

Farmers' Behaviour in The Implementation of Component PTT (Integrated Plant and Resource Management) in Irrigation Paddy Rice Fields Farming in Buru Regency Maluku Province Indonesia

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Abstract

Research on farmers' behavior in the application of PTT components (Integrated Plant and Resource Management) has been conducted on irrigated rice farming in Buru regency, Maluku province. This study aims to determine the farmers' behavior in applying components of PTT on irrigation paddy rice field. The measurement level of technology adoption by farmers was assessed for compliance with PTT technology approach recommended and was given a score on each aspect of the technology applied. The results of this research showed that the behavior of farmers in applying the PTT component irrigated paddy rice field was categorized as medium level (72.17% of the recommended), while for each PTT component elements such as excellent varieties and seed were categorized as medium level (69.79% of the recommended), planting as the moderate level (69.24% of the recommended), inorganic fertilizer as high level (80.28% of the recommended), organic fertilization as the moderate level (74.72% of the recommended), control of HPT was categorized as high level (97.01% of the recommended), weed control was categorized as high level (85.42 percent of the recommended) and harvest and post-harvest handling were categorized as high level (95.93% of the recommended).

Key Words: Level of implementation, PTT Components, Paddy fields, Buru District, Maluku Province, Indonesia

1. Introduction

Indonesian staple food still depends on rice. Energy consumptions derived from vegetable foods accounts for about 94% and the highest came from the grains (Purwantini and Ariani, 2008). According to the ASEAN Food Security Information and Training Center (2009), to achieve steady food security, the ratio of reserved food against domestic needs (Food security ratio) at least 20%, while food security at the domestic rice ratio just reached 4.38% (Hanani, 2009). Therefore, it is still needed hard efforts to increase rice production in order to increase national food security. On the other hand, efforts to increase rice production currently were prevented from several factors, such as the conversion of fertile rice lands is still going on, climatic anomaly, technology fatigue symptom, decreased quality of land resources impacting on the decline production. To meet the growing demand of rice are needed a cultivation technology breakthrough being able to increase sustainable production and productivity. According Adnyana and Kariyasa (2006), the use of efficient new technology provides opportunities for agricultural producers to produce more output with fewer inputs.

A breakthrough of the increase of productivity rice field has been successful through technological approach of Integrated Resource and Plant Management with wonderful results. Participatory approach is tailored to the specific conditions. According Kartaatmaja and Fagi (2000), Integrated Resource and Management Plant (PTT) approach is one of solutions in improving rice farming income, and enhancing sustainable rice productivity. PTT had been introduced and developed to the farmers since 2002 through the assessment and technology exhibition with experiment (demoplot) conducted by a technical unit of Research and Development of Agriculture in the area. To accelerate the development of PTT nationally, the Ministry of Agriculture launched the Field School of PTT (SL-PTT) since 2008 with a total area of 1.585 million ha, while in 2011 2.2 million ha (non hybrid rice), involving 88 thousand farmer groups/unit in 31 provinces, 402 districts / cities.

SL-PTT approach was expected to increase farmers' knowledge and skills in recognizing potential, planning farm plan, making decision, solving problems, and applying technologies in line with local resource conditions and environmental synergistically. Thus, their farms became more efficient, productive and sustainable (Ministry of Agriculture, 2011). Rice farming with Management Plant and Integrated Resource (PTT) in Maluku had been introduced to farmers starting in 2004 by the Center for Agricultural Technology (BPTP) Maluku by studying and exposing technology in Buru Regency. However, in the fact there was a big difference of production level between farmers and the result of study results in Buru Regency reaches 7 to 8 tons / ha of paddy whereas the farmer productivity ranged from 2 to 5 tons / ha dup (BPTP Research Report, 2008).

