AGRARIS: Journal of Agribusiness and Rural Development Research

Vol. 3 No.1 Januari 2017

NYOMAN NGURAH ARYA[1)],I KETUT MAHAPUTRA[1)], AND SUHARYANTO[2)]

[1)] Assessment Institute for Agricultural Technology (AIAT) of Bali
E-mail: arya_ngurah66@yahoo.com
[2)]Assessment Institute for Agricultural Technology (AIAT) of Bangka Belitung Islands
E-mail: suharyanto.bali@gmail.com

The Efforts for Productivity and Income Improvement of Rice Farming Through the Use New Superior Variety (Case Study)

DOI: 10.18196/agr.3142

ABSTRACT

Various efforts to increase rice production have been done in order to achieve rice self-sufficiency and food security, one of which is the creation of some New Superior Varieties (NSVs) of paddy. This study aimed to analyze the productivity, income, and efficiency of rice farming of New Superior Varieties, including Inpari 29, Inpari 31, and Inpari 32. This research was conducted on December 2014 until April 2015 in SubakGubug I, Gubug village, as one of the centers of rice production in Tabanan Regency. The study involved 30 farmers who planted those three new superior varieties in 9.38 hectares of wet land area. Each farmer used as replicates. Data were collected using interview and direct observation. Data was analyzed by Analysis of Variance (ANOVA). The results showed that Inpari 31 variety have the highest productivity, the highest revenue, the most efficient, and significantly different from the Inpari 29 and 32. Multiplication and dissemination of Inpari 31 variety to farmers can be done as soon as possible to increase rice production, achieve rice self-sufficiency and food security.

Keywords*: efficiency, inpari,paddy,productivity*

INTRODUCTION

Efforts to achieve self-sufficiency and food security, particularly rice, ahead looks set to face tough challenges, due to rapid population growth and conversion of paddy fields.In another aspect, the paddy soil fertility declines as management intensifies less attention to the balance of nutrients in the soil. The success of efforts to increase production, productivity and income of farmers depend on the ability of the provision and adoption of production technologies that include improved varieties, seed quality, and other related technological innovations (Jamal, 2009). Sembiring and Widiarta (2008) stated that, the success of increasing rice production was dominated by increasing in productivity than an increase in harvested area.

Various technological innovations have been produced as an effort to increase production, productivity, and income of rice farming, one of which is the creation of new superior varieties of paddy. High yielding varieties of paddy is believed to be one of the success key of increasing rice production (Sembiring and Widiarta, 2008; Hossain et al., 2006). Suwarno (2000) stated that, varieties of paddy have been able to increase the productivity of rice. Similar disclosed by Las (2002) *in*Susanto et al. (2003) that, the role of varieties along with fertilizer and water to increase productivity reached 75%. Furthermore, Suhartatik and Makarim (2010) revealed that the superior varieties have high yields because they have physiologicalcharacter in accordance with its environment.

Generally, the most farmers in Bali have planted Ciherang variety of paddy. A variety is used continuously in very long time can trigger an attack of pest is

increasing. Ciherang productivity on average 6.2 t/ha. IndonesianAgency for AgricultureResearch and Development (IAARD) until now been widely released several new superior varieties(NSVs) of paddy. There are several objectives of the creation and release of several varieties of rice, two of which are (1) an effort that the farmers can make rotation of varieties, which is expected to cut the cycle of pests and (2) to increase rice production.Related to some NSVs of paddy being created by IAARD, in which there are varieties Inparitypes, three of which are Inpari 29, 31, and 32.

The new superior variety (NSV) of Inpari 29 is suitable to be planted in irrigated rice lowlands paddy fields to an altitude of 400 m above sea level. This NSV is also resistant to immersion of flooding. The NSVs of Inpari 31 and 32 are suitable to be planted in lowland paddy fields to a height of 600 meters above sea level. The NSV of Inpari 29 was released in 2012, while the NSVs of Inpari 31 and 32 were released in 2013. Those varieties were introduced through assessments in SubakGubug I in 2014 and not yet available at the market. This study aimed to analyze the productivity, income, and efficiency of those new superior varieties.

METHOD

This study was conducted in SubakGubug I, in the Gubug village, Tabanan Regency, in December 2014 until April 2015. Tabanan is the largest rice producer in Bali province. The number of respondents in this study were 30 farmers who determined by random sampling. They were implemented the assessment of NSVs of Inpari 29, 31, and 32. Each variety is planted by 10 farmers. Respondents were divided into three groups according to the NSV of paddy planted. Each group consisted of 10 farmers.

