplanting to booting. This was gathered when 50% of the rice plants reached the booting stage.

7. Days from transplanting to heading. This was recorded when 50% of the rice plants formed heads.

8. Spikelet fertility. It was determined by counting the number of well developed spikelet in proportion to the total number of panicle using the scale:

Scale	Description	Remarks
1	90-100%	highly fertile
3	75-89%	fertile
5	50-74%	partly fertile
7	50% and below	highly sterile
9	0%	completely sterile

9. Days from transplanting to ripening. This was obtained when the grains of the upper ¾ portion of the panicle are firm using ten random samples per treatment.

10. Height at maturity. The height was measured from the tip of the tallest panicle of the rice plant to the base.

11. Lodging resistance. This was obtained before harvest using the following scale:

Scale	Description	Remarks
1	All plants are erect	Resistant
2	Plants are leaning at an angle of 70 degrees	Moderately Resistant
3	Plants are leaning at an angle of 45 degrees about 50% of the population are affected	Intermediate
4	Plants are leaning at an angle of 30 degrees about 50% of the population are Affected	Moderately Susceptible
5	All plants are fallen on the ground	Susceptible

12. Number of productive tillers per hill. The average number of productive tillers of ten random samples per treatment was gathered.

13. Length of panicle (cm). The length of the panicle was measured from the base to the top of the panicle using ten random samples per treatment.

14. Number of grains per panicle. The number of grains was counted and recorded during harvest. The same samples for length of panicle were used.

15.Number of filled grains per panicle. This was gathered from the average number of grains per panicle. Ten random sample plants per treatment were used.

16. Grain yield per plot (kg).This was taken after the grains have been sun-dried to approximately 14% moisture content. Winnowing was done to separate the filled from unfilled grains.

17. Weight of 1000 grains (g). One thousand seeds with 14% moisture content was counted and weighed.

18. Computed grain yield per hectare (kg/ha). The weight of dry filled grains per treatment was taken and the yield per hectare was computed using the following formula:

$$\text{Yield per hectare (kg)} = \frac{X}{10000\ m^2} \times \frac{\text{Yield}}{1.6m \times 6m}$$

19. Insect pest evaluation (Stem borers). Field rating for rice stem borers were based on actual number of dead hearts and white heads. Dead hearts were counted 45 days after transplanting while white heads counted ten days before harvesting. For both dead hearts and white heads, rating was based on the following (Phil Rice, 1993):

SCALE	Number of Dead Hearts	REMARKS	Number of White Heads	REMARKS
1	1-10	R	1-5	R
3	11-20	MR	6-10	MR
5	21-30	I	11-15	I
7	31-60	MS	16-25	MS
9	60 and above	S	26 and above	S

Where:

R= Resistant
MR= Moderately Resistant
I= Intermediate
MS= Moderately Susceptible
S= Susceptible

20. Blast (neck rot). Evaluation of rice blast (neck rot) was taken from the rice plants at the center rows. Computation in percent infection was taken using the formula:

$$\% \text{ Infection} = \frac{\text{No. of panicles infected}}{\text{Total no. of panicle}} \times 100$$

Analysis of Data

All quantitative data were analyzed using Analysis of Variance (ANOVA) for single factor arranged in Randomized Complete Block Design (RCBD) with three replications. The significance of differences among the treatment means were tested using the Duncan's Multiple Range Test (DMRT) at 5% level of significance.

RESULTS AND DISCUSSION

Agro-meteorological Data

Table 1 shows the temperature, relative humidity, amount of rainfall and sunshine duration from the October 2011 to January 2012. It was observed that the temperature ranged from 14.0-22.0°C, relative humidity ranged from 86.00%, and average rainfall is 4.00 mm.

High yielding varieties are tolerant to cool temperatures ranging from 17-22^{0}C. Some modern varieties are sensitive to an average temperature of 15^{0}C. Planting modern rice varieties in the upland need at least 100 mm for a sufficient water supply (IRRI, 2011).

