AGRONOMIC EFFICIENCY OF RICE IN INCREASING HARVEST INDEX (HI 400) IN INTENSIVE RICE OF SIMALUNGUN REGENCY NORTH SUMATERA PROVINCE

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ABSTRACT

This study aimed to analyze the productivity and economic consequences of an increase in the intensity of rice cultivation on irrigated land technical, analyze the sustainability index models optimum rice cultivation intensified with increased cropping intensity on irrigated fields of technical, and develop policy strategies in the implementation of the model optimum rice cultivation intensively on technical irrigation field with integrated crop management (ICM) approach that lower methane emissions on an ongoing basis. This study uses a split plot design. Treatment irrigation system as factors main plot the watering system is disconnected and the system of continuous flow (inundated) and fertilization as a factor sub plot that fertilization treatment is done by recommendations to Permentan No. 40/2007 and fertilizer recommendations based on the laboratory analysis with 8 level fertilization treatment with 3 replications. Analysis of the data quality of soil, water, methane emissions, production and productivity of rice was done by analysis of variance or ANOVA for analysis and production, productivity and methane emissions test followed by Duncan Multiple Range Test (DMRT). Agronomic efficiency (AE) of each nutrient in season I showed the highest N AE obtained in A2B3 treatment (intermittent and fertilization to Permentan No.40 (100% dose) + probiotics) 47,4 kg grain/kg N, agronomic efficiency of N, P and K in season II showed the highest AE N (44 kg grain/kg N) obtained in A2B6 treatment, agronomic efficiency in season III shows A2B6 treatment AE N has the highest (60,8 kg grain/kg N), in season IV, and the highest AE N (85,1 kg grain/kg N) obtained at A2B8 treatment (intermittent and fertilization laboratory analysis (40% dose) + probiotics).

A. INTRODUCTION

The effort to fulfillment the rice needs of 230 million people of Indonesia today requires hard work by involving tens of millions of people facing various natural and market factors that are not always friendly and supportive. The supply of food, especially rice in sufficient quantities and affordable prices remains a top priority of national development. In addition to the staple food of more than 95% of the people of Indonesia, rice farming has also provided employment for approximately 36,1 million rural farm households, so that in terms of national food security functions become very important and strategic because it also influences the political order and stability National (Deptan, 2008).

The high growth of population and and the high consumption of rice keeps the rice needs growing. This means that production growth is not able to keep up with the increase of population (Hilman et al., 2010). In 2011 the population of 241,1 million people with consumption rate of 139,15 kg per capita rice per year (BPS, 2011). Efforts to increase production to fulfill increasing food needs in line with the increase of population can be obtained by strategies of land and water resource utilization, and utilization of technology resources.

The development of rice harvest index to 400 (rice HI 400) through increased intensity of planting is a promising option to increase rice production in North Sumatra Province in especially and national in general without the need for additional extraordinary irrigation. Rice HI 400 means that farmers xiucan plant and harvest rice four times in rotation in one year, continuously on the same land. Development of rice HI 400 requires four supporting pillars. First, the production of super seed short-lived with age less than 85 days. Second, support of integrated pest management (IPM). Third, integrated nutrient management and site specific. And fourth, efficiency of planting and harvest management.

Increasing the intensity of planting needs to be supported with integrated crop management (ICM) which includes the application of basic and supporting technological components. The basic technological components include: (1) the use of new superior varieties; (2) quality and labeled seeds; (3) increase of plant population with 4:1 or 2:1 jajar legowo system; (4) location appropriate and balanced fertilization (based on soil analysis), Paddy Soil Test Kit (PSTK), Permentan No. 40/OT.140/4/2007, use of Leaf Color Chart (LCC); (5) control of plant pest organism through integrated pest control (IPC); and (6) the provision of organic fertilizer. Supporting technological components include: (1) proper tillage; (2) planting young seedlings 15 days; (3) planting seed one seedlings per planting hole; (4) intermittent irrigation, and (5) harvesting on time (Irianto, 2008).