Primary data were collected by a survey method, which interviewed respondents directly using a structured questionnaire (Sangarimbun and Effendi, 1989). The primary data include a land area, number and type of means of production, total costs of production, amount of production, price of grain/kg, etc. The secondary data were obtained from the results of previous research related to the research.The variables measured were limited to the amount of rice production whichwas obtained in the form of dry grain harvest and the amount of revenue and income are received by farmers. The average difference in production and revenues of those varieties were analyzed by analysis of variance (Sugiyono, 2011).

The rice farming profit can be determined by calculating the margin of the total revenue and total rice farming costs. Total revenue is the amount of grain production multiplied by the price per kilogram of grain. Total cost is all expenditure that used in the production process of rice farming, in the form of fixed costs and variable costs. Mathematically, farming profits formulated (Soekartawi, 1995), as follows:

$$I = TR - TC$$
$$= P.Q - (FC + VC)$$

where,

I = income (profit);P = the price of per unit rice production; Q = total rice production;FC = fixed cost; VC = variable cost

The level of efficiency of rice farming analyze using R/C ratio, mathematically is formulated as follows:

$$R/C\ ratio = \frac{TR}{TC}$$

where,

TR = total revenue; and TC = total cost

The average difference of rice production and its incomes were analyzed by analysis of variance (ANOVA) by F-test for more than two groups of samples. Its hypothesisis:

1. H_0: μ1 = μ2 = μ3, that means the average difference in grain production and rice farming income between groups is not significant.
2. H_1:at least two average values are different,that means the average difference in grain production and rice farming income between groups is significant.

The steps in to test the hypothesis by ANOVA, include (Wibisono, 2009):

1. Variance between groups is formulated as follows:

$$S_{\bar{x}}^2 = \frac{1}{(r-1)} \sum_{i=1}^{r} (\bar{x}_i - \bar{x})^2 \quad \ldots\ldots\ldots\ldots (1)$$

2. Variance within groups is formulated as follows:

$$S_i^2 = \frac{1}{n_i - 1} \sum (X_{ij} - \bar{x}_i)^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

3. Variance of population is formulated as follows:

$$S_t^2 = \frac{\sum (n_i - 1)\, S_i^2}{r\,(n-1)} \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

4. Value of distribution F (F-count) can be obtained by the formula:

$$F\text{-count} = \frac{n.S_{\bar{x}}^2}{S_t^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where,

r = number of groups

$\bar{x}_i$ = mean of each group

$Y\text{«}$ = mean of all groups
n = the number of samples in each group
X_{ij} = value of each observation

Furthermore, the value of the F-count compared with the F-table:

If F-count > F-table: H_0 is rejected
if F-count < F-table: $H_0$is accepted

If the F-test results show that between samples have an average difference is significant, then followed by Least Significant Differences (LSD) test. Value of LSD is obtained from the following equation:

$$LSD_{\alpha} = (t_{\alpha}, df_e). \sqrt{\frac{2\,(MS_e)}{r}} \quad \ldots\ldots\ldots\ldots (5)$$

where,

t_{α} = distribution of t-student
df_e = degree of freedom error
MS_e = mean squares error

RESULTS AND DISCUSSION

SubakGubug I is located in the lowlands and the semi technical irrigated land.SubakGubug I has 234 hectares of wet land and 749 farmers, so that every farmer managed 0.35 hectares wet land in average. The cropping pattern is applied in a year is paddy - crops - paddy. The first rice planting season is in rainy season, on November to February, the second rice planting is in dry season, on June to September, and on March to Junethe farmers plant crops.

THE USING OF LABOR

Labor allocated in managing rice farming comes from farmer's family and outside the family. The employment of family activities is generally devoted to sow, irrigate, fertilize, control pests and diseases, and clean up the embankment.The activities of tilling the soil, planting paddy, and weeding using labor from outside the family. Weeding jobs are paid based on the number of working hours, while the paddy planting and tilling the soil is done in bulk by area (per hectare). Tillage is done by a tractor.

Among three groups of samples, group of farmers who planted NSV of Inpari29used the least labor (Table 1).Farmers who plant NSV of Inpari 29 using the least amount of labor, because most of them are the main livelihood outside of the agricultural sector, such as hotel employees and construction workers.

