

Integrated Farming System of Corn and Cattle

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Abstract--- This article discusses the concepts of integrated farming system, the importance of integrated farming system development, and integrated farming system of corn and cattle. Integrated farming system is a farming system that combines a variety of crops and livestock and the application of various techniques to create suitable conditions to protect the environment, maintain land productivity and increase farmer income. The development of integrated farming system is very important, because the integrated farming system has many usages and advantages and benefits in line with the objectives of the regional development which is to improve the society welfare. And it can be a solution for the various problems that arise in the regional development. System integration of the corn and cattle (SIJS) to increase profit because it can increase productivity, reduce production cost and increase farmers income. SIJS contribute significantly for the income of farmers and cattleman. Then SIJS also can optimize the utilization of local resources such as the use of straw as animal feed and manure as organic fertilizer and produce biogas so no waste is wasted.

Keywords--- Integrated Farming System, Corn, Cattle

INTRODUCTION

This article discusses the concept of integrated farming system, the importance of an integrated farming system development, and integrated farming system of corn and cattle. Food security is one of the strategic issues in the context of developing countries. To support the food security program in the future, then each region is required to optimize the utilization of the land resources in order to further sustainability of production is maintained [1].

Development is a process of change from a less than good condition toward a better condition which lasted conscious, planned and sustainable in order to increase the welfare of the community life of a nation. Development must be interpreted as a multidimensional process involving major changes to both the structure of the economy, social change, reduce or eliminate poverty, reduce inequality and unemployment in the context of economic growth [2].

The new paradigm of agricultural development is to improve the quality and professionalism of human resources peasants as actively agents of integrated agricultural development. The development of agriculture aim to optimize the use of natural resources and advanced technology that is inexpensive, simple, and effective, supplemented with the structuring and institutional development of agriculture in the rural.

The concept of environmentally sustainable agricultural development is one of them with an integrated farming system of crop and livestock, that approach to farming system without waste. This system is an innovation that is extracted from the traditional wisdom that is enriched with the appropriate technology in the use of rice straw as feed and processing livestock manure as organic material [3].

Sustainable agricultural system is also often referred to as an organic farming system, integrated farming, environmentally friendly farming, agriculture natural harmony, or

ecological agriculture. This farm system is not just a process of planting and maintaining plants, but it is a cycle that is not disconnected from the pre-production process (selection of certified seed, organic fertilizer making), production (tillage, seed dispersal certified, maintenance) to post-harvest (harvesting, yields processing). Uninterrupted cycle in the agricultural process illustrates that agriculture is a system that is closely related to the environment (agro-ecosystem) [4].

Integrated farming system was introduced based on study and research results which then gradually appear cropping pattern, farming patterns until the term of the farm system. Integrated farming system of crop and livestock is one of the many technologies currently being developed in sustainability of production system and increase farmer income.

Integrated farming system was directed to the efforts to lengthen biological cycle by optimizing the use of agriculture and livestock by-products. Each chain of cycle resulted a new product that has high economic value, so this system was expected to optimize the empowerment and use of marginal land in all regions [5]. Thus it is very important integrated farming systems in as a solution to increase agricultural production.

Integrated farming system of crop and livestock is one of the many technology currently being developed in the framework of sustainability of production system and increase farmer income [1]. Integrated farming system of corn and cattle is system integration without waste so that plant waste into fodder input, otherwise livestock waste used to fertilize crops. The advantage of this model of integrated farming is the positive interaction between two or more commodities are combined [6].

METHODS

This study using library studies method. The activities in the research is summarize the definitions, concepts and research results from various references that are relevant with the research purpose. The references that used consists of books, proceedings, journals and others [7].

RESULTS AND DISCUSSION

Integrated Farming System

Sustainable development is development that focuses on fulfillment the needs of the present generations without compromising the fulfillment of the needs of future generation. Sustainable agriculture is agriculture that do not break, do not change, harmonious and balanced with environmental or agricultural obey and submit to the rules of nature. Sustainable development included sustainable agricultural development, so that sustainable agricultural development is development activities that integrate economic, social and environmental aspects. Sustainable agricultural development can be done with four models of system, namely 1) organic farming system, 2) integrated farming system, 3) low-external input farming system, and 4) integrated pest management [8].

Integrated farming system cope with the changes farm level, in a manner that balances food production, profitability, safety, animal welfare, social responsibility and environmental care [9] Integrated farming system has been used for integrated resource management which may not include either livestock or fish components. Its focus is the integration of livestock and fish, often within a larger farming or livelihood system [10].

Integrated farming system is a farming system that combines a variety of crop and livestock, and the application of various techniques to create suitable conditions to protect the environment, maintain land productivity and increase farmer income [8]. This farming system occurs between the input-output relationship of commodities, linkages between production activities with pre-production and post-production, as well as between agriculture and manufacturing activities and services [11]. This farming system is part of the agro-ecotechnology system consisting of various interrelated components include: non-farm business components, bio-physical nature, and socio-economic, political and cultural [12]. Integrated farming system is a system approach to the use of low external input between crops with livestock [13].