Activities SL-PTT rice in Maluku Province had been conducted from 2009 in five regencies namely Buru Regency of 5.000 ha, the Regency of West Seram (SBB) area was 1.500 ha, East Seram Regency area was 500 ha, Central Maluku Regency was 3.000 ha for SL -PTT rice. Whereas in Buru Regency in 2010 the area was about 2.700 ha. West Seram Regency (SBB) area was 1.500 ha, East Seram Regency area was 1.250 ha, Central Maluku Regency area was about 1.600 ha (Maluku Province Department of Agriculture, 2010). In SL-PTT farmers can learn directly in the field by learning and observing, expressing, analyzing, concluding, and reapplying, copying with and solving problems especially in terms of cultivating technic by studying together based on specific location. In practice farmers were accompanied by supervisors, POPT (crop pests observers), PBT (seed plants supervisors) and researchers.

Through the activities of SL-PTT is expected to accelerate the adoption of PTT component by farmers, by applying the concept of PTT farmers will be able to manage the available resources (varieties, soil, water and production infrastructures) integratedly in cultivating farmers' land based on specific condition location leading to achieve efficient farming. This study aims to determine the behavior of farmers in applying components of PTT on Rice paddy irrigation in Buru Regency.

2. Research Methods

2.1. Research Location

This research was conducted in the land of Waeapo, Buru Regency, Maluku Province because Buru Regency is the largest rice production centre in the Moluccas, besides PTT technology approach has been introduced to farmers in Buru since year 2004. Another consideration, the assessment and technology exhibition with experiment (demoplot) done by BPTP Maluku, and Buru Regency since 2009 has implemented SL-PTT program until now, the area of SL-PTT in 2011 of 5.500 ha in 16 villages and carried by 220 farmer groups.

2.2. Sampling Technique and Data Collection

Sampling technique used random sampling. The numbers of samples taken were 120 farmers. Primary data (cross-section) were obtained through direct interviews with farmers. Primary data collection was conducted in April to June 2012. Secondary data were collected from Agriculture Department, National Bureau of Statistic, and Local Government Institution.

2.3. Analysis Method

2.3.1. Behavioral Measurement Application Level Component Technology PTT approach

Measuring levels of technology adoption by farmers were assessed for compliance with PTT technology approach recommended and given a score on each aspect of the technology applied. Technological aspects are grouped into: (1) qualified and excellent varieties including varieties, seed treatment and number, (2) planting system includes planting, seedling age, number of seeds and plant spacing, (3) a balanced inorganic fertilization include N dose, the dose of P, K dose and timing of fertilizer application, (4) additional organic materials including the use of manure / straw utilization, (5) integrated pest control which includes the time of planting, pest observation, control nature and time of spraying, (6) control of weeds covering tillage and weed management, (7) harvest and post-harvest crop that included age, how to harvest and post-harvest handling. For the response of every single question leading to inappropriate the recommended behavior was given a score 1, less than the recommended behaviors scored 2, and behavior as recommended given a score of 3. Scores obtained from each of the question items are summed to obtain a total score with a minimum of 23 and maximum of 69.

The general form the level of implementation of PTT components technology approaches in rice farming in the District Waeyapo equation is as follows:

$$\text{Rate Application} = \frac{\text{Total value obtained}}{\text{Maximum value}} \times 100\%$$

Level implementation is obtained from the total value of farmer answers divided by the maximum of the questionnaire multiplied by 100%. Category level application components PTT rice, determined using continuum line as in Figure 1.



Figure 1. Lines Continuum

3. Results and Discussion

3.1. Description of Rice Farming Technology Implementation Approach PTT Farmers Respondents

From the results of PRA by Assessment Institute for Agricultural Technology (BPTP) Maluku were identified problems encountered in improving production. To solve the existing problems was selected technologies introduced, both in basic technology components (compulsory) and also chosen technology. Remember, that the selected technology components can be compulsory if the results of the PRA prioritize component technology became a necessity to solve the main problems of a region, and instead, a basic technology can be chosen technology.