The highest sunshine duration recorded was on the month of October 2011 and January 2012.

Table 1. Temperature, relative humidity, rainfall and daily sunshine duration from October 2011 to January 2012

MONTH	TEMPERATURE (°C)		RELATIVE HUMIDITY (%)	RAINFALL AMOUNT (mm)	DAILY SUNSHINE DURATION (min)
	Min	Max			
October	17.00	25.00	86.00	3.40	293.00
November	14.00	24.00	86.00	2.20	257.00
December	14.00	17.00	87.00	6.40	244.00
January	14.00	22.00	84.00	3.20	293.00
MEAN	14.00	22.00	86.00	4.00	284.00

Source: PAG-ASA Station, BSU, La Trinidad, Benguet

Height of Seedling before Transplanting

No significant differences on the seedling height of the fourteen rice entries were noted (Table 2). The seedlings were measured from the base to the tip of the longest leaf using a ruler. It was observed that all entries were almost uniform in height.

Table 2. Seedling height and height at maturity of the fourteen rice entries

ENTRY	SEEDLING HEIGHT (cm)	HEIGHT AT MATURITY (cm)
IR81551-2-1-3-3-2-PR	17.89	79.23[f]
PR34126-B-10	17.96	82.60[d]
NSIC R_C 104	18.00	81.17[e]
IR82187-17-3-2-1-2	17.91	68.17[g]
PR34110-B-4-3-1	18.24	93.30[a]
IR81528-15-3-2-2-PR	17.93	68.13[g]
PR34131-B-21-1	18.32	84.13[c]
PR34126-B-2	18.05	86.07[b]
IR82737-B-B-B-B-182	18.11	67.27[gh]
$PSBR_C$ 46	18.50	68.37[g]
IR83140-B-11-B	18.31	67.83[g]
PR34131-B-20-1	17.89	80.60[e]
IR83140-B-28-B	17.83	68.60[g]
Ketnel	18.40	65.97[g]
CV (%)	1.85	1.05

Means followed by common letters are not significantly different at 5 % level of significance

Height at Maturity

Plant height at harvest is shown in Table 2. It was gathered that PR34110-B-4-3-1 was significantly taller than other entries, being almost one meter tall followed by PR34126-B-2 and PR34131-B-21-1 with a mean of 86.07 cm and 84.13cm, respectively. Ketnel was found the shortest among the entries with a mean of 65. 87 cm, although it is well-adapted traditional variety. Significant differences may be due to their genetic make-up. Some varieties with a short final plant height show its resistance to lodging. This will keep away the panicle from falling on the ground through gravitational pull (Fang, 2005).

Number of Days to Recovery

Table 3 shows the number of days from transplanting to period of recovery which was recorded when rice plants were almost dark green in color. All the fourteen entries recovered in ten days except for three entries that recovered two to four days later (Figure 3). Faster recovery enhances the rice plant to reach its vegetative stage earlier. Consequently, faster recovery may also produce tillers earlier and probably earlier maturity (IRRI, 2011).

Number of Days from Transplanting
to Tillering

The number of days from transplanting to tillering is shown in Table 3. It was observed that IR81551-2-1-3-3-2-PR, PR34126-B-10, IR82187-17-3-2-1-2, PR34110-B-4-3-1, IR81528-15-3-2-2-PR, PR34131-B-21-1, PR34126-B-2, IR82737-B-B-B-B-182, IR83140-B-11-B, PR 34131-B-20-1 and IR 83140-B-28-B significantly produced tillers earlier within a mean of 20 days as compared to $PSBR_C$ 46 within 22 days. Ketnel produced tillers within a mean of 24 days. Rice varieties that produce tillers in later stage results to a minimum number of tillers (Lancashire, 1991).

