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Submission date: 10-Jun-2020 02:16AM (UTC+0300)
Submission ID: 1340960022
File name: 16._Strategy_For_Mininizing_Post-.pdf (7.32M)
Word count: 6995
Character count: 53214

PROCEEDING

ISBN: 978-602-73574-2-6

ISREM 2015
University of Wijaya Kusuma Surabaya

INTERNATIONAL SEMINAR

Resources, Environment, And Marine In The Global Challenge

"The Role Of Science and Technology In The Basis Of Environment To Support Sustainable Resource Development"

DITERBITKAN OLEH:
Pusat Pengkajian Hukum dan Pembangunan (PPHP)
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WELCOME ADDRESS

Foreword of The Chair of Organizing Committee the 1st ISREM 2015

Assalammualaikum Warrahmatullahi Wabarakatuh
Good Morning.

On behalf of the Organizing Committee, we congratulate dating to the speakers, the invited guests and all participants of the first International Seminar Resource, Environment and Marine (ISREM) held by Wijaya Kusuma Surabaya University.

Through the International Seminar, it is expected that there is intertwined interaction, communication and exchange of current research information so as to generate concepts and new thoughts on the role of science and technology in the basis of environment to support sustainable resource development. In addition to publication in the form of proceedings, the best papers presented at this international seminar, to be published in the international journal. The total in the first ISREM is 200 participants consisting of speakers, participants and invited guests.

Finally, we would like to thank you to all the speakers, the invited guests, the parties and all the donors who have supported this event and hopefully the success of this international seminar provides many benefits for us all.

Thank you
Wassalamualaikum Wr Wb

Dr. Ir. Hary Sastrya Wanto, MS
Chair of the Organizing Committee

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Rector of Wijaya Kusuma Surabaya

To honorable Ministry of Marine Affairs and Fisheries Indonesia.
To honorable Governor of East Java
To honorable Coordinator of Kopertis
To honorable Kapolda
To honorable Invited Speakers
To honorable Rectors
Ladies and Gentlemen

Assalammualaikum Warrahmatullahi Wabarakatuh
Good Morning.

Praised be to Allah SWT for His love and compassion that today we all gather for the first International Seminar Resource, Environment and Marine (ISREM) held by Wijaya Kusuma Surabaya University.

I would like to thank you for coming to this scholarly forum especially I would like to express my deepest gratitude to the Keynote speaker Ibu Susi Puji Astuti, Ministry of Marine Affairs and Fisheries who has spent time to attend and support this event. I wish to extend sincere gratitude to all respected delegates, invited speakers, presenters and participants for attending this seminar and for becoming our esteemed guests on this occasion. It is indeed a great honor for us to have you all at the seminar.

As we know, the theme "The Role of Science and Technology in the Basis of Environment to Support Sustainable Resource Development" is timely in order to address the issues and concerns about Resource, Environment and Marine in the Global Challenge. Indonesia includes one of the countries which own the biggest natural wealth in the world. If natural resource of Indonesia in mainland is combined with in the sea, so it is only Indonesia which has the biggest natural resources in the world. The utilization of the natural resources in Indonesia tend to economical aspect, while the aspects of ecology, biology, technology, and humanity is still limited. Whereas they have the very high economical value. For that reason, the International Seminar is the event of discussion on ideas, problems and solutions about resources, environment and marine as well as the information result of current research for scientists, observers, entrepreneurs, industrialists and policy makers. Thus, it will create the harmony the research activities with the problems and the real needs. This International Seminar is the 1st ISREM and it is hoped that the next year will be held again the 2 nd ISREM and so forth with the specific target.

Ladies and gentlemen
In the same time of this event, it is also held directly MoU among all Higher Education supporting the First ISREM 2015 and it will be established ISREM network. We will cooperate about seminar/ conference, student and lecturer exchange, research together.
Finally, on behalf of Wijaya Kusuma Surabaya University, I would like to take the opportunity to extend my appreciation to the committee, all participants and all sponsors, that have generously assisted us to host this seminar. I hope that we all could gain benefits and insights through this seminar.

Thank you,
Have a wonderful and insightful seminar
Wassalamualaikum Warrahmatullahi Wabarakatuh.