To determine the rate of adoption by farmers components PTT, PTT components in this study recommended were grouped into (1) qualified and excellent varieties including varieties, seed treatment and number, (2) planting system includes planting, seedling age, number of seeds and plant spacing, (3) a balanced inorganic fertilization include N dose, the dose of P, K dose and timing of fertilizer application, (4) additional organic materials including the use of manure / straw utilization, (5) integrated pest control which includes the time of planting, pest observation, control nature and time of spraying, (6) control of weeds covering tillage and weed management, (7) harvest and post-harvest crop that included age, how to harvest and post-harvest handling.

3.1.1. Variety and Seed Quality

Varieties most planted by farmers is new high yielding varieties (VUB), having been adaptive in the location of the study, 97.5% of the farmers planted recommended varieties such as Mekongga, Cigeulis, Ciharang, Inpari 1, and Inpari 6 Jete. The rest of farmers (2.5%) planted not recommended varieties which was Gondok (Table 1). Farmers did pay attention to seed quality, small percentage of farmers (6.67%) planted certified seeds, 61.67% planted illegal spread seeds, and 31.67% planted seeds owned by themselves or bought from other farmers.

Table 1. Distribution of Application Elements Superior Variety and Seed Quality Rice Farming in The District of Buru, 2012

PTT components	As directed		Less than the recommended		Not the recommended	
	Respondents	%	Respondents	%	Respondents	%
Improved varieties and seed quality						
- Varieties	117	97,50	3	2,50	0	0,00
- Seed quality	8	6,67	74	61,67	38	31,67
- Seed treatment	0	0,00	62	51,67	58	48,33
- Number of Seeds	38	31,67	50	41,67	32	26,67

Farmers tend to use excessive or inefficient seeds, for the transplanting system ranging from 20-40 kg / ha, 40-80 kg / ha, then for the seeded 80-150 kg / ha for the seeded spread. The observation results showed that 32% of farmers used the recommended seed, 42% almost close to recommended, and 27% not recommended.

Special treatment on seeds (drenched with fipronil) is recommended at the study site to anticipate winches rods attack, however farmers did not treat on the seed, the seed just was soaked by water overnight and drained before they were spread.

3.1.2. Cultivation

Planting consists of cropping systems, nursery, seedling age, number of seeds per hole. Cropping systems recommended for PTT approach is a system with parallelogram legowo transplanting, field observations showed 53% of farmers did transplanting (parallelogram legowo 2:1, 4:1 and tiles: 22 x 22 cm), 25% of direct seeding (seeded) with distance and 22 percent of direct seeding with stocked (table 2). The capital and human resources limitation are the reason farmers to choose the seeded spread system.

For transplanting system, the observation results show that to get a good crop seedling growth needs fertilization in the nursery, especially organic fertilizers or manure and urea fertilizer.

Table 2. Application of Element Distribution in Rice Planting Rice in the District of Buru, 2012

PTT components	As directed		Less than the recommended		Not the recommended	
	Respondents	%	Respondents	%	Respondents	%
<i>Cultivation</i>						
- Cropping systems	63	52,50	30	25,00	27	22,50
- Age seedlings	14	11,67	94	78,33	12	10,00
- The number of rods	34	28,33	45	37,50	41	34,17
- Distance plant	36	30,00	56	46,67	28	23,33

Planting for young seedlings (<21 days) is recommended for PTT approach, planting young seedlings will produce more than the number of tillers using old seeds. The results of observations of the location of the study there were 12 per cent of farmers using old seedlings <21 days, 88% of farmers using old seedlings> 21 days.

To obtain better growth and yield crops, it is recommended to use less seed which is not more than 3 seeds per hill. Using a little seed is intended to reduce seeds competition. The numbers of seeds per hole were recommended between 2-3 rods/ holes, 28% farmers did as recommended, but the majority of farmers (72%) using seed> 3 rods / holes.