Figure 3a. Rice seedlings at ten days after transplanting

Figure 3b. Rice seedlings at 15 days after transplanting

Number of Days from
Transplanting to Booting

The number of days from transplanting to booting is shown in Table 3. It was observed that NSIC R_C 104 was the earliest to boot followed by PSBRc 46, together with IR82737-B-B-B-B-182 and IR83140-B-11-B that boot two days later. Such a significant difference is due to varietal characteristics. Earlier booting of rice results to a thicker and longer neck that keeps away the grains from compactness on their leaf sheath. Later

Table 3. Number of days from transplanting to recovery, tillering and booting of the fourteen rice entries

ENTRY	DAYS FROM TRANSPLANTING TO		
	RECOVERY	TILLERING	BOOTING
IR81551-2-1-3-3-2-PR	10.00	20.00	69.00
PR34126-B-10	10.00	20.00	69.00
NSIC R_C 104	12.00	23.00	65.00
IR82187-17-3-2-1-2	10.00	20.00	69.00
PR34110-B-4-3-1	10.00	20.00	71.00
IR81528-15-3-2-2-PR	10.00	20.00	67.00
PR34131-B-21-1	10.00	20.00	72.00
PR34126-B-2	10.00	20.00	72.00
IR82737-B-B-B-B-182	10.00	20.00	67.00
PSBR_C 46	12.00	23.00	67.00
IR83140-B-11-B	10.00	20.00	67.00
PR34131-B-20-1	10.00	20.00	71.00
IR83140-B-28-B	10.00	20.00	69.00
Ketnel	14.00	24.00	79.33
CV (%)	0.00	0.00	0.44

Means followed by common letters are not significantly different at 5 % level of significance

booting causes compactness of the grains inside the leaf sheath wherein the tip spikelet starts to ripen while the spikelets inside the leaf sheath delayed to come out (IRRI, 2011).

Number of Days from
Transplanting to Heading

Number of days from transplanting to heading is shown in Table 4. It was observed that $PSBR_C$ 46 was the earliest to form head with a mean of 76 days while the

Table 4. Number of days from transplanting to heading and ripening of the fourteen rice entries

ENTRY	DAYS FROM TRANSPLANTING TO	
	HEADING	RIPENING
IR81551-2-1-3-3-2-PR	78.00	119.00
PR34126-B-10	79.00	120.00
NSIC R_C 104	79.00	114.00
IR82187-17-3-2-1-2	79.00	122.00
PR34110-B-4-3-1	83.00	122.00
IR81528-15-3-2-2-PR	78.00	119.00
PR34131-B-21-1	82.00	121.00
PR34126-B-2	81.00	120.00
IR82737-B-B-B-B-182	77.00	117.00
$PSBR_C$ 46	76.00	112.00
IR83140-B-11-B	78.00	115.00
PR34131-B-20-1	81.00	118.00
IR83140-B-28-B	80.00	116.00
Ketnel	95.67	133.00
CV (%)	0.69	0.00

Means followed by common letters are not significantly different at 5 % level of significance

check variety, Ketnel was the latest to produce head in 95 days. Earlier heading produces higher percentage of panicle to emergence while later heading delays ripening of grains (IRRI, 2011).

Number of Days from
Transplanting to Ripening

Table 4 shows the number of days from transplanting to ripening wherein $PSBR_C$ 46 significantly ripened earlier in 112 days. NSIC R_C 104 and IR82737-B-B-B-B-182 followed with mean of 114 and 117 days, respectively. Ketnel was the latest to ripen (133 days). Timely ripening of rice grains has a greater chance of producing a good quality of grains (IRRI, 2011)

Tiller Number

The number of tillers at maximum stage was recorded when the flag leaf of the rice plant came out. Table 5 shows that $PSBR_C$ 46 and NSIC R_C 104 produced the highest number of tillers with means of 17.07 and 16.66, respectively. PR34131-B-20-1 and IR81528-15-3-2-2-PR recorded the lowest number of tillers with means of 11.17 and 11.41, respectively. Tiller number could be a remarkable measure of yield potential in a certain variety (Fang, 2005). PSBRc 46 and NSIC Rc 104 appear to have greater potential than the other entries used based on tiller number.