Prof. H. Sri Harmadji., dr., Sp.THT-KL (K)

Rector of Wijaya Kusuma Surabaya University

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SCHEDULE OF AGENDA

TIME	ACTIVITY	PIC
07.30-08.00	Registration	Sections of Secretariat and Registration
08.00-08.20	- Opening Ceremony - The National Anthem of Republic of Indonesia	Sections of Receptionist and Protocol
08.20-08.30	Speech By Chair of The Organizing Committee	Sections of Receptionist and Protocol
08.30-08.45	Speech and Official Opening by Rector of Wijaya Kusuma Surabaya University, Indonesia	Sections of Receptionist and Protocol
08.45-09.45	KEYNOTE SPEAKER The Fishery and Marine Ministry of Indonesia: SUSI PUDJI ASTUTI	Sections of programs, formulator, and taking minute Coordinator
09.45-10.00	MOU (All Higher Education supporting the 1st ISREM 2015)	Sections of Receptionist and Protocol
10.00-10.15	COFFEE BREAK	Section of Beverages and Meals
10.15-12.30	Invited Speaker	Sections of programs, formulator, and taking minute Coordinator
	Professor Dr. M. Dileep Kumar	
	Rexton F. Chakas, PhD	
	Professor Dr. Basri Rashid	
	Prof. Dr Ruswiati Surya Saputra, SE, MS	
	Prof. Dr. Ir. Achmadi Susilo, MS	
12.30-13.00	LUNCH	Section of Beverages and Meals
13.00-16.00	PARALLEL SESSION	Sections of programs, formulator, and taking minute Coordinator
16.00-Finished	COFFEE BREAK	Section of Beverages and Meals

ISBN: 978-602-73574-2-6

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In The Global Challenge 2015
University of Wijaya Kusuma Surabaya, 29-30 September 2015

STRATEGY FOR MINIMIZING POST-HARVEST LOSSES THROUGH TECHNOLOGY DEVELOPMENT IN TUBAN REGENCY, EAST JAVA, INDONESIA

Markus Patiung , Erna Hariyanti, Nugrahini Susantina
Wijaya Kusuma University

Abstract*:* Main problem encountered on rice post-harvest handling is high rice losses quantitatively or qualitatively. Paddy grain with high water content show easily damage characteristic and will loss at post-harvest handling and other operations. This study aims to know (1) how much rice losses during post-harvesting operations; (2) conversion unit from Harvested Dried Paddy to Milling Dried Paddy; (3) milling conversion unit from Milling Dried Paddy to rice. The results showed that increase of rice production in Tuban can be achieved by increasing production per hectare unit and reducing post-harvesting losses. Post-harvest losses in Tuban still quite high 11.15%. This means that every year Tuban still lose paddy grain more than 70.882 tons or about IDR 212.65 million annually. Largest losses occurred at the harvesting and threshing process. This process is still using simple technology. Farmer groups need more modern and efficient of post-harvest machines. Recommendation, one of machine recommended is reaper type and combine harvester. Rice mill is also an important part of the post-harvest losses. In this process, farmers produce rice grain from paddy to be sold and consumed. Inspection of rice milling technology regularly will make efficiency achieved.

Keywords: Post-harvest Losses, Strategy and technology.

1. INTRODUCTION

Rice post-harvest handling was a strategic effort to support national food security due to its important roles, directly or indirectly. Directly, post-harvesting system had roles to minimized product losses, maintained the quality of crop, and increased adding value, competitiveness, farmer's income. Thus, post-harvesting system indirectly supported national food security program [1].

There were some factors that affected post-harvest losses such as rice variety, post-harvest equipments and operation that determined number of product losses, farmers, harvest time, threshing technology, location, season. It was presumably caused by (1) the technology was still not technically, economically appropriate for local social culture that different in some areas, (2) no incentive for high quality paddy or rice so farmers ignored how to handling crop better [2].

Main problem encountered on rice post-harvesting operation was a high losses both quantitative and qualitative aspect. Paddy grain (unmilled rice) with high water content showed easily damage characteristic and would be loss at post-harvest handling and processing. This problem caused low income for farmers [3].

Actually, rice production could be increased when supported with good handling at harvest time and milling process. At harvest time, threshing, transportation, drying, storing, and milling could be the source of most losses with high percentage. Survey by Central Bureau of Statistic showed that rice losses in Indonesia were currently high reach 10.12% [4].