TABLE I. THE USING OF LABOR PER HECTARE

Activities	Sum of labor based on farmers sample groups (person days)		
	Inpari 29	Inpari 31	Inpari 32
Tillage	11.58	10.56	10.57
Planting	12.00	12.00	13.00
Weeding	13.67	13.73	14.23
Irrigating	5.21	6.13	6.02
Controlling of pest	2.01	2.56	2.21
Cleaning up the embankment	2.04	2.04	1.94
Harvesting	19.35	20.25	20.15
Total	65.86	67.26	68.12

Source: Primary Data (analyzed)

The planting and weeding is done by workers from outside the family and most of them are women, because of the availability of labor in the family is very limited (an average of two people per farm household) and most of farmers also work in other sectors, such as in the tourism sector, buildings, etc. The Harvesting carried out by workers coming from outside of Bali, because the local harvest labor is limited.

PRODUCTION FACILITIES

In rice farming, the type of production facilities that are used in addition to labor, are seed, fertilizer, and pesticides. The use of production facilities in the type, amount, and timing will be able to provide maximum production. The amount of seed which used an average of 38.75 kilogram per hectare for the farmers who planted NSV of Inpari 29 (Table 2). This amount exceeds the recommended, namely 30 kilograms per hectare. Farmers tend to use beyond recommended because they anticipated for replanting if there are plants die.

TABLE 2. THE TYPE AND NUMBER OF PRODUCTION FACILITIES PER HECTARE

Type of production facilities	Amount (kg/ha)		
	Inpari 29	Inpari31	Inpari 32
Seed	38.75	30.19	29.49
Urea	270.93	244.69	249.14
Nitrogen, Phosphate, and potassium (NPK)	279.41	274.56	275.69
Organic fertilizer	608.95	1,081.81	929.77

Source: Primary Data (analyzed)

The using of urea more than recommended but using of nitrogen, phosphate, and potassium (NPK) less than recommended. Department of Agriculture Tabanan Regency recommended 100 kilograms per hectare for urea and 300 kilo-

grams per hectare for NPK. Improper using of fertilizers which will have an impact on rice production is not optimal.

PRODUCTION COST

The production cost of rice farming in the study site, consists of fixed cost and variable cost. The fixed cost includes property tax, subak dues, depreciation of equipment, and offerings. The variable cost consists of the purchase of seeds, fertilizers, pesticides, and labor (Table 3). Expenditures are calculated as cost of production in this paper is all expenses paid in cash, while no cash cost is not included in the analysis, such as labor within family.

Tillage and planting paddy are paid by the piece (one hectare = Rp 1,200,000), while weeding is paid as a daily labor (one day = 8 hours) with a wage of Rp 80,000 per person days. Wages harvest is Rp 60,000 per quintal of grain. Among the production cost components, harvesting needed the highest cost that is in average 44.67% depending on the amount of rice production is obtained, while depreciation of equipment needed the lowest cost, so that in average 0.92%. The farmers group who planted NSV of Inpari 31 needed the highest cost of production, while the farmers group who planted Inpari 32 needed the lowest production cost.

The total cost of rice farming is not determined by the variety of paddy, but depend on the habits of farmers. Farmers in the research site seems to have not been able to manage his farm efficiently. The using of seeds and urea fertilizer were higher than the recommended.

Rice Production

The rice harvest was done in the early to mid-April 2015 after the rice plants aged 105-115 days after planting. The production is observed in real plot yields, in the form of dry grain harvest. The results showed that, NSV of Inpari 31 have the highest productivity, while NSV of Inpari 29 have the lowest productivity.Productivityof Inpari 31 is 7,698 kg/ha;Inpari 32 is 7,149kg/ha; and Inpari 29 is 6,909 kg/ha.

The results of this study differentwith Jamil et al. (2015) whose states that, NSV ofInpari 29 has a higher yield than NSVs of Inpari 31 and 32. According to Jamil (2015), NSV of Inpari 29 had an average yield of 6.5 tons/ha; NSV of Inpari 31 has yield on average 6 tons/ha; and the yield ofInpari 32 on average 6.3 tons/ha. The differences are guessed to be affected by agro-ecosystem and farmer's management. Farmers who plant NSV of Inpari 29 using a large excess of urea fertilizer, that's why the intensity of pests and diseases is quite high and many plants are fall down. According to Wahid (2003) the excess fertilizer N in rice can increase pests and diseases, plant fall down, and extend the life of the plant.Kasniari and Supadma(2007) stated that, excessive N fertilizer also have an impact on the increasing number of empty grain that affect rice production to be low.