Planting distance recommended is legowo 2:1 or 4:1. The benefits of legowo row planting system are (1) all rows clumps laying on the outskirts generally give higher yields (plant side effects), (2) easier in controlling of pests, diseases and weeds, (3) there is space for water management, and (4) the use of fertilizer more efficient and effective. The observation of 30% of farmers applying legowo row, 42 percent use a tile spacing and the remaining 28% of farmers use irregular spacing or spread.

3.1.3. Inorganic Fertilizer

In the location of study N, P and K factors for rice were met by a single inorganic fertilizers namely Urea, Sp-36, Za and inorganic compound fertilizer which Ponska and Pelangi. Observations result showed that 100% of farmers use fertilizer compound, and 8.3% of farmers use compound fertilizer and single fertilizers, this is due to lack of fertilizer availability. The results showed the use of N ranged between 45-170 kg / ha, an element of P between 7.5 - 85 kg / ha and the elements of K between 7.5 to 40 kg / ha, with an average that is the fulfilment of N 100 kg / ha, the element P 26 kg / ha and 22 kg K elements / ha, dose for elemental N and K are still below doses recommended compared with fertilizer recommendations for plain Waeapo the production target 5.6 tons / ha which is 124 kg / ha of N, 24 kg / ha of elemental P and 40 kg / ha of elemental K (Susanto, 2011).

Table 3. Application Distribution of Inorganic Elements Balanced Fertilization on Rice Farming in The District of Buru, 2012

PTT components	As directed		Less than the recommended		Not the recommended	
	Respondents	%	Respondents	%	Respondents	%
Inorganic fertilization						
- Dose N	69	57,50	43	35,83	8	6,67
- Dose P	86	71,67	30	25,00	4	3,33
- Dose K	42	35,00	45	37,50	33	27,50
- Application time	61	50,83	57	47,50	2	1,67

The results showed (Table 3) for doses of N there are 57% of farmers in line with the recommendation, 36% less than the recommended 7% of farmers are not as recommended, while for P dose consists of 72% of the farmers as recommended, 25% less than the recommended farmers and 3 % farmers not as recommended, then K dose comprises of 35% of farmers as recommended, 37% less than the recommended farmers and 28% of the farmers are not as recommended.

In addition to the right amount or dose of fertilizer, proper fertilization time will also determine the efficiency of fertilization. The observation result showed that 87% of farmers in the location of research did fertilizing twice and 23% did fertilizing three times, the first fertilization ranged between the ages of 15 - 30 days after planting (urea and ponska / pelangi), the second fertilization ranged in age 40-50 days after planting (urea and ponska / pelangi) and third fertilization at the age above 60 days after planting (urea and ponska / pelangi). Time for P and K fertilizer application by farmers less as recommended, because P and K fertilizer in the PTT recommended approach given all the first fertilization to a maximum in order to be able to be absorbed by plants. The results showed 51% of farmers applied fertilizer as recommended, 47% less than the recommended 2% and not as recommended.

3.1.4. Addition of Organic Materials

The additions of organic matter such as manure or bokasi have been applied by most farmers (60%) because the farmers have realized that the addition of organic matter is able to improve soil structure (Table 4).

Table 4. Application Distribution Element Fertilization Organic Materials on Rice Farming in The District of Buru, 2012

PTT components	As directed		Less than the recommended		Not the recommended	
	Respondents	%	Respondents	%	Respondents	%
Organic fertilization						
- Manure / bokasi	36	30,00	27	22,50	57	47,50
- Utilization of straw	92	76,67	28	23,33	0	0,00

Doses of organic matter ranged from 100 kg / ha to 2000 kg / ha applied at the time of land preparation. Hay crop utilization done by farmers, 63% of farmers returning straw to the soil while the remaining 37% of the farmers burn hay crop residues. In the rainy season the straw directly returned to the land because of the rapid decomposition, while in the dry season straw was processed into bokasi before being returned to the land.