Increased productivity, efficiency of soil and water in dry-climate agriculture in globalization is needed agriculture resource management strategy. Strategies for optimizing production management in addressing environmental, health and food issues need to be done so as to be able to exist in conditions of climate change, land and water degradation and land conversion (Munir, 2012). Farmers are interested if economically efficient. This means economic efficiency when technically efficient (Tien, 2011). Efforts to improve the efficiency of N fertilizer use can be achieved by planting improved varieties that respond to N administration and improving cultivation methods, including proper crop density, proper irrigation, and appropriate N fertilization, both the dose, N (Wahid, 2003). Factors influencing production efficiency are farmers' ages and education levels, dummy variables of season, farmers group, land owner status, rice farming location, and number of parcel of land ownership (Kusnadi et al, 2011).

B. MATERIAL AND METHODS

Location and Time of Study

Simalungun Regency North Sumatera Province was chosen as the study location because it is the main rice production center in North Sumatera Province. Has a technical irrigation land area of 41.694 hectares of total rice field area of North Sumatra Province 329.254 hectares. The study location for intensive rice cultivation was has been implemented in Nagori (Purbaganda Village), Pematang Bandar Subdistrict, Simalungun Regency. The location of this study was chosen because it is a technical irrigation rice field that has water supply for 11 until12 months in one year as the main condition of application of rice harvest index 400.

Analysis of soil samples and water quality has been done at Soil Laboratory Assessment Institute for Agricultural Technology (AIAT) North Sumatera and Environment Center Laboratory of North Sumatera Province, dan methane emission analysis at Greenhouse Gas Laboratory of Agricultural Environment Research Center, Jakenan Pati, Central Java. The study began in January 2011 until December 2012 (24 months).

Types and Data Sources

The data collected includes biophysical and socioeconomic data of the community, conducted by direct observation or literature study, report collection and measurement data of research institutions. Sources of data are from selected respondents for in-depth interviews to obtain data and information on socioeconomic status. Biophysical data obtained by means of observation, experiment and measurement in situ, data from laboratory especially data processing materials or field samples are processed in the laboratory.

Early observation and data collection were conducted by measuring the soil physic , soil chemistry and water at the beginning conditions before the plot treatment activity was done. Observations on the conditions in the research plots were done on the following parameters: (1) soil quality (soil chemistry) during the four seasons includes soil pH, nitrogen (N), phosphate (P), potassium (K) and organic carbon, in accordance with the soil chemistry properties from the Soil Research Center Bogor; (2) quality of paddy water in inlet, mapped and in outlet for four seasons includes water pH, temperature, electrical conductivity (EC), nitrogen total, phosphate, potassium, calcium (Ca), magnesium (Mg), natrium (Na) and iron (Fe), referring to Government Regulation No. 82 on 14 December 2001 the Management of Water Quality and Water Pollution Control; (4) agronomic efficiency and (5) supporting data include agronomic crop performance: vegetative data consist of plant height, maximum productive rice saplings, plant biomass and dry weight of sterilization. Generative data consits of Dried Harvested Grain (GKP) and Dried Unhusked Grain (GKG) with a water content equivalent to 14%. The yield component includes the number of productive rice saplings, grain per panicles, unhulled grains, empty grains, percentage of unhulled grain, weight of 1000 grains and the Harvest Index (HI); (7) secondary data for modeling; (8) counted economic data include input and output data for four seasons.

Statistical Analysis

Agronomic efficiency is to see an increase in grain yield per kilogram from the provided fertilizer (Singh et al., 1988), with the following formula:

Aex = (Ynpk-Yox) / Fx

Aex = grain yield increasing (kg/hectare)

Ynpk = grain yield with fertilization (kg/hectare)

Yox = grain yield without fertilizer (kg/hectare)

Fx = dose fertilizer used (kg/hectare)

C. RESULTS AND DISCUSSION

Efficiency of nutrient use by Mosier et al. (2004) and Witt et al. (1999) can be expressed in the form of agronomic efficiency, ie kilograms of yield increase per kilogram of nutrients given. Furthermore, Witt (2005) suggests that the level of agronomic efficiency at a site greatly determines from the amount of fertilizer provided. The higher the agronomic efficiency, the smaller the amount of fertilizer provided. Otherwise, the lower the agronomic efficiency the higher the amount of fertilizer. Furthermore, it was stated that the amount of fertilizer given did not guarantee the increase in yield.