Many factors affected rice losses during post-harvesting operations such as rice variety, plant condition, level of maturity, harvesting system, rice production, post-harvesting equipments, and milling system. While the cause of rice losses variation were caused by (1) information about technology for minimizing rice losses did not reach to local farmers; (2) dissemination of technologies still not optimally achieved so the farmers get a problem to do an innovation on the technology; (3) Rice losses measurement method used had not been uniform; (4) man who measured rice losses in the field had not yet implemented the methods properly [5].

In this regard and consider that the application of post-harvest technology currently had experienced with many changes so it was necessary to studied on the post-harvest losses. It aimed to obtain data of rice losses and rice conversion accurately [6].

Main problem encountered on rice post-harvesting operation was a high losses both quantitative and qualitative aspect. This problem caused tendency on no incentive for farmers to increase their income. Paddy with high water content possessed easily damage characteristic and loss at post-harvest handling and processing [7][8].

This study aimed to know (1) how much rice losses during post-harvesting operations (stacking, threshing, drying, and milling); (2) conversion unit from Harvested Dried Paddy into Milling Dried Paddy; (3) milling conversion unit from Milling Dried Paddy to rice.

The benefits of the research is provide advice to government, especially in Tuban district, in order to improve the farmers living through increased incomes by improving rice post-harvest handling.

2. RESEARCH METHODS

This study located at Tuban district, from 20 subdistricts was randomly selected five sub districts for sample. The sub districts were Merak Urak, Singgahan, Rengel, Tambak Boyo, and Widang. From each sub district was selected one village and from this village would be chosen one farmer group. The respondents were members of the farmer group and were selected three persons from the staff and seven farmers. So, total of respondents were 50 persons randomly selected. The operations of the study were measuring rice post-harvesting losses from the field including stacking, threshing, drying, and milling. This study was carried out at paddy field ecosystem in Tuban.

Method for rice losses measuring on stacking operation

Losses measuring were conducted by using gunny-sack as place for the bundles of panicles after cutting. Scattered paddy on gunny-sack used the farmers and stacked paddy were weighed respectively [9].

Method for rice losses measuring on threshing operation

For measuring losses on threshing operation was conducted by (1) collected and weighed the paddy that spilling out from the thresher used by the farmers at the thresher mat, (2) separated and weighed the paddy that mixed with undesirable materials, (3) separated and weighed unthreshed paddy and paddy that still attached on straw.

Method for rice losses measuring on drying operation

Measuring method that used was comparing weight of paddy before and after drying process at the same water content.

Method for rice losses measuring on milling operation

Measuring was carried out by comparing rice production value between milling process usually applied by the farmers with national rice production.

3. DISCUSSION

Potention of rice production in five districts

Total of rice production in five districts under study was 162.637 ton per year and contributed 33.27% to total rice production at Tuban regency. It showed that these districts had significant effect to rice production stability in Tuban. Rice productivity at three districts, Merak Urak (63.1 kw/ha), Singgahan (63.93 kw/ha) and Widang (65.9 kw/ha), were higher than the average production at regency level (60.61 kw/ha) [10]. Rice productivity in Tuban regency actually could be increased. Because empirical data of rice productivity from other area in East and West Java Province, for Ciherang variety that mostly planted, able to yielded rice up to 70-90 kw/ha. Even, demplot data from research institute for Ciherang variety showed its potential up to 85 kw/ha.

From potential of post-harvesting losses, the production of five districts provided information about rice losses reach 14.52% or equal with 24.395 tons per year. The high losses deserved special attention by the farmers due to it could increase their income. The results showed that the highest losses were on harvesting and threshing process. Post-harvesting losses was found at five operation stages including rice harvesting, stacking, threshing, drying and milling process.

Post-Harvesting Losses of rice in 5 Sub Districts

Post-harvesting losses at five district was started on harvesting process include cutting the rice stalk in the field at maturity date. The result showed that post-harvesting losses was 2.67% on average. These losses occurred due to using of serrated sickle and cutting tools rather optimally. Besides that, speed of harvesters when cutting process in order to obtained maximal product also increased rice losses. The highest losses were known at Rengel (2.83%) and Singgahan (3.14%). Combine harvester machine was only one unit in each district so it was impossible to serve all of farmer groups.

There were 72 units serrated sickle found at Tambakboyo but all of them were highly broken and not useful again. From the table, it have been seen that the technology unevenly disseminated.