3.1.5. Integrated Pest and Disease Control (PHT)

The concept of PHT is a multidisciplinary ecological management approach that utilizes various control tactics compatibly in a single coordination management system, as a result it does not result in the natural balance disturbance and losses. PHT is a combination of controls such as, population monitoring of and crop damage (Sirappa & Hutuely, 2010).

Observations in the field showed (Table 5) that the farmer seeks to implement integrated pest control strategies include (1) farmers determined varieties planted based on the level of resistance to pests and diseases, (2) the right planting implementation or simultaneous planting has been done by farmers, 91% in accordance with the agreed time and most farmers planted beyond the 9% agreed time because the land has not been ready yet to cultivate, (3) the farmers clean land and observe the pest routinely, (4) farmers often spray pesticides ranging between 2-12 times per season with an average of 6 times per season, spraying pesticides to control pests and diseases, but there are some farmers who do the spraying in order to anticipate the attacks. The farmers spray the plant too much pesticides.

Table 5. Distribution Application Control Elements HPT on Rice Farming in The District of Buru, 2012.

PTT components	As directed		Less than the recommended		Not the recommended	
	Respondents	%	Respondents	%	Respondents	%
Control HPT						
- Planting time	109	90,83	11	9,17	0	0,00
- Observations pests	99	82,50	21	17,50	0	0,00
- The nature of Control	116	96,67	4	3,33	0	0,00
- Spraying time	113	94,17	7	5,83	0	0,00

3.1.6. Weed Control

Weed control PTT approach can be done by processing soil completely, pulling weeds by hand, using a hedgehog / gasrok or with herbicides. Complete processing soil is done by farmers using tractors (95%) and a small portion still use livestock (5%), tillage depth ranges between 10-15 cm, tillage is in accordance with the recommendation that cultivation is done twice at intervals of 2 weeks between the first plow to plow both the malign purposes remains of rice straw. Application of manure (organic material) is given at the second rover in order that organic material can be spread evenly, smoothing performed at a later stage and the land ready for planting. Complete processing soil is one approaches to weed control on PTT. Observations in the field showed that most farmers did not process their soil well (51%), it means that after beeing plowed and directly planted. This was due to limited tractor operator manpower (table 6).

Farmers spray using herbicide in controlling weeds, this way were chosen by farmers because lack of human resources at the pace of study. The frequency of spraying depends on the weed condition, the average of spraying is twice, at 15 DAT and 40 DAT. Herbicides widely used are Ally, DMA-6, Rompas, lindomin and supremeo.

Table 6. Distribution of Application Elements Weed Control in The District of Buru, 2012

PTT components	As directed		Less than the recommended		Not the recommended	
	Respondents	%	Respondents	%	Respondents	%
Weed control						
- Plow	59	49,17	36	30,00	25	20,83
- Handling weeds	103	85,83	17	14,17	0	0,00

Farmers using transplanting system with parallelogram legowo or tile control weed by spraying weeds both with herbicides and manually by hand or tool called gasrok because it is easier to get rid of weeds. There are 86% of farmers weeding manually.

3.1.7. Harvest and Post Harvest

Harvest and post-harvest handling is very important because of yield loss and quality deterioration during the harvest and post harvest remains high, which is about 20% and the harvest and post-harvest handling is not good leading to low quality of grain and seed (Zaini et al., 2004).