The agronomic efficiency (AE) of each nutrient in season I presented in Table 5.13. Showed the highest AE N obtained at A2B3 treatment (intermittent and fertilizing Permentan No. 40 (100% dose) + probiotics) 47,4 kg grain/kg N, followed by A2B6 treatment (intermittent and fertilizing laboratory analysis (100% dose) + probiotics) 42,2 kg grain/kg N, and A2B2 treatment (intermittent and fertilizing laboratory analysis) 39,1 kg grain/kg N. The highest EA P also obtained at A2B3 treatment (197,4 kg grain/kg P), followed by A2B6 treatment (170,3 kg grain/kg P) and A2B2 treatment (intermittent and fertilizing laboratory analysis) 157,6 kg grain/kgP. The highest AE K also obtained at A2B3 treatment (177,7 kg grain/ kgK), followed by A2B1 treatment (intermittent and fertilizing Permentan No. 40) and A2B4 treatment (intermittent and fertilizing Permentan No. 40 (70% dose) + probiotics), each as much 132,3 and 120,2 kg grain/kg K. While the lowest AE nutrients N, P, K was obtained in A1B8 treatment (inundated and fertilized laboratory analysis (40% dose) + probiotics), 10,3 kg grain/kg N; 41,36 kg grain/kg P; and 22,8 kg grain/kg K.

Table 1. Agronomic efficiency in some combination of fertilization in season I in Purbaganda Village, Pematang Bandar Subdistrict, Simalungun Regency

Treatment	N, P, K application (kg/hectare)	Dried unhusked grain (ton/hectare)	Increased yield (kg/hectare)	Agronomic Efficency (kg grain/kg nutrient)		
				N	P	K
Zero treatment	-	3.000*	-	-	-	-
A1B1	112,5 N+27 P_2O_5+30 K_2O	6.318	3.318	29,5	122,9	110,6
A1B2	90 N+22,3 P_2O_5+40,8 K_2O	5.497	2.497	27,7	111,9	61,2
A1B3	112,5 N+27 P_2O_5+30 K_2O	6.630	3.630	32,3	134,4	121,0
A1B4	78,8 N+18,9 P_2O_5+21 K_2O	5.185	2.185	27,7	115,6	104,0
A1B5	45 N+10,8 P_2O_5+12 K_2O	3.967	967	21,5	89,5	80,6
A1B6	90 N+22,3 P_2O_5+40,8 K_2O	6.205	3.205	35,6	143,6	78,6
A1B7	63 N+15,6 P_2O_5+28,5 K_2O	3.853	853	13,5	54,6	29,9
A1B8	36 N+8,9 P_2O_5+16,3 K_2O	3.372	372	10,3	41,6	22,8
A2B1	112,5 N+27 P_2O_5+30 K_2O	6.970	3.970	35,3	147,0	132,3
A2B2	90 N+22,3 P_2O_5+40,8 K_2O	6.517	3.517	39,1	157,6	86,2
A2B3	112,5 N+27 P_2O_5+30 K_2O	8.330	5.330	47,4	197,4	177,7
A2B4	78,8 N+18,9 P_2O_5+21 K_2O	5.525	2.525	32,1	133,6	120,2
A2B5	45 N+10,8 P_2O_5+12 K_2O	4.278	1.278	28,4	118,4	106,5
A2B6	90 N+22,3 P_2O_5+40,8 K_2O	6.800	3.800	42,2	170,3	93,1
A2B7	63 N+15,6 P_2O_5+28,5 K_2O	4.023	1.023	16,2	65,5	35,8
A2B8	36 N+8,9 P_2O_5+16,3 K_2O	3.457	457	12,7	51,1	28,0

