Integration of superior varieties of sidenuk rice production with beef cattle business

Suharyono¹, S N W Hardani¹, T Wahyono¹ and C E Kusumaningrum¹

¹ Center for the Application Isotopes and Radiation, BATAN, Lebak Bulus Raya 49 St., Jakarta, Indonesia 12440

suharyono@batan.go.id

Abstract. Utilization of nuclear techniques in agriculture, animal husbandry and environment has found technology of superior varieties of rice with the name of SiDenuk, animal feed (feed supplement and concentrate plus) and organic fertilizer worm (kascing). The technologies have been disseminated, but the profitability of livestock farmers only comes from the sale of one commodity, so the income are still not optimal. The purpose of this research activity was to find out how far the profit income from farmers when the three technologies were integrated. The methodology used was the BATAN (INTAAN) integration model between SiDenuk rice with animal feed and kascing fertilizer. The three stages that have been implemented were 1) observation of the production of rice, straw, panicle compared to the national superior varieties, and the economic aspects of SiDenuk rice business unit, 2) the treatment of kascing fertilizer for SiDenuk Rice and 3) the economic aspect of the INTAAN application model. The observed parameters consisted of rice production, rice straw, panicle, rice production and economic aspects. The experimental design used in this study was Completely Randomized Design. The data were analyzed by variance analysis (ANOVA) using SPSS version 20. Step 1, rice production and Si Denuk rice straw tended to be higher than Ciherang, Ir-64, Mikongga and Mentikwangi, while the amount of rice in panicles was significantly different at P <0.05. The value of grain in panicles was 190, 120 and 116 seeds. The economic value of farmers harvests was Rp.1202500 / 1000 m². Step 2. Treatment by kascing (K), compared with compost (C) and combination of K + C was able to affect rice production, and number of panicles in grain, but the production of paddy was not significantly different, only tended to be higher if given treatment of the K fertilizer. The numbers of rice production and panicle were 720 and 608 vs. 452 kg / 1000 m² of dry harvest grains respectively, and 170.6 and 162.6 vs. 150.2 seeds/panicles. Step 3. The advantages of using INTAAN model related to Si Denuk rice production integration with beef cattle business were Rp 5594055.56, Rp 5778699.97, Rp 6107833.34, Rp 8383224.35 and Rp 8661321.29. The conclusion shows that rice varieties SiDenuk, grain production, rice straw was higher than national varieties, kascing fertilizer increased rice production, panicle and tended to increase rice straw production compared with fertilization with compost. INTAAN model was able to get the value of sales profit higher than the value of profit from the sale of one commodity.

1. Introduction
Field conditions for agricultural and livestock activities related to the availability of manpower, fertile land and pasture for livestock are limited; therefore a breakthrough is needed to solve the problem.
Human resources for cultivation, planting, maintenance, harvesting and post-harvesting and livestock rising are generally mostly older (over 50 years old) and fewer young people. These conditions resulted in the production of agricultural and livestock activities generated low and the benefits obtained are also less. As a result young workers are not interested in doing business in agriculture and livestock. Another problem faced is the availability of less sustainable livestock feed, and increases production of rice and livestock crops is not achieved.

In order for the production of paddy, livestock and manure products to gain more benefits, then a way that comes from the sale of some commodities of rice, livestock, animal feed, organic fertilizer and worm larvae as seeds. The proceeds from the sale of these commodities are expected to increase the added value of revenues from profits when compared to selling only one commodity, so that young workers will be interested in doing business units in agriculture and livestock. On the basis of that needed a technological breakthrough that able to increase the added value of income more than the results of farming and livestock by farmers. The technology used is the result of research and development (R & D) of BATAN that has been disseminated. Then SiDenuk superior rice varieties are integrated with livestock feed and kascing fertilizer. This integration model is called the BATAN-style integration model (INTAAN).

Rice crop is one of food commodities that plays an important role in the life of the economy in Indonesia. The agricultural sector is the most important field of life to be a source of life for most of Indonesia's population and get the main priority in development that aims to improve the living order of the economy that is able to encourage the improvement of people's standard of living [1].