Table 7. Application of Element Distribution of Harvest and Post-harvest Handling on Rice Farming in The District of Buru, 2012

PTT components	As directed		Less than the recommended		Not the recommended	
	Respondents	%	Respondents	%	Respondents	%
Harvest and Post Harvest						
- Harvesting	89	74,17	31	25,83	0	0,00
- How to harvest	110	91,67	8	6,67	2	1,67
- Post Harvest	120	100,00	0	100,00	0	0,00

The results of the field observations indicated that group harvest activity with a profit-sharing system 6: 1 meaning six parts for the landlord and one part for the harvester, length of cultivation started planting to harvesting time ranging from 90-123 days. Days after planting depend on the variety and cropping systems, equipment used in the form of sickle harvesting, number of days of harvest ranged from 1-3 days / ha depending on the number of groups of harvesters, stacked crops using pedestal tarp prior to threshing, threshing activities carried out immediately after harvest is completed by using a thresher (Dores). Drying is carried out directly in the field using pedestal tarp for farmers who do not have a drying floor, drying done to achieve $\pm 14\%$ moisture content, drying time ranges from 2-3 days depending on the weather. Almost 100% of the farmers managed harvest and post-harvest as recommended.

3.2. The Application Level Components PTT Rice Buru District

Assessment of the application of the PTT component paddy fields by farmers was based on the PTT component which is recommended in the study site (site-specific). Specific elements of the technology used indicators by farmers were given a score based on the level of compliance with the recommended. The technology application score was categorized into three levels namely high, medium and low. The calculation result of each score level application components PTT of farmers is presented in Table 8.

The application of the use of high yielding varieties showed that 14.17% are included as the high category, 79.17% are included as moderate category, and 6.67% are included as low category, while the average grade level of application of high-yielding varieties in the location of research was classified as moderate category (69.79% of the recommended).

Farmers were categorized as high category in terms of cultivation application level accounted for 38.33%, then 33.33% are included as moderate category and 28.33% as low category. Furthermore, the average investment rate of application of elements of the location of the study are moderate category (69, 24% of the recommended). Inorganic fertilizer application rate, there are 56.67% of the farmers included in the high category, 38.33% are included in moderate category and 7.50% are included in low category. Then, the average rate of application of inorganic fertilizer at the sites were classified as high category (80, 28% of the recommended).

The level of application of organic fertilizers, there are 40.83% of the farmers included in the high category, 51.67% are categorized as moderate level and 5.00% are categorized low level. In addition, the average fertilizer application rate of organic material at the sites are included as moderate category (74.72% of the recommended). The application of pest control element, 96.67% are included in the high category, 3.33% were included in the moderate category, while the average rates of application of HPT control elements including the location of the research are the high category (97.01% of the recommended).

Table 8. The application level components PTT Rice Buru District, 2012

PTT components	Category	% Recomendaded	Number	
			Person	%
Improved varieties and seed quality	High	> 75	17,00	14,17
	Moderate	51 - 75	95	79,17
	Low	< 51	8	6,67
	Average application rate (%) :		69,79 (moderate)	
Cultivation	High	> 75	46,00	38,33
	Moderate	51 - 75	40	33,33
	Low	< 51	34	28,33
	Average application rate (%) :		69,24 (moderate)	
Inorganic fertilization	High	> 75	68,00	56,67
	Moderate	51 - 75	46	38,33
	Low	< 51	6	5,00
	Average application rate (%) :		80,28 (high)	
Addition of Organic Materials	High	> 75	49	40,83
	Moderate	51 - 75	62	51,67
	Low	< 51	9	7,50
	Average application rate (%) :		74,72 (moderate)	
IPM control	High	> 75	116	96,67
	Moderate	51 - 75	4	3,33
	Low	< 51	0	0,00
	Average application rate (%) :		97,01 (high)	
Weed control	High	> 75	90	75,00
	Moderate	51 - 75	22	18,33
	Low	< 51	8	6,67
	Average application rate (%) :		85,42 (high)	
Harvest and Post Harvest	High	> 75	120	100,00
	Moderate	51 - 75	0	0,00
	Low	< 51	0	0,00
	Average application rate (%) :		95,93 (high)	
Total Components PTT	High	> 75	45	41,67
	Moderate	51 - 75	71	55,00
	Low	< 51	4	3,33
	Average application rate (%) :		72,17 (moderate)	

Application of weed control element by 75% are included in the high category, 18.33% are included in moderate and 6.67% included in low category. Meanwhile, the average rate of application of weed control element including the location of the research on the high category (85.42 percent of the recommendation).