A1 = inundated, A2 = intermittent, B1 = fertilization Permentan No. 40, B2 = fertilization laboratory analysis, B3 = fertilization Permentan No. 40 (100% dose) + probiotics, B4 = fertilization Permentan No. 40 (70% dose) + probiotics, B5 = fertilization Permentan No. 40 (40% dose) + probiotics, B6 = fertilizer laboratory analysis (100% dose) + probiotics, B7 = fertilizer laboratory analysis (70% dose) + probiotics), B8 = fertilization laboratory analysis (40% dose) + probiotics

* yield of kg dried unhusked grain without fertilization

Agronomic efficiency of N, P and K nutrients presented in Table 5.14 shows the highest AE N (44 kg grain/kg N) was obtained at A2B6 treatment, followed by A2B2 treatment (42,2 kg grain /kg N) and A1B6 (41,9 kg grain/kg N). The lowest N agronomic efficiency was obtained in A1B5 and A1B7 treatment (10.8 kg grain/kg N). The highest AE P was obtained in A2B6 treatment (180,4 kg grain/kg P), followed by A2B2 and A1B6 treatment (170,3 and 169,0 kg grain/kg P). A2B1 treatment (intermittent and fertilization Permentan No. 40), gave the highest AE K (133,3 kg of grain/kg K), followed by A2B3 and A2B4 treatment (132,3 and 131,0 kg grain/kg K).

Table 2. Agronomic efficiency in some combination of fertilization in season II in Purbaganda Village, Pematang Bandar Subdistrict, Simalungun Regency

Treatment	N, P, K application (kg/hectare)	Dried unhusked grain (ton/hectare)	Increased yield (kg/hectare)	Agronomic Efficency (kg grain/kg nutrient)		
				N	P	K
Zero treatment	-	3.000*	-	-	-	-
A1B1	112,5 N+27 P_2O_5+30 K_2O	5.893	2.893	25,7	107,2	96,4
A1B2	90 N+22,3 P_2O_5+40,8 K_2O	5.752	2.752	30,6	123,3	67,4
A1B3	112,5 N+27 P_2O_5+30 K_2O	5.950	2.950	26,2	109,3	98,3
A1B4	78,8 N+18,9 P_2O_5+21 K_2O	5.525	2.525	32,0	133,6	120,2
A1B5	45 N+10,8 P_2O_5+12 K_2O	3.485	485	10,8	44,9	40,4
A1B6	90 N+22,3 P_2O_5+40,8 K_2O	6.772	3.772	41,9	169,0	92,4
A1B7	63 N+15,6 P_2O_5+28,5 K_2O	3.683	683	10,8	43,7	23,9
A1B8	36 N+8,9 P_2O_5+16,3 K_2O	3.457	457	12,9	51,1	28,0
A2B1	112,5 N+27 P_2O_5+30 K_2O	6.998	3.998	35,5	148,1	133,3
A2B2	90 N+22,3 P_2O_5+40,8 K_2O	6.800	3.800	42,2	170,3	93,1
A2B3	112,5 N+27 P_2O_5+30 K_2O	6.970	3.970	35,3	147,0	132,3
A2B4	78,8 N+18,9 P_2O_5+21 K_2O	5.752	2.752	34,9	145,6	131,0
A2B5	45 N+10,8 P_2O_5+12 K_2O	4.108	1.108	24,6	102,6	92,4
A2B6	90 N+22,3 P_2O_5+40,8 K_2O	7.027	4.027	44,7	180,4	98,7
A2B7	63 N+15,6 P_2O_5+28,5 K_2O	4.194	1.193	18,9	76,4	41,8
A2B8	36 N+8,9 P_2O_5+16,3 K_2O	3.598	598	16,6	67,0	36,7

A1 = inundated, A2 = intermittent, B1 = fertilization Permentan No. 40, B2 = fertilization laboratory analysis, B3 = fertilization Permentan No. 40 (100% dose) + probiotics, B4 = fertilization Permentan No. 40 (70% dose) + probiotics, B5 = fertilization Permentan No. 40 (40% dose) + probiotics, B6 = fertilizer laboratory analysis (100% dose) + probiotics, B7 = fertilizer laboratory analysis (70% dose) + probiotics), B8 = fertilization laboratory analysis (40% dose) + probiotics