Number of Productive Tillers

Table 5 revealed the number of productive tillers per hill. NSIC R_C 104 has the most number of productive tillers while Ketnel and IR81551-2-1-3-3-2-PR produced the least number of productive tillers. Productive tillers exemplify the potential yielding capability of a certain rice variety. Rice plants with high number of productive tillers turns out a greater number of grains (IRRI, 2011).

Table 5. Number of tillers and productive tillers of the fourteen entries

ENTRY	NUMBER	
	TILLER	PRODUCTIVE TILLER
IR81551-2-1-3-3-2-PR	12.35[de]	5.13[cd]
PR34126-B-10	13.87[cd]	5.60[cd]
NSIC R_C 104	16.67[b]	8.60[a]
IR82187-17-3-2-1-2	13.47[d]	6.50[c]
PR34110-B-4-3-1	14.25[c]	6.40[c]
IR81528-15-3-2-2-PR	11.41[e]	5.97[cd]
PR34131-B-21-1	13.48[d]	6.53[c]
PR34126-B-2	13.87[cd]	6.33[cd]
IR82737-B-B-B-B-182	12.53[cd]	6.50[c]
$PSBR_C$ 46	17.07[a]	6.33[cd]
IR83140-B-11-B	12.17[de]	6.60[b]
PR34131-B-20-1	11.17[e]	5.93[cd]
IR83140-B-28-B	13.26[d]	5.37[d]
Ketnel	12.26[cd]	4.83[e]
CV (%)	8.30	9.03

Means followed by common letters are not significantly different at 5 % level of significance

Lodging Resistance

As to reaction to lodging by the fourteen rice entries, it was observed that all varieties are highly resistant. Fang (2005) stated that resistance to lodging signifies a greater stand of 90 degrees until plants fully ripen. This will maintain the panicle away from falling off the ground.

Length of panicle

The length of panicle of the fourteen rice entries is shown in Table 6. Among the entries evaluated, it was observed that NSIC R_C 104 had the longest panicle with a mean of 19.45 cm. It was followed by PR34131-B-20-1 with a mean of 17.51 cm and Ketnel had the shortest panicle with a mean of 14.28 cm. Significant differences could be due to their genetic make-up. Longer panicles contain more grains than shorter ones. Although, this was proven in almost Asian varieties that length of the panicle is not the basis for concluding the grain content (Lancashire, 1991).

Spikelet Fertility

Table 6 demonstrates the spikelet fertility of the different entries. It was observed that NSIC R_C 104 was found highly fertile among all entries. IR81551-2-1-3-3-2-2PR, PR34126-B-10, IR82187-17-3-2-1-2, IR82187-17-3-2-1-2, PR34110-B-4-3-1, IR81528-15-3-2-2-PR, PR34131-B-21-1,PR34126-B-2, IR82737-B-B-B-B-182, PSBR_C 46, PR34131-B-20-1, IR83140-B-28-B and Ketnel were found fertile. Jagadish (2007) stated that rice spikelet is more fertile in a temperature ranging from 24^0C-30^0C.

This is due to the effect on time of the day in spikelet anthesis relative to a high temperature episode on spikelet fertility.

Table 6. Length of panicle and spikelet fertility of the fourteen rice entries

ENTRY	LENGTH OF PANICLE (cm)	SPIKELET FERTILITY
IR81551-2-1-3-3-2-PR	25.37[ef]	partly fertile
PR34126-B-10	26.96[bc]	partly fertile
NSIC R_C 104	29.45[a]	highly fertile
IR82187-17-3-2-1-2	25.07[fg]	partly fertile
PR34110-B-4-3-1	27.44[b]	partly fertile
IR81528-15-3-2-2-PR	25.86[def]	partly fertile
PR34131-B-21-1	27.56[b]	partly fertile
PR34126-B-2	27.51[b]	partly fertile
IR82737-B-B-B-B-182	26.21[cde]	partly fertile
$PSBR_C$ 46	26.57[bcd]	partly fertile
IR83140-B-11-B	27.29[b]	fertile
PR34131-B-20-1	27.51[b]	partly fertile
IR83140-B-28-B	27.45[b]	partly fertile
Ketnel	24.28[g]	partly fertile
CV (%)	3.16	