SiDenuk variety has been released based on the Decree of the Minister of Agriculture no. 2257 / Kpts / SR.120 / 5/2011 on May 2, 2011. SiDenuk came from the Diah Suci variety irradiated by 0.2 kGy gamma ray from Co-60 with a potential yield of 9.1 tons/ha of dry grain milled (DMG) and the number of grains per panicle as much as 175-200 grains [2, 3]. Production capacity of rice and seeds/panicle is high. It is expected that the production of rice straw is also high. This means that the availability of SiDenuk rice straw is more and will be readily available on an ongoing basis, so the need for straw basal feed for cows will be met. Furthermore, it is also reported that rice production from SiDenuk is able to be sold in the form of grain during harvest, or dry milled grain, or dry grain harvested seeds, or conventional milled rice, and modern milled rice. The sales result from each post-harvest product is different, the income will be different and easy to know. To know the extent of SiDenuk varieties, the production of rice, rice straw and grain per panicle will be observed which is compared to the national superior varieties of Ir 64, Ciharang, Mikongga and Menthikwangi. Economic aspect of production of SiDenuk variety will be observed.

Throughout the year, rice harvest produces rice straw in large quantities of about 20 million tons per year, so that rice straw has the potential to become animal feed. Rice straw is part of root without root left after harvest. As it is known that rice is the second important food crop after wheat and more than 90% of Indonesians consume rice as staple food [4]. Increased rice production is also accompanied by an increase in rice straw waste. The abundance of rice straw that has not been utilized optimally encourages researchers to develop the potential of rice straw into something that has high economic value [5].

Increased production of livestock, especially ruminant livestock is influenced by feed. In order to live and produce high, livestock requires nutrients that have high quality, balanced, easy to obtain and available throughout the year. However, the availability of feed is the main obstacle faced by farmers, especially during the dry season. Therefore it is necessary alternative feed that is able to meet the needs of livestock continuously. One that can be utilized is rice straw.

Rice straw as a basal feed at this early stage is calculated only from its production, which will then be given to cows which are added to the ConPlus concentrate as reinforcing feed. Cow dung will be processed by cultivation of worms, and will produce organic fertilizer named fertilized worm (kascing). For the next kascing is used for rice fertilization SiDenuk. The two BATAN R & D results covering livestock feed and kascing technology were obtained, respectively through the utilization of nuclear
techniques in the form of tracer and radiation which were used for biological evaluation of metabolic results in rumen fluid and microbial stimulation of Aspergillus niger [6, 7].

ConPlus is a development of low quality local concentrate and improved quality by the addition of dietary supplements in its composition. This feed supplement is made based on local materials which is a technology that has been produced previously. The development of locally based feed supplement technology is actually the development of a multinutrient urea molasses block (UMMB), or multi nutrient feed supplement (MFS), and multinutrient feed supplements without molasses (MFSWM). This feed supplement was able to increase daily weight gain of beef cattle, milk production, beef and dairy cattle reproductive performance, also gave positive response to milk nutrition, and feed digestibility of Etawa goat cross breed [8, 9]. Urea Multi nutrient medicated block is also a development of UMMB and able to increase milk production and weight gain after calving of beef cattle [10]. ConPlus has been used to fatten cattle on Idh Adha Day and improve the condition of the female cow body where body condition score (BCS) is only one value.

Based on the above BATAN R & D information, the results of research with the use of nuclear techniques will be integrated between SiDenuk rice crops with livestock, livestock feed and kascing fertilizer. This INTAAN model will be the maximum profit-raising pattern for farmers, since the profits will be greater if compared to the profit value of one commodity sale.

2. Experimental method

Three stages of the activities that have been carried out in the research were 1) observation of the production amount of rice straw and paddy from SiDenuk variety compared with national rice varieties (Mikongga, Ciherang, IR 64 and Menthik Wangi), 2) fertilizer treatment with kascing fertilizer compared with compost, and fertilizer kascings + compost to the production of paddy and rice straw from SiDenuk, and stage 3) economic value calculation of integration model BATAN (INTAAN).

2.1. Stage 1: Observation of paddy and rice straw production of Si Denuk varieties compared with national varieties

The research was conducted in Sompilan, Donoharjo Village, Ngaglik Subdistrict, Sleman District, Yogyakarta Special Region. The study was a case study on farmers. With the initial stage of the research was an approach to farmers to know the socio-cultural and economic conditions through interviews and application of technology. Interviews were conducted with farmers. The application of technology was based on the increase of integrated paddy production, which consists of the use of SiDenuk variety and national superior varieties (Mikongga, Ciherang, IR 64 and Menthik Wangi).