* yield of kg dried unhusked grain without fertilization

Agronomic efficiency in season III (Table 5.15) showed that A2B6 treatment had the highest AE N (60,8 kg of grain/kg N), followed by A1B6 treatment (50,7 kg grain/kg N) and A2B3 (48,1 kg grain/kg N). The highest AE P (245,1 kg of grain/kg P) was also obtained at A2B6, followed by A2B8 treatment (219,3 kg of grain/kg P) and A1B6 treatment (204,5 kg of grain/kg P). The highest AE K was obtained at A2B3 treatment (180,5 kg of grain/kg K), followed by A1B3 and A2B1 treatment, each as much 146,5 and 142,7 kg of grain/kg K.

Table 3. Agronomic efficiency in some combination of fertilization in season III in Purbaganda Village, Pematang Bandar Subdistrict, Simalungun Regency

Treatment	N, P, K application (kg/hectare)	Dried unhusked grain (ton/hectare)	Increased yield (kg/hectare)	Agronomic Efficency (kg grain/kg nutrient)		
				N	P	K
Zero treatment	-	3.000*	-	-	-	-
A1B1	112,5 N+27 P_2O_5+30 K_2O	6.800	3.800	33,8	140,7	126,6
A1B2	90 N+22,3 P_2O_5+40,8 K_2O	6.942	3.942	43,8	176,6	96,6
A1B3	112,5 N+27 P_2O_5+30 K_2O	7.395	4.395	39,7	162,8	146,5
A1B4	78,8 N+18,9 P_2O_5+21 K_2O	4.533	1.533	19,5	81,1	73,0
A1B5	45 N+10,8 P_2O_5+12 K_2O	3.655	655	14,5	60,6	54,6
A1B6	90 N+22,3 P_2O_5+40,8 K_2O	7.565	4.565	50,7	204,5	111,9
A1B7	63 N+15,6 P_2O_5+28,5 K_2O	3.797	797	12,7	51,0	27,9
A1B8	36 N+8,9 P_2O_5+16,3 K_2O	4.108	1.108	30,8	124,1	67,9
A2B1	112,5 N+27 P_2O_5+30 K_2O	7.282	4.282	38,0	158,6	142,7
A2B2	90 N+22,3 P_2O_5+40,8 K_2O	7.225	4.225	46,9	189,3	103,5
A2B3	112,5 N+27 P_2O_5+30 K_2O	8.415	5.415	48,1	200,6	180,5
A2B4	78,8 N+18,9 P_2O_5+21 K_2O	5.893	2.893	36,7	153,0	137,8

A2B5	45 N+10,8 P_2O_5+12 K_2O	4.335	1.335	29,7	123,6	111,2
A2B6	90 N+22,3 P_2O_5+40,8 K_2O	4.872	5.472	60,8	245,1	134,1
A2B7	63 N+15,6 P_2O_5+28,5 K_2O	4.902	1.902	30,2	121,7	66,6
A2B8	36 N+8,9 P_2O_5+16,3 K_2O	4.958	1.958	54,4	219,3	120,0

A1 = inundated, A2 = intermittent, B1 = fertilization Permentan No. 40, B2 = fertilization laboratory analysis, B3 = fertilization Permentan No. 40 (100% dose) + probiotics, B4 = fertilization Permentan No. 40 (70% dose) + probiotics, B5 = fertilization Permentan No. 40 (40% dose) + probiotics, B6 = fertilizer laboratory analysis (100% dose) + probiotics, B7 = fertilizer laboratory analysis (70% dose) + probiotics), B8 = fertilization laboratory analysis (40% dose) + probiotics
* yield of kg dried unhusked grain without fertilization