This was one of high post-harvest losses causes at Tuban. The condition of harvest equipments in study area was still relatively poor although evenly farmer groups found there. Limitations of the modern crop tools provided an indication that the farmer groups had not been interested to applying modern technology for harvest activity. The farmers still passively waited for government to procurement of new harvest tools.

Rice losses on stacking stage

The results showed an average loss during stacking process by 2.85%. The highest losses found at Widang (3.55%) and Singgahan (3.45%) districts. Loosing rate was due to the way to rice stacking did not use an adequate base equipments. Paddy just placed only on land at the harvest operation. Grain losses were usually due to scattered when removal of

stacked rice to thresher machine. Some farmers even brought the panicle far enough towards thresher machine used, for example, their home. Distances between the field and thresher caused more loss grain on the way.

Rice losses on threshing stage

For threshing, all of districts have been used thresher machine. There was no treading or beating on a board. There were a thousand of threshers in Tuban. The results showed an average loss on threshing process by 5.4%. Level of losses was caused by the threshing way that not maximally operated. Rice losses were due to rice grain spilling out from pedestal set up on land. Rice grain thrown out from thresher was more than 1 kg on average for every 51.5 kg grain. Then it followed by the grain blown out with undesirable materials and empty grains. And the grain that did not fall out because it was still attached to the paddy stalk in this process. The greatest losses were occurred in Merak Urak (5.98%) and Widang (5.79%) districts.

To avoid losses during threshing used thresher machine the farmers should be using nets or covering in order to the scattered grain could be accommodated again. In addition, it recommended that farmers used wide tarpaulins or plastic mat under thresher so that there was not a lot of grain scattered on the ground and difficult to be collected.

Rice losses at drying stage

Losses during the drying process on average by 1.20%. The highest losses encountered in Tambakboyo (1.60%) and Rengel (1.37%) district. Drying process in all districts used same method namely sun-drying. Drying process usually conducted for two days with grain thickness range from 4 – 7 cm. Grain losses usually increased when farmers dried them on the road side, Staurpalin or plastic mat. So when it was dried and placed in a sack would create a lot of losses. Good drying should be done on the floor drying of cement (concrete) which had a slightly slope. So the grain would dry quickly and there was not much grain left behind when taken back. However, not many farmers had area specifically for drying operation. For farmers located near the rice milling, usually they dried the paddy grain at filed of owned milling. So, after dry and ready to be milled at optimum moisture content, under 14%, farmers could directly mill grain into rice. Harvested Dried Paddy in area study observed range between 23-25%.

To produce good quality rice, the rice grain should be promptly dried, either by sun drying or artificial drying (flat bed dryer). If late, the quality of rice would decrease because the grain with high water content and moisture could cause spoilage, mildew, germinated or turn yellow rice. Beside caused by poor drying floor, rice losses also occurred because attacked by birds or chickens.

Rice losses at milling stage

Milling was stripping process of paddy grain to yield rice. In this process, there were two types of rice milling tool namely one phase (single pass) and two phase (double pass) types. In one phase type, the process of dehusking and milling was fused, loading grain to machine would be out become rice in one-time process, whereas in 2 phase type, the process was carried out twice. Usually, grain losses were caused by incorrect adjustment of blower suction and blowing for husk and bran, thus large amounts of rice grain also carried there. The rice yield was calculated from 100 kg milled rice owned the farmers as sample. The yield of 60 means every 100 kg of milled rice produces 60 kg of rice. The yield of 60 percent was assumed as a number of national rice yield.

The largest losses encountered in milling at Tambakboyo (3.83%) and Singgahan (2.83%) district. The average losses at 5 districts were 2.40%. The losses incurred due to the milling could vary depending on where farmers milled their paddy grains. For each mill was different one another concerning with the operation, depending on machine quality and operator skills. Milling losses was out of control the farmers.

Losses control for rice milling could be done if the relevant departments always performed inspection the feasibility of milling machines in their area. This was very important because the number of rice mills in Tuban was many and vary in size. Recorded by Department of Agriculture, there were 200 units of small-scale rice mills with rice production of less than 500 kg per hour, 382 units of medium-scale rice mills with rice production of 500-1000 kg per hour, and 26 units large-scale with rice production more than 1,500 kg per hour.