Means followed by common letters are not significantly different at 5 % level of significance

Number of Grains per Panicle

Table 7 illustrates the total number of grains per panicle. It was observed that $PSBR_C$ 46 gained the highest number of grains per panicle with a mean of 128.87

Table 7. Number of total grains and filled grains per panicle of the fourteen rice entries

ENTRY	NUMBER	
	TOTAL GRAINS PER PANICLE	FILLED GRAINS PER PANICLE
IR81551-2-1-3-3-2-PR	115.03^{b}	46.57^{c}
PR34126-B-10	98.63^{c}	45.93^{cd}
NSIC R_C 104	89.23^{d}	62.87^{a}
IR82187-17-3-2-1-2	116.27^{b}	48.10^{cd}
PR34110-B-4-3-1	98.17^{c}	37.43^{f}
IR81528-15-3-2-2-PR	113.73^{b}	49.03^{bc}
PR34131-B-21-1	98.43^{c}	49.33^{bc}
PR34126-B-2	97.67^{c}	39.83^{ef}
IR82737-B-B-B-B-182	115.73^{b}	48.50^{bc}
$PSBR_C$ 46	128.87^{a}	42.90^{de}
IR83140-B-11-B	113.87^{b}	50.17^{b}
PR34131-B-20-1	97.97^{c}	41.17^{b}
IR83140-B-28-B	114.33^{e}	50.80^{b}
Ketnel	87.90^{d}	41.77^{e}
CV (%)	1.35	3.90

Means followed by common letters are not significantly different at 5 % level of significance

followed by IR82187-17-3-2-1-2 with a mean of 116.27 while NSIC R_C 104 and Ketnel had the lowest number of grains per panicle with mean of 89.23 and 87.90, respectively. This result seem to suggest that PSBRc 46 has the greatest number of grains among the entries tested. Panicle with an optimum number of grains had a greater yield than those of many compacted grains in a panicle (Fang, 2005).

Number of Filled Grains Per Panicle

The result on filled grains per panicle is shown in Table 7. It was observed that NSIC R_C 104 had the most number of filled grains (62.87) followed by IR83140-B-28-B (50.80). In contrast, PR34110-B-4-3-1 produced the lowest number of filled grains per panicle. Most of those varieties that are resistant to pests and diseases had a high percentage of filled grains than unfilled (Fang, 2005).

Grain yield and Computed
Grain Yield per Hectare

Total and computed grain yield of the different rice entries is shown in Table 8. Statistical analysis shows that NSIC R_C 104 produced the highest computed grain yield over IR81551-2-1-3-3-2-PR and IR 82737-B-B-B-B-182 with a mean of 2.75 kg per hectare. PR 34126-B-10 and PR34131-B-20-1 obtained the lowest grain yield per plot with a mean of 1.14 kg. In corresponding to the computed grain yield per hectare, NSIC Rc 104 gained the highest while PR34126-B-10 and PR34131-B-20-1 obtained the lowest. Such differences could be attributed to their varietal differences and compactness of grains in the panicle.