Planting of young seedlings less than 20 days, legowos row planting, organic fertilizer 200kg/1000 m², chemical fertilizer 30 kg Phonska and 15 kg Urea/1000 m² and utilization of waste from rice straw. The land that will be used as a nursery was processed, then ransacked into the mud. After that, the seed was sown on a plot that has been made. Soil processing was done by hand tractor until the soil forms mud. Planting was done with legowo 2: a 1-row system by planting move 1 stem/clump) [1, 11]. Age of seedlings when planting less than 20 days after seedling. Pest and disease control was done by farmers using observation with integrated disease pest control system. Weeding done using weeding tools and done 3 weeks after planting followed by hand grass removal. Watering was still natural by way of flooding on the surface and added when the water starts to shrink. Harvesting using sickles and threshing was done by banging on a special tool made of wood. Production was taken by tiling 2.5 m² x 2.5 m² to calculate the production of each hectare. The economic value of farmers' income was also calculated. Parameter measured production of rice and rice straw also panicle. The experimental design used in the study was a Complete Randomized Design. The data were analyzed by analysis of variance (ANOVA) using SPSS 20 version.

2.2. Stage 2: Effect of kascing fertilizer on rice straw and rice production of Denuk varieties

Procedures for planting up to harvest rice as in the activity of Stage 1. The difference was seen in the treatment of fertilizer, and not compared with the national superior varieties. Location of activity was
higher than sea level, because it was close to Mount Merapi approximately 10 km, while the stage 1 distance of approximately 25 km. Fertilization with inorganic fertilizer was adjusted to the use of a standard amount of fertilizer which was added with 3 organic fertilizer treatment. Each of kascing fertilizer (K), compost fertilizer (C) and the combination of kascing and compost fertilizer (K+C). The amount of organic fertilizer from 3 treatments was adjusted with the standard. Parameters observed the amount of rice straw, rice production and seeds/panicle of SiDenuk variety. The experimental design used in the study was a Complete Randomized Design. The data were analyzed by analysis of variance (ANOVA) using SPSS 20 version.

2.3. Stage 3: The economic value of the result of BATAN model integration activities
Integration of BATAN model was an integrated activity between BATAN’s R and D of rice, animal feed and cattle dung with process of worm cultivation. These results have been disseminated, but integrated has never been implemented. The superior rice variety used was SiDenuk variety. This rice was grown in three farmer groups at planting season I. The farmer group was in the village 1) Wonorejo, Sariharjo, 2) Sompilan, Donoharjo, 3) Suruh, Donoharjo, Ngaglik and Sleman districts. The procedure of planting in accordance with standard operational procedures established by the Department of Agriculture in the area, as well as the harvest of paddy. The Farmers’ Group from Suruh cooperates with seed breeders and certification centers for seeds to be sold as seeds. The seed breeder was willing to buy the paddy crop when it was harvested (dried grain of harvest/DGH) or bought in dry harvest (dried milled grain/DMG) condition. A DHG with the price Rp.4500 / kg, this price was higher when compared with the standard price of the DHG price which was Rp.3500 / kg. As for the other two groups were sold at the time of DHG, DMG and sold in the form of ground rice with conventional and modern milling.

The result of the activities of the livestock nutrition group was the plus concentrate (ConPlus) which was a feed provider of energy and protein for beef cattle. This ConPlus was tested on beef cattle to be fattened and sold during Idhul Adha Day. The cattle used for the 3 species of research which were owned by the farmers of livestock, each given concentrate plus diet (ConPlus), and the gift was tailored to the nutritional needs which in line with the desire to increase body weight / head / day. The price of cattle at the beginning of buying was Rp. 14 million/head. Each cattle farmer besides raising cattle also works on rice cultivation. They also exist as owners or landowners. Land used to grow food crops (paddy) area of 1000 m².

Cow manure was processed by worm cultivation, the fermentation process was completed 21 days. In this research work together with one of the professors at the Faculty of Agriculture, University of Gadjah Mada (Margino, 2015) which facilitated the house of worm fertilizer (kascing). Manure kascing was packed in sacks 25 kg.