This farming system is a system of management of crop, livestock and fish with its environment to produce an optimal product and nature tend to be closed to the external input [14]. Integrated farming system is the utilization

resources are dual aimed and balanced with the selection of plant and animal species [15]. This farming system is a farming system which is based on the concept of recycling between the cultivation of plants, fisheries and livestock [16].

Integrated farming system is the system invariably having combination of crop and animal components. Where, the product and byproduct of one component can be used for other component. Integrated farming and mixed farming benefits more interms of economic returns than the mono crops. The demand for food is increasing day by day due to decreased food production; there is continuous conversion of agricultural lands to residential lands and also the number of farmers working in the field is drastically reduced [17]. An integrated farming system is one of the alternatives for climatic change mitigation [18].

Agricultural systems are setting the stabilized farming, unique and feasible are managed based on the practice match with physical environmental, biological and socioeconomic according to objectives, preferences and household resources. The farming can be as cultivation or livestock raising. The feasible farming is productive and efficient that have productivity, or production per unit of high land [19]. System integration can also increase household income by processing cow manure into compost. Then compost can be sold to other farmers or people that need its. Integrated farming systems approach system in a single production cycle [20].

Integrated farming system is one of the diversified activities of commodities that can be done to offset the demand for agricultural products (mainly food crop) are constantly increasing through the utilization of a synergistic relationship between commodity endeavored, without damaging the environment and high labor absorption. Implementation of integrated farming system is the right choice to increase farmers' income and at once to utilize optimally agricultural resources.

Integrated farming is defined as biologically Integrated farming system which integrates natural resources and regulation mechanisms into farming activities to achieve maximum replacement of offfarm inputs, secures sustainable production high quality food and other products through ecologically preferred technologies, sustain farm income, eliminates or reduces sources of present

environment pollutions generated by agriculture and sustains the multiple function of agriculture [21].

Based on some of the above concepts, it can be concluded that the integrated farming system is a farming system that combines two or more fields of agriculture, which is based on the recycling biological concept, an linked of input-output between the mutually commodities which approach of low-external input utilization, which is done at the land, through the utilization of crop waste, animal manure, fish waste for the purpose of increasing the production and productivity so as to increase farmer income and can create condition that are environmentally friendly farming. Then it should consider several aspects, namely: Sustainability that environmental friendly (environmentally tolerable), is socially accepted by society (socially acceptable), are economically viable (economically feasible) and politically acceptable (politically desirable).

Development of Integrated Farming System

Development of integrated farming system is a very important thing to do, this is because the integrated farming system has many benefit and advantage, That is: a) a food provider the most effective and efficient; b) almost no component is wasted; c) to improve the effectiveness and efficiency of production; d) farmers can have several sources of income; e) there is guarantee if the crop failure; f) has a byproduct; g) reduce dependence on external inputs; h) agricultural waste can be used as biomass; i) energy efficient and cost-effective; j) are the biological balance, pests are not so much; k) develop alternative solutions which include energy biogas energy; l) able to improve the supply of fertilizers and animal feed; m) able to improve significantly the lives of small farmer [22].

Advantages of integrated farming system are productivity, profitability, sustainability, balanced food, environmental safety, recycling of waste, saving energy, adoption of new technology, money round the year, availability of fodder, fuel and timber, employment round the year, agro-industries, increases input efficiency, standard of living and avoid degradation of forest [21].

Integrated farming system could also be a solution to the problems in the regional

development. This is include: a) physical environment damage; b) biotic environmental damage such as: the decline of biological resources, illegal logging, damage to coastal ecosystems, rivers, and lakes; c) damage to natural resources; d) natural disasters; e) lack of development of local potential [23].

The importance of the development of integrated agricultural system are supported by some research results. Integrated farming system in North America could increase the diversification of agricultural production more competitively and more environmentally suitable. Integrated farming system in the United States can improve soil quality and efficiency of land use, reduce dependence on external inputs, control pests and increase the population of insect pollinators, promote the conservation of biodiversity are scarce, increased the output, diversified food, the benefits of food security and strengthen the agriculture economy [24].

Integrated farming system in India were able to increase the income of farmers, production cost is reduced or no cost of materials, provide additional job and minimize the risk of production. This system can save resources and high level of production, sustainability and preserving the environment [25]. This system can improve soil fertility and productivity, reduce environmental hazards, the potential for food security, nutritional benefit, job creation and provide additional income [26]. The system is also profitable and productive [27].