Application harvest and post-harvest element, 100% are included in the high category (95.93% of the recommended). Figure 2 also presents the level of implementation of each component PTT rice Buru district.

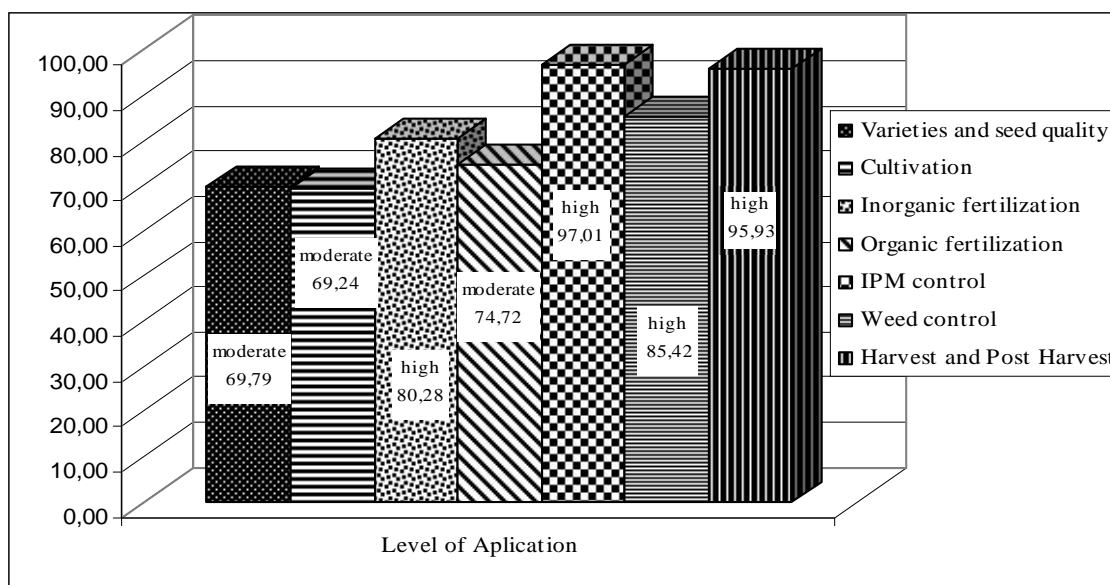


Figure 2. The Application Level of Each PTT Component

The results of the calculation of the total score of PTT application components as a whole, show that there are 42% of farmers (48 respondents) are classified high category, 55% of farmers (69 respondents) as moderate category and 3% of farmers (3 respondents) as low category. Then, the average adoption rate by farmers PTT component at the sites included in the category of moderate (72.17% of the recommended). Figure 3 shows the average line of the continuum of adoption rate by farmers PTT component of the location study.

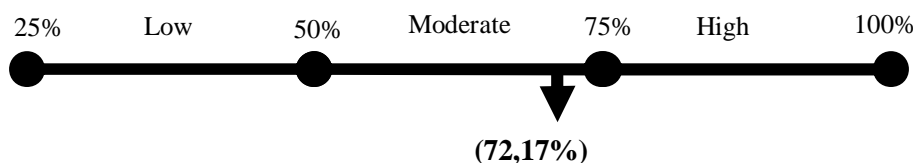


Figure 3. Outline Application Level Component Continuum PTT Rice Irrigation District Buru 2012

4. Conclusion

1. Farmers’ behavior in applying components of irrigated rice PTT as a whole, are generally classified in the moderate category.
2. Component application behavior of excellent varieties and quality seeds, planting and fertilizing organic materials, categorized as moderate level.
3. Component application behavior of inorganic fertilizers, integrated pest control, weed control, and harvesting and post-harvest handling, classified as high category (as recommended).

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