Based on the INTAAN model, the economic analysis of the business unit integration between SiDenuk rice and beef cattle business unit was calculated from the profit of grain or rice sales, which was then added to the profit value of the sale of fattening beef cattle (BC) on Idhul Adha Day, non-productive cow (CRI), animal feed (ConPlus / CP, feed supplement / FS), kascing organic fertilizer (MK) and worm larvae (WL). While SiDenuk rice business unit was divided into two kinds of sales in the form of grain and rice. Sales of dry harvested grains (DHG), or dried unhulled grains (DMG), or dry harvesting grain for seed (GDHS). Sales of rice in the form of traditional milling (TMR) and modern (MMR). So the total value of profits resulting from integration activities of SiDenuk rice business unit with beef cattle business unit can be made with a formula to calculate it. So total profit values are MMR + BC + CRI + FS + CP + MK + WL. Cultivation activities of rice crops, cattle and earthworms (Lumbricus rubillus) were carried out for 3 months, as well as for the production of animal feeds.

3. Result and discussion

3.1. Stage 1: Observation of paddy and rice straw production of Si Denuk varieties compared with national varieties
Paddy and rice straw production among rice varieties in the planting season I showed no significant difference ($P > 0.05$), but the production of panicle showed significant difference ($P < 0.05$). SiDenuk grain production tended to be higher when compared with the Ciherang and Ir 64 varieties, the amount of production were 640 vs 547 and 593 kg/1000 m². This was supported by the result of the calculation of the number of grains on the panicle, the number of grain panicle from SiDenuk 190 vs 116 and 120. According to SK Minister of Agriculture no. 2257 / Kpts / SR. 120 / 5/2011 on May 2, 2011 the number of grains in panicles was 170-200 [2, 3]. Production of grain, rice straw and number of rice panicles of several varieties during planting season I are shown in Table 1.

| Superior varieties | Paddy grain (kg/1000 m²) | Rice straw (kg/1000 m²) | Panicle (kg/1000 m²) |
|--------------------|--------------------------|--------------------------|----------------------|
| Ciherang           | 548<sup>a</sup>          | 671<sup>a</sup>          | 116<sup>b</sup>      |
| IR64               | 593<sup>a</sup>          | 593<sup>a</sup>          | 120<sup>b</sup>      |
| SiDenuk            | 640<sup>a</sup>          | 640<sup>a</sup>          | 190<sup>a</sup>      |

Superscript on the same line is significantly different at $P < 0.05$.

Observation activities of rice production, rice straw and seeds per panicle have been carried out during the planting season II. The results are presented in Table 2.

| Superior varieties | Paddy grain kg/1000 m² | Rice straw kg/1000 m² | Panicle Seeds/panicle |
|--------------------|-------------------------|------------------------|------------------------|
| IR64               | 805<sup>a</sup>         | 853<sup>a</sup>        | 119<sup>b</sup>        |
| SiDenuk            | 811<sup>a</sup>         | 827<sup>a</sup>        | 170<sup>a</sup>        |
| Mikongga           | 669<sup>b</sup>         | 789<sup>a</sup>        | 128<sup>b</sup>        |
| Menthikwangi       | 696<sup>b</sup>         | 800<sup>a</sup>        | 160<sup>a</sup>        |

Production of rice, and the number of panicle seeds in the dry season II, were statistically significantly different at $P < 0.05$. Production of rice and seeds/panicle of SiDenuk, Ir 64, Mikongga and Menthikwangi were 811 vs 805, 669 and 696 kg/1000 m² and 170, 119, 128 and 160 respectively. However, the production of rice straw was not significantly different. The production of Si Denuk and Ir 64 rice straws were seen to tend to be higher than those of Mikongga and Menthikwangi varieties. The number of panicles is closely related to the ability of the plant to produce the seedlings and the ability to maintain the various physiological functions of the plant. The more saplings are formed, the greater the chances of the formation of saplings that produce panicles. At the time the plant begins to bloom almost all of the photosynthetic results are allocated to the generative parts of the plant (panicles) in the form of flour. In addition also mobilization of carbohydrates, proteins and minerals in the leaves, stems, roots to move to the panicle [12].