Table 8. Total and computed grain yield of the fourteen rice entries

ENTRY	GRAIN YIELD	
	TOTAL (kg/ 9.6m^2)	COMPTUED (t/ha)
IR81551-2-1-3-3-2-PR	2.12^{ab}	2.21^{ab}
PR34126-B-10	1.14^{e}	1.19^{e}
NSIC R$_C$ 104	2.75^{a}	2.87^{a}
IR82187-17-3-2-1-2	1.90^{c}	1.98^{c}
PR34110-B-4-3-1	1.21^{cd}	1.26^{cd}
IR81528-15-3-2-2-PR	2.04^{b}	2.13^{b}
PR34131-B-21-1	2.10^{ab}	2.19^{ab}
PR34126-B-2	1.15^{d}	1.20^{d}
IR82737-B-B-B-B-182	1.97^{b}	2.05^{b}
PSBR$_C$ 46	2.20^{ab}	2.29^{ab}
IR83140-B-11-B	1.60^{c}	1.67^{c}
PR34131-B-20-1	1.14^{d}	1.19^{d}
IR83140-B-28-B	2.07^{ab}	2.16^{ab}
Ketnel	1.16^{d}	1.21^{d}
CV (%)	10.12	11.11

Means followed by common letters are not significantly different at 5 % level of significance

<u>Weight of 1000 Filled Grains</u>

Table 9 and Figure 4a-d show the weight of 1000 grains. It was gathered that PR34131-B-20-1 gained the heaviest weight with a mean of 30.33 grams followed by

IR 81528- 15-3-2-2- PR with a mean of 29.67 grams. On the other hand, PR 34110-B-4-3-1 and PR34131-B-21-1 were the lightest with a mean of 21.33 and 20.67 grams,

Table 9. Weight of 1000 grains of the fourteen rice entries

ENTRY	WEIGHT OF 1000 GRAINS (g.)
IR81551-2-1-3-3-2-PR	27.00[e]
PR34126-B-10	25.00[c]
NSIC R_C 104	26.00[d]
IR82187-17-3-2-1-2	26.00[d]
PR34110-B-4-3-1	21.33[b]
IR81528-15-3-2-2-PR	29.67[f]
PR34131-B-21-1	20.67[a]
PR34126-B-2	25.33[cd]
IR82737-B-B-B-B-182	26.00[d]
PSBR_C 46	27.67[ef]
IR83140-B-11-B	27.67[ef]
PR34131-B-20-1	30.33[g]
IR83140-B-28-B	29.67[f]
Ketnel	25.00[c]
CV (%)	5.74

Means followed by common letters are not significantly different at 5 % level of significance

respectively. Well dried and fully ripened grains are lighter than soft grains wherein soft grains had higher moisture content that made it heavier (Jagadish, 2007).

Insect Pest Evaluation

Table 10 shows the evaluation of stem borer expressed as dead hearts and white heads which was done before booting and after heading, respectively. For dead hearts, it

Table 10. Reaction to Stem Borer of the fourteen rice entries

ENTRY	WHITE HEADS		DEAD HEARTS	
	Rating	Remarks	Rating	Remarks
IR81551-2-1-3-3-2-PR	5	I	3	MR
PR34126-B-10	7	MS	5	I
NSIC R_C 104	3	MR	1	R
IR82187-17-3-2-1-2	5	I	3	MR
PR34110-B-4-3-1	5	I	3	MR
IR81528-15-3-2-2-PR	7	MS	5	I
PR34131-B-21-1	7	MS	5	I
PR34126-B-2	7	MS	5	I
IR82737-B-B-B-B-182	5	I	3	MR
PSBR_C 46	7	S	5	I
IR83140-B-11-B	5	I	3	R
PR34131-B-20-1	7	MS	5	I
IR83140-B-28-B	7	MS	5	I
Ketnel	5	I	3	MR
CV (%)	0.00		0.00	

Means followed by common letters are not significantly different at 5 % level of significance

was found that NSIC R_C 104 was the most resistant while PR34126-B-10, IR81528-15-3-2-2-PR, PR34131-B-21-1, PR34126-B-2, $PSBR_C$ 46, IR83140-B-11-B and IR83140-B-28-B were found to be intermediate. On white heads, NSIC Rc 104 was the most resistant while PR34126-B-10, IR81528-15-3-2-2-PR. PR34131-B-21-1, PR34126-B-2, PSBRc 46, PR34131-B-20-1 and IR83140-B-28-B were found susceptible. Rice stem borers are serious pests of rice. They infest plants from the seedling stage to maturity and mostly likely during ripening stage but it could be treated by applying lannate and curzate (IRRI, 2007). Furthermore, NSIC Rc 104 could be used by the farmers for further evaluation.