Integrated farming system in Ethiopia, Zimbabwe, Mali and Sub-Saharan Africa can reduce poverty, improve livelihoods of smallholder crop-livestock and boost national economic growth. While in Nigeria integrated farming system as integrated system of agricultural crops, livestock, fisheries, processing. [28], [29].

Integrated farming system in Vietnam could improve yield four times as compared to non-integrated systems [30]. In Japanese integrated farming systems can reduce the purchase cost of fodder and fertilizer costs, so that can increase farmer income. And Then more intensive and profitable, because it can increase the yield and production quality in the highlands [31].

Integrated farming system in Thailand could take advantage of livestock waste as a source of plant nutrients and organic fertilizer to improve

crop yields and reduced production costs [32]. While in Brazil integrated farming system can obtain higher yields and more profitable and better for the environment [33], [34].

Some research in the country. Integrated farming systems to increase productivity and farmer income and reduce production costs. Integrated farming system can increase farmer income by utilizing vacant land into productive [35], [36], [37].

Integrated farming system could increase farmers income, improve soil fertility, water and air quality and creating environmental compatibility [38]. Integrated farming system could ensure the sustainability of land productivity and provide results and optimum added value [39]. Integrated farming system can improve the efficiency of farming, or to maximize profits by minimizing security risks [15], [40]. Integrated farming system is often recommended as one of the most promising solutions for declining soil fertility and declining productivity in system intensification in Nigeria [41].

Integrated Farming Systems of Corn and Cattle

Integrating livestock with crops offers farmers opportunities to improve soil health and enter new, diversified markets that can reduce risks and increase farm resilience to weather extremes. Before adding livestock to an operation, however, it's important to understand the financial, infrastructure, and marketing demands involved in producing animals. Contracting grazing services might be a good way to begin integrating livestock with a cropping operation [42].

Integrated farming systems BioCyclo-Farming (BCF) is a system combining elements of the plant with cattle elements such that these two elements be in synergy with one another and biological cycles. BCF system characteristics related to the mitigation of climate change impacts are: the return of organic waste to the land, which utilizes waste recycling, agricultural systems without waste by installing a bio-digester that produces biogas [43].

Integrated farming system of corn crops and cattle is an attempt to combine corn crop and cattle farmers in farming system. Waste corn used as cattle feed in the form of fresh or after being processed or preserved while animal waste used as

fertilizer on maize. The inhibiting factor in adopting utilization of corn straw for animal feeding are the lack of feed storehouse, the lack of knowledge in preserving corn straw and the availability of many other feed resources. The barrier to adoption of the use of manure as organic fertilizer was the lack of knowledge in composting and the cost of manure processing [44].

System integration of rice plant, corn-beef cattle at the level effort scale < 0.50 ha, and scale ownership of beef cattle earn Rp 11,826,026, giving an average income of farmers amounted Rp 21,003,173 for large scale > 1 ha, and Rp 23,197,101 on a scale of 0.50 to 1 ha, and Rp 11,826,026 on a broad scale land < 0.5 ha. System integration of rice plant, corn-beef cuttle a major contribution to the revenue-livestock farming system is the contribution of corn on a scale rice farming land area < 0.5 ha 66.40 %, 74.04 ha and 0.50 to 1 scale and scale > 1 ha of 78.00 % and for of beef cattle on a broad scale land < 0.5 ha 33, 60 %, scale 1 ha land area 0,5-25.96 %, and the scale of land area > 1 ha 22 % [45].

The integration of the corn and cattle are economically able to reduce costs and increase revenue of corn crop farming and cattle business. Socially integrated system able to strengthen farmer groups and environmental performance can be more conducive [46]. concluded that the integration systems of coconut-corn-goat can improve productivity and farmer's income. The integration of crops and livestock in the area of coconut may increase oil production from 9.211butir / year to 18 081 grains / year. The corn crop is cultivated among coconut plantations ha 0.6 ha of the area within 1 year and 2 times planting produce as much corn pipil 2829.6 kg worth USD 3.3955 million [47].

Feeding corn waste fermentation in cattle collectively enclosure able to provide the biggest daily weight gain, reaching 0.2944 kg / head / day. So that the integration of the corn and cattle provide an income of Rp. 6,212,067 with a rate of R/C 1.5 [48]. System integration of annual crops-cattle were able to benefit. System integration is able to give big contribution to the income of farmer-breeder [49].

Technically the integration of the corn-cattle-coconut are viable by using the introduction of appropriate technologies and statistically significantly different treatment patterns of

farmers are subsidized production facilities, especially with patterns of pure peasant farmer farming [50]. Implementation of the integration system of corn and cattle can increase revenue by 78.2% per season compared to non integration with large scale planting 3 ha and the number of cows 20 head. In addition, the weight gain of cattle produced are higher, such as 0.5 kg/head/day [51].