In season IV (Table 5.16), the highest N agronomic efficiency (85,1 kg of grain/kg N) was obtained at A2B8 treatment (intermittent and laboratory analysis fertilization (40% dose) + probiotics), followed by A1B8 and A2B5 treatment (72,5 and 70,6 kg grain/kg N). The highest AE P (343,0 kg grain/kg P) was also obtained at A2B8 treatment, followed by A2B5 and A1B8 treatment (294,1 and 292,3 kg grain/kg P). The highest AE K (264,7 kg grain/kg K) was obtained at A2B5 treatment, followed by A1B5 and A2B4 treatment (238,7 and 237,6 kg grain/kg K)

Treatment	N, P, K application (kg/hectare)	Dried unhusked grain (ton/hectare)	Increased yield (kg/hectare)	Agronomic Efficency (kg grain/kg nutrient)		
				N	P	K
Zero treatment	-	3.000*	-	-	-	-
A1B1	112,5 N+27 P_2O_5+30 K_2O	7.310	4.310	38,3	159,6	143,7
A1B2	90 N+22,3 P_2O_5+40,8 K_2O	6.743	3.743	41,6	167,7	91,7
A1B3	112,5 N+27 P_2O_5+30 K_2O	7.962	4.962	44,1	183,8	165,4
A1B4	78,8 N+18,9 P_2O_5+21 K_2O	6.998	3.998	50,8	211,5	190,4
A1B5	45 N+10,8 P_2O_5+12 K_2O	5.865	2.865	63,7	265,3	238,7
A1B6	90 N+22,3 P_2O_5+40,8 K_2O	7.197	4.197	46,6	188,0	102,8
A1B7	63 N+15,6 P_2O_5+28,5 K_2O	6.120	3.120	49,5	199,7	109,2
A1B8	36 N+8,9 P_2O_5+16,3 K_2O	5.610	2.610	72,5	292,3	159,9
A2B1	112,5 N+27 P_2O_5+30 K_2O	7.933	4.933	43,8	182,7	164,4
A2B2	90 N+22,3 P_2O_5+40,8 K_2O	7.423	4.423	49,1	198,2	108,4
A2B3	112,5 N+27 P_2O_5+30 K_2O	8.812	5.812	51,7	215,2	193,7
A2B4	78,8 N+18,9 P_2O_5+21 K_2O	7.990	4.990	63,4	264,0	237,6
A2B5	45 N+10,8 P_2O_5+12 K_2O	6.177	3.177	70,6	294,1	264,7
A2B6	90 N+22,3 P_2O_5+40,8 K_2O	8.160	5.160	57,3	231,2	126,5
A2B7	63 N+15,6 P_2O_5+28,5 K_2O	6.715	3.715	59,0	237,8	130,1
A2B8	36 N+8,9 P_2O_5+16,3 K_2O	6.063	3.063	85,1	343,0	187,7

A1 = inundated, A2 = intermittent, B1 = fertilization Permentan No. 40, B2 = fertilization laboratory analysis, B3 = fertilization Permentan No. 40 (100% dose) + probiotics, B4 = fertilization Permentan No. 40 (70% dose) + probiotics, B5 = fertilization Permentan No. 40 (40% dose) + probiotics, B6 = fertilizer laboratory analysis (100% dose) + probiotics, B7 = fertilizer laboratory analysis (70% dose) + probiotics), B8 = fertilization laboratory analysis (40% dose) + probiotics
* yield of kg dried unhusked grain without fertilization

Agronomic efficiency in the four seasons presented in Table 5.17 with the highest AE N (340 kg grain/kg N) was obtained in A2B6 treatment (intermittent and fertilizing laboratory analysis (100% dose) + probiotics). Dosage 90 N + 22,3 P_2O_5 + 40,8 K_2O kg/ha and the addition of probiotics to intermittent irrigation conditions, gave a higher yield of grain per kilogram N than other treatments. The nutrient content also increases the nutrient agronomic efficiency of P, characterized by a grain yield increase 745,3 grain kg/kg P. A2B2 treatment with the same nutrient dosage, but without the probiotic increase in grain yield per kilogram N is lower at 305,4 kg. At a dose of 112,5 N + 27 P_2O_5 + 30 K_2O kg/ha at A2B3 treatment (intermittent and fertilizing Permentan No. 40 (100% dose) + probiotics), gives an increase in grain yield of 294.2 kg and simultaneously provides the highest AE P and AE K with grain yield increase of 745,5 kg/kg P and 587,2 kg/ kg K.