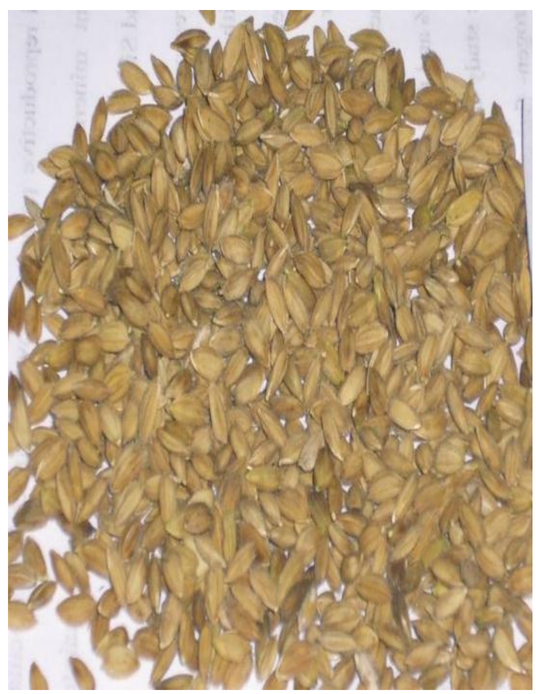
Blast (neck rot)

Rice blast disease evaluation was taken before harvest. It was observed that all entries were resistant to neck rot. The fungus is able to infect and produce lesions on all organs of the rice plant except the root (Kato, 1999). In addition, all entries could be further evaluated by farmers as it was found highly resistant.

Ketnel

NSIC 104

PSBRc 46



IR81551-2-1-3-3-2-PR

Figure 4a. Grains of the fourteen entries

PR34126-B-10

IR82187-17-3-2-1-2

PR34110-B-4-3-1

IR81528- 15- 3-2-2-PR

Figure 4b. Grains of the fourteen rice entries

PR34131-B-21-1

PR34126- B-2

IR82737-B-B-B-B-182

IR83140- B- 11- B

Figure 4c. Grains of the fourteen rice entries

PR34131-B-20-1

IR83140-B-28-B

Figure 4d. Grains of the fourteen rice entries

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

PSBRc 46 and NSIC 104 produced the highest number of tillers and productive tillers. In contrast, Ketnel gained the lowest number of tillers and productive tillers.

NSIC Rc 104 was the earliest to boot and it was found to have highly fertile spikelet. On the other hand, Ketnel was the latest to boot. NSIC Rc 104 produced the longest panicle and highest number of filled grains. Consequently, it gained the highest yield. Ketnel recorded the lowest yield.

PSBRc 46 was the earliest to form head and ripen, while Ketnel was the latest. It also obtained the highest number of grains per panicle in contrast with Ketnel which produced the lowest.

Furthermore, PR 3410-B-4-3-1 was the tallest at maturity while Ketnel was found the shortest. Also, PR34131-B-20-1 had the heaviest weight of 1000 filled grains.

Conclusion

Results showed that NSIC Rc 104, IR81551-2-1-3-3-2-PR and PSBRc 46 had good growth performance and yield. These varieties showed significant differences on rate of recovery, tiller number, number of productive tillers per hill, length of panicle, number of grains per panicle, number of filled grains per panicle, grain yield per plot, weight of 1000 grains and computed grain yield per hectare.

NSIC R_C 104 was the earliest to boot and ripen. Consequently, it produced the highest yield. Most of the entries were susceptible to white heads and dead hearts that resulted to a low yield.

Recommendation

All entries need further evaluation for more stable results under cool-elevated condition and within other seasons.

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