Integration of corn and cattle can provide added value generated from waste forage corn as cattle feed and wastes (feces) cattle as fertilizer for the corn crop [52]. Integration of corn and cattle can increase the income and welfare of farmer. This integration will be able to be realized by farming corn with an area of between 2-3 ha and supported by raising cattle were collectively enclosure [3]. Integration of corn and cattle can increase corn production and increase the revenue of Rp 940,000/USD 2.0715 million growing seasons/planting season. Where the R/C ratio increased from 1.57 to 1.81 [53].

Integration system corn and cattle is farming system without waste (zero waste) so that the plant waste into fodder input, otherwise livestock waste used to fertilize crops. The advantage of this integrated system is the positive interaction between two or more commodities are combined, so that it can increase the income of farmer [6]. Integration corn and cattle in Sari Mulya the village very beneficial because it can use manure which can efficiently use fertilizer so thatto increase the revenue of Rp 240.000/ha/growing season. Manure biogas can reduce the cost of the purchase of kerosene and time searching for firewood, other than to the waste products of biogas can be used directly into manure [54].

Integration of corn and cattle have the effect of a dual economy. On the one hand, the production cost per unit becomes cheaper due to optimization of local resources, on the other hand increased production of corn and production cost savings as anutilization of livestock manure so no waste is not utilized [55]. In system integration corn-cattle, the income can be derived from corn crops, calves, and manure. Thus, the advantages gained in a land area larger than when planting only corn. System integration corn-cattle in South Sulawesi to provide benefits Rp 4.797.118 /ha /planting season with the B/C ratio of 1.40 [56].

The return of organic matter to the soil increases CO₂ fixation in the soil in the form of

soil organic matter. Increasing soil organic C positive impact on soil fertility, seed production and biomass plants. Carbon content of the soil increases of 2.04%, equivalent to CO₂ moored 40.80 tonnes / ha, being 3.32%, equivalent to 66.40 tonnes / ha in year 6 BCF applications, an increase of carbon in the soil for 3 , 65 tons / ha / year, equivalent to tethering 12.28 tonnes / ha / yr of CO₂. Seed production of maize increased from 2.1 t / ha to 5.9 t / ha in year 5 BCF application. Total biomass increased from 6 t / ha to 16.8 (tons/ha). The recycling system BCF technologies that use waste from the farming system into farm production inputs to produce products that store carbon is carbon mitigation technologies tethering by slowing the conversion of carbon into the atmosphere of CO₂ gas. Installing a biodigester in BCF technology that utilizes manure waste to produce biogas and modifications in cattle feed rations is mitigation technologies that can reduce CH₄ emissions from cattle farming activities [43].

The supplementation of 60%-80% grass fodder with concentrate lowered the concentration of methane gas in cattle breathing by 28.7%, from 617 ppm to 440 ppm, while the methane emissions from cattle manure decreased by 31%, from 1367 ml/head/d to 943 ml/head/d. Installing a bio digester that generates biogas served to accommodate methane gas emissions from cattle dung and used it for bioenergy. Composting reduced the formation of methane gas from cattle manure through a regular process of turning over that gives aeration and forms aerobic condition in the heap of cattle dung. Recycling produces a variety of organic products that store carbon for a longer period of time and slowed the conversion of organic C into CO₂. This study showed that the diverse activities of an integrated crop-cattle farming could be an alternative solution to climatic change mitigation [18].

The corn yield of the farm that adopts ICLS was higher than the municipality and state yield average. In 2012, due to a long drought period, a decrease of 32.47% of corn yield was observed on the farm. Likewise, the Fortuna municipality average presents a 60.29% decrease. These data indicates that losses of the crop production systems resulting from environmental factors can be minimized by adopting integrated systems. Thus, the ICLS can be a technological practice which can improve the crop yield in Fortuna county and Maranhao State [57].

CONCLUSION

Integrated farming system is a farming system that combines two or more fields of agriculture, which is based on the recycling biological concept, an linked of input-output between the mutually commodities which approach of low-external input utilization, which is done at the land, through the utilization of crop waste, animal manure, fish waste for the purpose of increasing the production and productivity so as to increase farmer income and can create condition that are environmentally friendly farming. Then it should consider several aspects, namely: Sustainability that environmental friendly (environmentally tolerable), is socially accepted by society (socially acceptable), are economically viable (economically feasible) and politically acceptable (politically desirable).

Development of integrated farming systems is a very important thing to do, because the integrated farming system has many benefits and advantages in order to increase the income and welfare of farmers. integrated farming systems could also be a solution to overcome the problems that arise in the regional development.

Implementation of the system integration of the corn and cattle (SIJS) to increase profits because it can increase productivity, reduce production costs and increase farmers' income. SIJS contribute significantly to the income of farmers and breeders. Then SIJS also can optimize the utilization of local resources such as the use of straw as animal feed and manure as organic fertilizer and produce biogas, so no waste is wasted.

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