Revenue and Incomeof RiceFarming

The farming system is not only focused on the production and productivity aspects, but also on the revenue aspect. The production process of farming system combined various production factors under their control, basically aims

TABLE 3. THE COST OF RICE FARMING PER HECTARE IN SUBAKGUBUG I IN DECEMBER 2014

Type of cost	Sum of cost (Rp)		
	Inpari 29	Inpari 31	Inpari 32
Fixed costs			
a. Property tax	150,000	150,000	150,000
b. Subak dues	100,000	100,000	100,000
c. Depreciation of equipment	90,667	90,222	86,667
d. Offerings	296,500	290,000	275,000
Sub-total	637,167	630,222	611,667
Variable costs			
a. Seed	297,053	303,285	299,204
b. Urea	487,680	440,440	448,445
c. Nitrogen, phosphate, and potassium (NPK)	642,633	650,644	645,583
d. Pesticides	617,261	655,834	665,828
e. Labor (tillage, plant, and weeding)	3,493,600	3,498,400	3,538,400
f. Harvesting	4,145,538	4,619,125	4,289,491
Sub-total	9,683,765	10,167,728	9,483,351
Total cost	10,320,932	10,797,950	10,095,018

Source: Primary Data (analyzed)

to acquire several outputs, revenue, and profit. Farm revenue is the total value of farm products within a specified period, whether sold or not sold. Farm income (profit) is margin between total revenues and total production costs (Soekartawi, 1995). Prices farmers receive an average Rp 4,243 per kilogram, in the range of Rp 4,100 to Rp 4,500per kilogram.

TABLE 4. THE REVENUE, COST, AND PROFIT OF RICE FARMING PER HECTARE

Commentary	Amount (Rp)		
	Inpari 29	Inpari 31	Inpari 32
Revenue	28,948,329	33,231,471	30,258,280
Cost	10,320,932	10,797,950	10,095,018
Profit	18,627,397	22,433,520	20,163,262
RC ratio	2.81	3.08	3.00

Source: Primary Data (analyzed)

Table 4 showed that, NSV of Inpari 31 provides the highest revenue and income. The NSV of Inpari 31 is also the most efficient. Revenues, income, and efficiency of rice farming system are influenced by the number and types of production factors, the price of production factors, and product prices is received by farmers.

THE RESULTS OF ANALYSIS BY ANOVA

Paddy productivity

Based on an analysis of variance is known that value of F-count is 8.361, while F-table is 5.488 (F-count > F-table) with a value of p = 0.001 (p < 0.01). There are differences in means productivity among those varieties (Table 5). Therefore, H_0 is rejected or H_1 is accepted.

TABLE 5. THE RESULT OF ANOVA ANALYSIS FOR PADDY PRODUCTIVITY

	Sum of Squares	DF	Mean Square	F	Sig.
Between Groups	3,274,687	2	1,637,343	8.361	0.001
Within Groups	5,287,423	27	195,830		
Total	8,562,110	29			

Source: Primary Data (analyzed)

Based on the results of ANOVA analysis (Table 5), then followed by Least Significant Differences (LSD) analysis. The results of LSD analysis showed that,means productivity of Inpari 31 was significantly different with the two other varieties (p < 0.01). But, between NSVs of Inpari 29 and Inpari 32 had no significant which was showed by p = 0.236 (p > 0.05) (Table 6).

The result indicates (Table 6) that, NSV of Inpari 31 is the most appropriate variety with the agro-ecosystem in SubakGubug I, so it has the best performance among those varieties.The NSV of Inpari 31 has the greatest opportunities develop in areas that have the same agro-ecosystem with SubakGubug I.

TABLE 6. THE RESULT OF LSD ANALYSIS FOR PADDY PRODUCTIVITY

(I) varieties and its mean productivity (kg/ha)	(J) varieties and its mean productivity (kg/ha)	Mean Difference (I-J) (kg/ha)	Sig.
Inpari 29 6,909	Inpari 31 7,698	-789**	0.000
	Inpari 32 7,149	-240ns	0.236
Inpari 31 7,698	Inpari 29 6,909	789**	0.000
	Inpari 32 7,149	549**	0.010
Inpari 32 7,149	Inpari 29 6,909	240ns	0.236
	Inpari 31 7,698	-549**	0.010

Source: Primary Data (analyzed)
Commentary: **= significant at level error 1%
ns = non significantly

The Rice Farming Profit

The result using analysis of variance (Table 7) showed that, the average revenues ofInpari 31 were significantly different from the two other varieties. Value of F-count is 8.788 but F-table is 5.488 (F-count > F-table) with a significance level (p) = 0.001(p < 0.01).