Harvest and post-harvest activities was so susceptible to quantitative and qualitative losses. Quantity losses or volume losses caused by large number of rice be expelled at harvesting, during transport, scattered at threshing operation, or drying. While qualitative losses could be due to a chemical or physical damage, such as germinated grain, cracked, yellow beans, and etc.

Post-harvest losses analysis and solutions

From the observations and calculations performed above, could also be shown the conversion value of grain produced, called Harvested Dried Paddy, ready to be milled after the water content was declined. At five districts under study were used 100 kilograms of sample grain from the farmers groups. In each 100 kg of harvested dried paddy with water content range 23-25% could be decreased up to 10-14%. After declining the moisture and other losses would be obtained the weight of Milled Dried Paddy range 66-82 kg. This mean that the conversion value of Harvested Dried Paddy to Milled Dried Paddy was in range 66-82%. The average conversion value in the district was 72%.

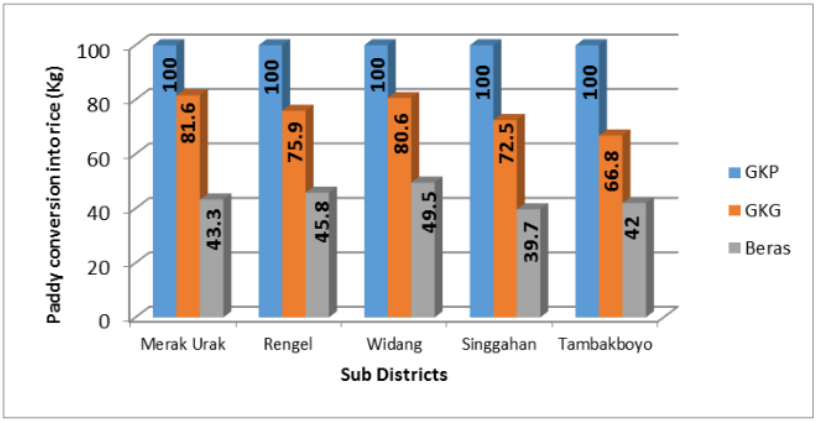

Figure 1. Paddy conversion into rice in 5 sub districts

Improving of skills and post-harvest technologies need to be applied, because it involves post-harvest losses that caused by the process of harvesting, threshing and drying. Furthermore, the calculation of conversion value from paddy into rice was also varied. In each 100 kg of milled rice (GKG) which converted into rice, the gained weight range between 55-60 kg of rice. Average value of conversion in five districts was 58%. The conversion rate could still be improved, but it could not be achieved directly by farmer groups, because it related to the milling process performance that existed in the region.

Overall post-harvest losses in five districts were still quite high reach 11.15% on average. The largest losses occurred in the process of harvesting, stacking and threshing. So it was recommended that the application of modern harvesting equipment should be evenly disseminate among farmer groups. Use of sickle should be gradually changed to paddy cutting scissors type and carrying, so it could be expected losses declining.

Table 1. Results of rice post-harvest losses, 2014

No	Activities	Tuban (%)	East Java (%)	National (%)
1	Stacking	2.85	2.90	0.73
2	Threshing	5.40	5.50	6.00
3	Drying	1.20	1.47	1.83
4	Milling	2.40	2.45	1.00
Total losses		11.15	12.32	9.56

Source: Research primary data 2014

Technology for minimizing rice losses

The critical point of losses occurred at the stage of harvesting and threshing. Both of stages were also cause of post-harvest losses in Tuban. Department of Agricultural in Tuban together with farmer groups were expected to perform a variety of attempts to suppress or reduced the rate of losses by increasing rice post-harvest technology applications. The goals were farmers could reduce or suppress the rice losses, improve the quality of paddy grain and rice, and increase the yield of milled rice and selling price. The technology to suppressed post-harvest losses could be described as follows:

Technology for determine harvest time

Farmers were expected to perform harvesting at optimal age. Optimal harvest time achieved after 90-95% of rice grain attached on panicle was already yellow or golden yellow. Harvested rice in this condition would yield very good grain with low content of green grain or grain whitewash. Harvested rice at optimum conditions would also yield high rice milled.