Rice in producing the amount of grain is influenced by various factors such as the characteristics of panicle length and nutrient availability. Each rice varieties have different characteristics of panicle length. The longer the panicle, the more grain will be formed. Differences in the number of grains per panicle produced from each variety are caused by genetic factors of each variety. Besides, environmental factors play a role in the high number of per panicle grain, because the sunny weather conditions can increase the rate of photosynthesis, the energy of light used to overhaul the water and the acid gas of charcoal is converted into food, the resulting photosynthate will be stored in the stem and leaf tissues, then will be translocated to grain maturation level [13].

3.2. Stage 2: Effect of kascing fertilizer on rice straw and rice production of Denuk
Based on statistical result, kascing, compost fertilizer, and combination of compost and kascing fertilizer did not give significant difference in rice straw yield (P <0.05). However, based on data obtained, kascing fertilizer tended to give the highest influence on rice straw production from SiDenuk varieties compared with the amount of rice straw production that production from SiDenuk varieties compared with the amount of rice straw production that was fertilized with compost or combination of kascing and compost. The production amount was 1560 kg vs. 1276 and 1348 kg respectively (Figure 1).

![Figure 1. Rice Straw production of SiDenuk.](image)

The statistic shows that compost, kascing and combination of compost and kascing fertilizer gave significant difference to the production of paddy varieties (P <0.05). Treatment of kascing fertilizer gave significant effect (P <0.05) on rice production and higher production compared with composted fertilizer, but with combination of K+C was not significantly different. The amount of production from K fertilized and the combination of K+ C was 720 and 608 kg/1000 m² vs 452 kg/1000 m² (Figure 2).

![Figure 2. Paddy production of SiDenuk.](image)

Statistical analysis showed that compost, kascing and combination of kascing compost fertilizer gave significant difference to the production of panicle of varieties (P <0.5). Based on the data obtained, kascing fertilizer has the greatest influence of panicle varieties when compared with compost and K+C combination, but the number of grains/panicle was not significantly different P<0.05. The values were 170.6 and 162.6 vs 150.2 grains/panicle (Figure 3).
Based on Figures 1, 2 and 3 it is shown that kascing fertilizer has the greatest influence on grain production and the number of panicle of rice varieties. This shows that kascing fertilizer had sufficient nutrients for productivity of rice crops. This is in line with the opinion of Rohaeni et al., (2012) [14] which states that the availability of nutrients become a very important factor in stimulating the panicle initiation process to be perfect, so that the chances of grain formation become more. If during the process of filling the grain, not balanced with the availability of sufficient nutrients will form a lot of empty grain. Percentage of grain contents is one indicator of crop productivity, the higher the percentage of grain content obtained by a variety indicates that the variety has high productivity [15]. Kascing fertilizer had the greatest influence in the production of rice straw varieties. This was because the nutrients contained in the fertilizer kascing had a role in cell division, formation of albumin, the formation of flowers, fruits and seeds, accelerate the maturation of seeds and root development. Maximum growing root caused the plant to more easily absorb the nutrients needed for the growth and development of the plant, resulting in average weight of fresh straw obtained in kascing fertilizer treatment was better than with other treatments [16]. Nutrients that have been absorbed by roots, both used in the synthesis of organic compounds and fixed in ionic form in plant tissues, will contribute to the increase of dry weight of plants [17]. Excessive use of inorganic fertilizers will damage soil fertility in paddy-fed rice paddies. Researchers who previously reported that using organic fertilizer had a significant effect on rice growth and productivity. When combined with inorganic rice is able to boost production and while maintaining and improving soil health [18].

![Figure 3](image-url)  
**Figure 3.** Panicle production of SiDenuk.

### 3.3. Stage 3: The economic value of the result of BATAN model integration activities

The observation of SiDenuk rice in three locations after 3 months was harvested. The yields were distinguished by three kinds of grain production, the first was dried harvest (DGH), the second, dry milled grains (DMG) and the third, dry seed harvesting grains (GDHS). Observations on traditional milled rice (TMR) and modern milled rice (MMR) were produced from DMG. The profit from each type of post-harvest production was Rp.567388.89; 752033.3; 1081166.67; Rp. 3356557.68 and Rp. 3634654.62. The amount of profit on MMR sales was higher than the profit value of other production sales. The gain disaggregation from MMR sales when compared to DGH, DMG, DGHS and TMR sales was 72.99; 65.71; 54.15 and 3.98%.