This suggests that the combination of fertilizers (N, P, and K) affects the efficiency of nutrient use.

Changes in the combination of N, P, and K fertilizers cause to the efficiency of N, P, and K nutrient use also changed (Syafrudin et al., 2006). The efficient dose of N at the study site was 90 kg-12,5 kg N per hectare, while the P dose was 22,3 kg-27,5 kg P_2O_5 per hectare, and the K dose was 30 kg K_2O per hectare (Syafruddin et al.,2006)

Table 5. Agronomic efficiency of each treatment combination in four seasons in Purbaganda Village, Pematang Bandar Subdistrict, Simalungun Regency

Treatment	N, P, K application (kg/hectare)	Agronomic Efficency (kg grain/kg nutrient)		
		N	P	K
Zero treatment	-	-	-	-
A1B1	112,5 N+27 P_2O_5+30 K_2O	208,7	519,7	406,7
A1B2	90 N+22,3 P_2O_5+40,8 K_2O	236,4	523,6	280,1
A1B3	112,5 N+27 P_2O_5+30 K_2O	224,7	579,3	459,1
A1B4	78,8 N+18,9 P_2O_5+21 K_2O	231,6	528,5	399,5
A1B5	45 N+10,8 P_2O_5+12 K_2O	144,6	455,8	384,7
A1B6	90 N+22,3 P_2O_5+40,8 K_2O	301,9	628,6	335,2
A1B7	63 N+15,6 P_2O_5+28,5 K_2O	119,5	329,3	177,9
A1B8	36 N+8,9 P_2O_5+16,3 K_2O	164,7	486,0	263,3
A2B1	112,5 N+27 P_2O_5+30 K_2O	265,3	621,6	475,0
A2B2	90 N+22,3 P_2O_5+40,8 K_2O	305,4	638,2	340,4
A2B3	112,5 N+27 P_2O_5+30 K_2O	294,2	745,5	587,2
A2B4	78,8 N+18,9 P_2O_5+21 K_2O	277,8	681,7	530,6
A2B5	45 N+10,8 P_2O_5+12 K_2O	231,3	628,5	507,1
A2B6	90 N+22,3 P_2O_5+40,8 K_2O	340,8	745,3	398,5
A2B7	63 N+15,6 P_2O_5+28,5 K_2O	181,8	466,9	251,4
A2B8	36 N+8,9 P_2O_5+16,3 K_2O	219,2	650,1	352,3

A1 = inundated, A2 = intermittent, B1 = fertilization Permentan No. 40, B2 = fertilization laboratory analysis, B3 = fertilization Permentan No. 40 (100% dose) + probiotics, B4 = fertilization Permentan No. 40 (70% dose) + probiotics, B5 = fertilization Permentan No. 40 (40% dose) + probiotics, B6 = fertilizer laboratory analysis (100% dose) + probiotics, B7 = fertilizer laboratory analysis (70% dose) + probiotics), B8 = fertilization laboratory analysis (40% dose) + probiotics

D. CONCLUSION

Agronomic efficiency (AE) of each nutrient in season I showed the highest AE N was obtained at A2B3 treatment (intermittent and fertilization Permentan No. 40 (100% dose) + probiotic) 47,4 kg grain/kg N, agronomic efficiency of N, P, and K nutrients in season II showed the highest AE N (44 kg grain/kg N) obtained at treatment A2B6, agronomic efficiency in season III (Table 5.15) showed that A2B6 treatment had highest AE N (60,8 kg grain/kg N) (Table 5.16), and the highest AE N (85,1 kg grain/kg N) was obtained in A2B8 treatment (intermittent and fertilizing laboratory analysis (40% dose) + probiotics).

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