Stacking stage
The process before rice loading into thresher machine was stacking and collecting rice panicles. This stage also had the losses potential. To avoid or reduce the losses at harvest it should use suitable plastic mat or gonny sack at stacking and transport stage, so that the scattered paddy grain could be accommodated within the plastic mat or sack. The use of plastic mat and container at the stacking and transport process was able to suppressed losses up to 2%.

Threshing stage
Farmers in Tuban detached paddy kernel from the panicle by using power thresher machine. Indirect threshing of harvested paddy must be avoided, because indirect threshing of harvested paddy also yields losses when transported or feed by animals. Indirect threshing operation would damage the quality of grain due to moisture and chemical damage.
Grain damage after threshing delay for a day could increase losses between 1-3%. Paddy grain damage impacted on rice quality. Stacking operation should not be conducted for more than one day and storage using plastic mat or tarpaulin, not placed on the ground or floor.
Thresher machine performance would determine the degree of losses. Rotation speed of cylinder on thresher determined the outcome threshing, grain losses, and unthreshed paddy due to still attached to the panicle. Power thresher machine owned by farmer groups were suggested to run at speed of 400-450 rpm.
The main losses on threshing process was affected the behavior of farmers who worked less carefully, and rice reversal frequency in the tresher machine. The farmers did not aware the threshing cylinder speed and size of plastics used during threshing. Farmer groups were expected to use the optimal speed and tarpaulin to accommodate scattered paddy grain. Because paddy grain not only fall into the machine,but also much grain thrown out of the machine.
Some groups of farmer in Tuban had more advanced in harvesting technology. Some districts had familiar with reaper harvesting machine and combine harvester had also been done. Performance of both tools proved that farmers could harvest faster, cheaper and saved the lost grain. Reaper and combine harvester machine really able to minimized losses range 6-10%.

Drying technology
The drying process still need to be improved because not all farmers had drying place. Mostly drying process was sun-dried and it resulted losses caused by scattered, fed animals, and mixed with undesirable materials.

Sun-drying should consider to the light intensity, temperature changing, thickness and frequency of reversal. Drying process without regard to the matters mentioned above could lead to decrease rice quality, for example rice would be broken on milling process. Artificial dryer technology with husk fuel was superior technology that easy to apply because the drying cost was cheaper and more efficient with good quality.

Storaging technology
Generally farmers stored paddy grain in two ways (1) bulk system, dried paddy was stored in a place that was safe from pests and weather, and (2) storing used plastic bags, goony sack, dustpan basket and the others.
Losses during storing was caused by the condition of packaging, storage place, pests and diseases, local weather, and grain moisture content that would follow the equilibrium of air in the outside. In an airtight storage the moisture generally would not much change, while in the no airtight storage grain moisture would follow the change of surrounding humidity. Farmers who saved their paddy grain usually they dried until the moisture content below 10%, very dry, because usually the grain would be stored until the next harvest.

Milling technology
Milling operation was stripping process to produced rice grain by separation of lemma and palea layers and take out rice seed. In this process, farmers very depend on the milling machine and operator skills. Losses in milling stage was generally caused by incorrect adjustment of the suction blower (milling equipment), inappropriate blowing of the husk and bran. The losses could reach up to 2%.
Rice quality would be determined in the polishing process. A good process would yield rice with bright and shiny appearance, high degree of polishing. Incorrect milling process yielded brown rice, lower milling meter, high percentage of broken rice. Milling and polishing process that affected rice quality should be monitored and supervised by the farmers and agricultural department regularly. Because the large number of rice mills in a region did not guarantee good quality rice and even.

4. CONCLUSION

a. Increase of rice production in Tuban can be achieved by increasing production per hectare unit and reducing post-harvesting losses.
b. Post-harvest losses in Tuban still quite high 11.15%. This means that every year Tuban still lose paddy grain more than 70.882 tonnes or about IDR 212.65 million anually.
c. Largest losses occurred at the harvesting and threshing process. This processes are still using simple technology. Farmer groups need more modern and efficient of post-harvest machines.

Recommendation

a. One of machine recommended is reaper type and combine harvester. The machines can be managed together, so it can increase the income of farmer groups.
b. Rice mill is also an important part of the post-harvest losses. In this process, farmers produce rice grain from paddy to be sold and consumed. Inspection of rice milling technology regularly will make efficiency achieved.
c. It is expected that this study can be comprehensively continued in all districts to determine the priority areas in the government policy concerning with rice and other crops production.

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