Along with the cultivation of SiDenuk rice cultivation, there has also been a business unit of beef cattle which was distinguished from fattening cattle business (BC), unproductive cow (CRI), feed (ConPlus / CP and feed supplement / FS), organic fertilizer from worm cultivation (MK) and larvae of earthworm/WL (Lumbricus rubellus). The respective sale result obtained profit respectively Rp. 2566666.67; Rp. 1000000; Rp. 400000, Rp. 500000, Rp. 500000 and Rp. 60000 (Figure 4a).
In accordance with the INTAAN model integration application, the profits from DGH, or DMG, or DGHS, TMR and MMR sales were added to the benefits of the beef cattle business unit including BC, CRI, CP, FS, MK and WL. So the number of advantages of the INTAAN model integration result was Rp. 5594055.56, Rp. 5778699.97, Rp. 6107833.34, Rp. 838322.35 and Rp. 8661321.29 (Figures 4a and 4b).

| Commodity                          | Profit (Rp)       |
|-----------------------------------|-------------------|
| Dried grain of harvest (DGH)      | 567388.89         |
| Dried milled grain (DMG)          | 752033.3          |
| Grain of dry harvest seeds (GDHS) | 1081166.67        |
| Traditional milled rice (TMR)     | 3356557.68        |
| Modern milled rice (MMR)          | 3634654.62        |
| Beef cattle (BC)                  | 2566666.67        |
| Cattle reproductive improvement (CRI) | 1000000        |
| Feed supplements (FS)             | 500000           |
| Concentrate plus (CP)             | 400000           |
| Manure kasking (MK)               | 500000           |
| Worm larvae (WL)                  | 600000           |

(a)

Figure 4 (a) Detailed information on the summary of words from several commodities and information on the figures from the sale of each commodity (Rp) in the SiDenuk and Beef Cattle business units based on the INTAAN model. (b) The value of profit from sales integration between SiDenuk rice business unit with beef cattle business.

Profit income from the sale of one commodity compared with some commodities from the result of integration between SiDenuk rice and beef cattle business unit was very big difference of profit. This can be seen from the value of profit at the time of the sale of one commodity, the highest profit of MMR, but still lower if compared with the value of MMR sales profit added with the profit from the sale of beef cattle business unit. The value is Rp. 3634654.62 vs Rp. 8661321.29 or the difference in profits up to 40.88%. Especially when compared with the sale of one commodity DGH was Rp.567388.89 vs Rp. 8661321.29, so the difference in profits up to 65.83%.

On the basis of the use of INTAAN model (integration of BATAN research results in the form of SiDenuk rice varieties, feed supplement, Concentrate plus (ConPlus) and fertilizer worm (MK) is very promising to increase farmer income and invite young human resources participate in the development of agriculture and livestock. Especially the INTAAN model was developed into a model of integration of organic farming model BATAN, then the value of the profits will be more and more secure, because organic food selling value is higher and will have a positive impact on the welfare, human health and
young human resources will be more interested in participating in business units in agriculture and livestock.

The result of integration of SiDenuk rice business unit with beef cattle based on INTAAN model looks bigger profit. Revenue from this integration result has been supported by previous researchers who reported that profit with cattle fattening business alone was only Rp. 611250 / ha/head / year, while the business unit of rice plants only got Rp. 12745000/ha/year. Furthermore, after the integrated activities for beef cattle got profit Rp. 3477380 / head / year, and the cultivation of rice crops as much as Rp. 90517250/ha/year [19]. Tjeppy (2007) [20] mentioned that the main objective of integrating food crops and livestock was to obtain maximum benefit, further mentioned that one characteristic of integration activities between farmers and livestock.

The above income gains are seen to give hope to the farmers in carrying out the activities of farm or livestock business unit in an integrated way as well as the INTAAN model. Rohaeni et al., 2005 [21] livestock integration system in farming was one of the efforts to achieve the optimization of agricultural production. This effort has been largely undertaken which significantly added value to both farm produce and livestock productivity. Integrated farming was able to reduce production costs, especially on the provision of forage, as a source of labor and can contribute in the purchase of fertilizer.