TABLE 7. THE RESULT OF ANOVA ANALYSIS FOR RICE FARMING PROFIT

Commentary	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.333E13	2	3.667E13	8.788	0.001
Within Groups	1.126E14	27	4.172E12		
Total	1.860E14	29			

Source: Primary Data (analyzed)

Based on the results of ANOVA analysis (Table 7), then followed by LSD analysis. The results of LSD analysis showsthat, means income difference of Inpari 31 and Inpari 29 was significantly at level error 1% ($p = 0.00$; $p < 0.01$) Means income difference between of Inpari 31 and 32 was significantly at level erros 5% ($p = 0.019$; $0.05 < p < 0.01$). But, between Inpari 29 and Inpari 32 had no significant is showed by $p = 0.104$ ($p > 0.05$) (Table 8).

TABLE 8. THE RESULT OF LSD ANALYSIS FOR RICE FARMING PROFIT

(I) varieties and its mean profit (Rp/ha)	(J) varieties and its mean profit (Rp/ha)	Mean Difference (I-J) (Rp/ha)	Sig.
Inpari 29 18,627,397	Inpari 31 22,433,520	-3.806.000**	0.000
	Inpari 32 20,163,262	-1.535.900^{ns}	0.104
Inpari 31 22,433,520	Inpari 29 18,627,397	3.806.100**	0.000
	Inpari 32 20,163,262	2.270.300*	0.019
Inpari 32 20,163,262	Inpari 29 18,627,397	1.535.900^{ns}	0.104
	Inpari 31 22,433,520	-2.270.300*	0.019

Source: Primary Data (analyzed)
Commentary: ** = significant at level error 1%
* = significant at level error 5%
ns = not significant

CONCLUSION

Inpari 31 has the highest productivity and significantly different with Inpari 29 and 32. Inpari 31 also provides the highest income and significantly different with Inpari 29 and 32. Among those varieties, Inpari 31 is the most efficient, with its RC ratio is 3.08.

Multiplication and dissemination of Inpari 31 variety can take immediately to improve rice production. The allocation of production factors to be carried out more carefully in order to improve the efficiency of rice farming system.

REFERENCES

Hossain, M., M.L. Bose, & B.A.A. Mustafi. 2006. Adoption and productivity impact of modern rice varieties in Bangladesh. *Journal of The Developing Economies*XLIV(2): 149-166.

Jamal, E.2009. Telaahan penggunaan pendekatan sekolah lapang dalam pengelolaan tanaman terpadu (PTT) padi: kasusdi Kabupaten Blitar dan Kediri, JawaTimur. *Jurnal Analisis Kebijakan Pertanian* 7(4): 337-349.

Jamil, A., Satoto, P. Sasmita, Y. Baliadi, A. Guswara, &Suharna. 2015. Deskripsi Varietas Unggul Baru Padi. *Badan Penelitian dan Penembangan Pertanian*.

Kasniari, D.A.N. & A.A.N. Supadma. 2007. Pengaruh pemberian beberapa dosis pupuk (N, P, K) dan jenis pupuk alternatif terhadap hasil tanaman padi (*Oryza sativa* L.) dankadar N, P, K Inceptisol Selemadeg Tabanan. *Jurnal AGRITROP* 26 (4):168-176.

Sembiring, H., &Widiarta, I.N. 2008. Inovasi teknologi padi menuju swasembada beras berkelanjutan.Dalam: A.K. Makarim*et al*. (eds.): Buku 2. *Inovasi Teknologi Tanaman Pangan. ProsidingSimposium V Tanaman Pangan*. PusatPenelitian Penelitian dan Pengembangan TanamanPangan, Bogor.

Singarimbun, M. dan S. Effendi. 1989. *MetodePenelitian Survey*. LP3ES, Jakarta.

Soekartawi, A. 1995. *Analisis Usaha tani*. UI Press, Jakarta.

Sugiyono, 2011. *Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif, dan R & D).*Edisi 12. Alfabeta, Bandung.

Suhartatik, E., & A.K. Makarim. 2010. Morfologi dan Fisiologi Tanaman Padi. *Balai Besar Penelitian Tanaman Padi*.

Susanto, U., A.A. Daradjat, & B. Suprihatno. 2003.Perkembangan pemuliaan padi sawah di Indonesia. *Jurnal Litbang Pertanian* 22(3): 125-131.

Suwarno. 2000. Orientasi penelitian plasma nutfah dan pemuliaan untuk menyongsong tantangan perpadian masa depan. *Apresiasi Seminar Hasil Penelitian Tanaman Padi*. Balai Penelitian Tanaman Padi, Sukamandi, 10"11 November 2000.

Wahid, A.S. 2003. Peningkatan efisiensi pupuk nitrogen pada padi sawah dengan metode bagan warna daun. *Jurnal Litbang Pertanian* 22 (4): 156-161.

Wibisono, Y. 2009. *Metode Statistika*. Cetakan Kedua (revisi). Gadjah Mada University Press, Yogyakarta.