4. Conclusion
The result of integration activity between rice business unit from SiDenuk and beef cattle varieties shows that SiDenuk's superior rice varieties for paddy and seed production per panicle were higher than National varieties. Production of rice straw tended to be equal to the amount of rice production. Kascing fertilizer contributed to the increased production of rice and grain/panicle from SiDenuk varieties. Application of INTAAN model were able to increase farmer's income more than if without integration (one commodity sold). The highest total profit was obtained by selling milled rice with modern milling (MMR) plus the value of profit of beef cattle business and waste processing with worm cultivation. Total profit value was Rp 8661321.29 (MMR) vs Rp. 5594055.56 (DHG), Rp. 5778699.97(DMG), Rp. 6107833.34 (GDHS), and Rp. 8383224.35 (TMR) respectively.

Acknowledgement
This research was supported by Indonesia National Nuclear Energy Agency. We thank our colleagues from Center for Application of Isotopes and Radiation (PAIR) and who provided insight and expertise that greatly assisted the research, although they may not agree with all of the interpretations/conclusions of this paper. We thank people animal nutrition in PAIR for assistance with particular technique, methodology etc for comments that greatly improved of this paper.

References
[1] Purnomo 1996 Rice Planting Technology Jajar Legowo System. Agricultural Information Sheet Agricultural Technology Research Institute Karangploso
[2] Wahyudi B I Rial A and Shiddiq M 2013 Description of Superior Varieties of Breeding Mutations of Rice, Soybean, Green Beans, Cotton, Sorghum. Nuclear Science and Technology Dissemination Center National Nuclear Energy Agency
[3] Mugiono Hambali Sutisna S and Yulidar 2011 Inpari Sukiden Description of Superior Variety of Breeding Mutation Result Dissemination and Partnership Center National Nuclear Power Agency
[4] Empel Mireille van Makkar H P S Dijkstra J Lund Peter 2016 Agricul., Veterinary Sci. Nutrition and Natural Resources 11 37
[5] Yanuarianto O Amin M Iqbal M and Hasan S D 2015 J. of Indonesian Animal Sci. and Tech. 1 (1) 47-52
[6] Suharyono Shintia N W H and Teguh W 2015 A Scientific J. for The Applicat. of Isotopes and Radiation 11 99-111
[7] Nana M Larasati T R D Nurhasni Meliana N 2015 A Scientific J. for The Applicat. of Isotopes and Radiation 11 13-25
[8] Suharyono 2010 Development of feed supplements for ruminants and introduction to farmers. Nuclear Sciences, scientific presentations of middle/major researchers 1(1) Center for the Dissemination of Nuclear Science and Technology BATAN 1-40
[9] Suharyono Faizal Z Gito W and Asih K 2015 Proc. of Nat. Sem. on Livestock and Veterinary Techn. 164-71
[10] Suharyono H Sutanto H Sutanto Purwanti Martanti A Agus and R Utomo 2014 Atom Indonesia J. 40(2) 49-56
[11] Suardana P A Antara M and Nature M N 2013 J. Agrotekbis 1(5) 477-84
[12] Mahmud Y and Purnomo S S 2014 J. of Sci. Solutions 1(1) 1-10
[13] Chozin M Sudjamiko S and Barchia M F 2017 Australian J. of Crop Sci. 11 5
[14] Rohaeni W R Sinaga A and Ishaq M I 2012 Agricultural Informatics 21(2) 107-15
[15] Ikhwani Suhartatik E and Makarim A K 2010 J. of Food Crops Agriculture Research 29(2) 63-71
[16] Syakhril Riyanto and Arsyad H 2014 AGRIFOR J. XIII(1)
[17] Sulistyoeno Eko Suwarno Lubis I and Suhendar D 2012 Agrovigor. 5(1) 1-8
[18] Morteza S Alireza N Shankar L L 2011 J. of Agricultural Sci. 3(3) 217-24
[19] Judy M T, Panelewew V V J and Mirah A D P 2014 Zooteck. J. 34(2) 1-9
[20] Soedjana T D 2007 J. of Agricultural Research and Development 26(2) 82-7
[21] Priyanti Atien 2007 Impact of the Livestock Integration System Program on Allocation of Working Time, Farmer Income and Expenditure Dissertation Bogor Agricultural University