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Land consolidation in Ky Anh district, Ha Tinh Province, Vietnam

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Abstract

The study was carried out in Ky Anh district, Ha Tinh province, to analyze the situation and economic efficiency of land consolidation. The secondary data on land consolidation results is collected from Department of Agriculture and Rural Development of Ky Anh district. A survey of 99 households from three communes is conducted to gather data on agricultural productivity of sub-land use types. Economic efficiency is measured by three indicators (production value, added value, and capital efficiency). Land consolidation helps people to decrease land fragmentation, arrange fields, and proactive irrigation, create favorable conditions for the application of science and technology, and improve the economic efficiency of sub-LUTs, thereby increasing farmers' income. Land consolidation is necessary to gain targets according to Plan No. 537/KH-UBND. The state must implement proper rules to encourage people to acquire land and apply science and technology to production. Provide adequate capital to consolidate and develop fields. Training to assist farmers in gaining faster access to advanced science and technology, market knowledge, production and business management, etc.

Keywords: Agricultural production, land consolidation, Ky Anh district

Land fragmentation has been shown to significantly reduce crop output in numerous nations (Abubakari *et al.*, 2016; Tan *et al.*, 2008a) ^[1, 22]. It leads to differences in applying science and technology to production (Huyen *et al.*, 2024) ^[8] and raises agricultural labor and crop production expenses (Ho *et al.*, 2017) ^[6]. Consequently, it reduces crop and farm incomes (Tran & Vu, 2019) ^[24]. Vietnam is one of the countries facing the most severe land fragmentation in rural areas because land is granted to households and individuals based on the principle "almost, there are far, there are good" to ensure justice (Huyen *et al.*, 2024; Marsh *et al.*, 2007) ^[8, 13].

According to Nguyen *et al.*, (2023) ^[14] application of science and technology is an inevitable trend to create high-quality agricultural products that are competitive in the market while contributing to sustainable land use (Huyen *et al.*, 2023; Zhang *et al.*, 2022) ^[7, 29]. Large parcels of land are very crucial for applying science and technology in agriculture. Land consolidation is a method of land concentration by changing land use rights among households and individuals (Huyen *et al.*, 2024) ^[8]. Land consolidation has a vital role in reducing land fragmentation, enhancing agricultural infrastructure, and increasing agricultural profitability (Bizozza, 2021; Chen *et al.*, 2024; Wojewodzic *et al.*, 2021; Yin *et al.*, 2022) ^[2, 3, 26, 28]. Improved land fragmentation factors minimize the

overall production costs of the relevant agricultural segment (Tan *et al.*, 2008b) ^[23]. Many studies have demonstrated that apart from lowering operational farming expenses, land consolidation improves the landscape, and environmental conditions, and also helps the location thrive in other domains (Li *et al.*, 2018; Satola *et al.*, 2018; Shan *et al.*, 2019) ^[12, 19, 20]. In Vietnam, agricultural land consolidation has been applied by numerous localities, and it is the most significant condition for new rural construction (Nguyen *et al.*, 2023) ^[14].

Ky Anh district is located on the North-South traffic artery, with 23 kilometers of National Highway 1A, making it convenient for economic development and cultural commerce. It is a good location for marine tourism development, especially with 21 kilometers of coastline and a handy transportation system. Implementing Resolution No 04-NQ/TU, Resolution No 06-NQ/TU (Party Executive Committee of Ha Tinh Province, 2021b, 2021a) ^[15, 16], Ky Anh district has promoted land consolidation to form large-scale concentrated production areas, bringing increasing income to people. At the end of 2023, only approximately 40% of the area has been consolidated according to Plan No. 537/KH-UBND (Ky Anh District People's Committee, 2022) ^[11].

After more than two years of land consolidation, several agricultural production models have delivered stable income to people, land fragmentation has improved significantly, and agricultural production organization is favorable. However, the results have not been achieved as planned.

Thus, it is necessary to evaluate the results of land consolidation and analyze the economic efficiency of the Sub-LUTs before and after land consolidation in Ky Anh district. It is an important basic to give practical recommendations to enhance it.

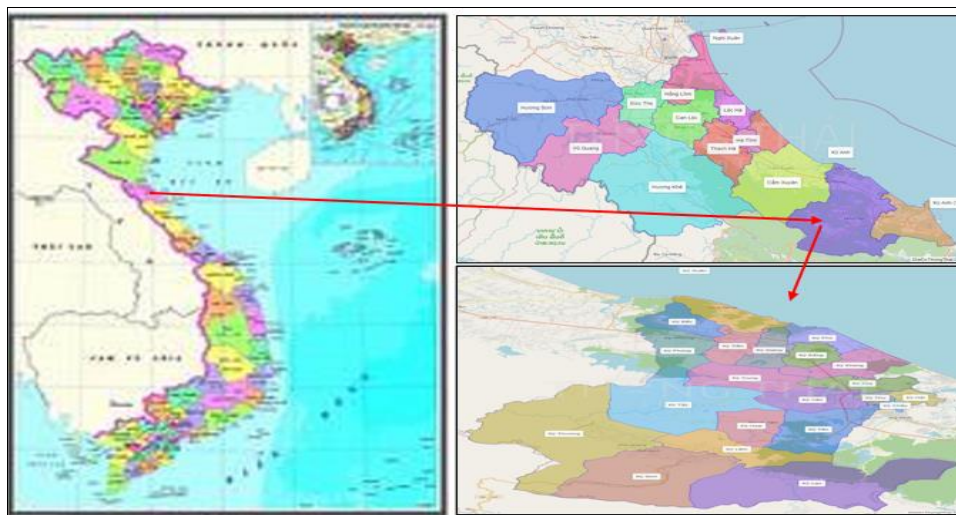


Fig 1: Geographic location map of Ky Anh district

Methodology

Data collection: Primary data on land consolidation are collected from the People's Committee of Ky Anh district, Department of Agriculture and Rural Development of Ky Anh district, and the People's Committee of communes. Secondary data are collected by investigating 99 households from three communes (Ly Xuan, Ky Phu, Ky Van). Three communes were chosen based on criteria such as representing two sub-regions. The communes of Ky Xuan and Ky Phu present the delta sub-region; Ky Van commune present the coastal sub-region. The main survey criteria include area, productivity, yield, and intermediate costs. The number of investigated households is determined by the following formula (I). Where, n is the number of investigated households; N is the total of households that participated in land consolidation; e is the allowable error ($e=10\%$).

$$n = \frac{N}{1 + N(e)^2} \quad (\text{Yamane, 1969}) \quad (I)$$

Methods of evaluating the economic efficiency s of land use types (LUTs) and sub-land use types (Sub-LUTs):

The economic efficiency of agricultural land use is evaluated according to many different indicators. Application of guidelines for assessing the effectiveness of land use sustainability proposed by FAO, can include 3 indicators: production value (PV), value added (VA), and capital efficiency (CE). Production value is calculated based on production data and prices domain. Value added is determined as the difference between production value and intermediate costs. Capital efficiency is calculated as the quotient between value-added and intermediate costs.

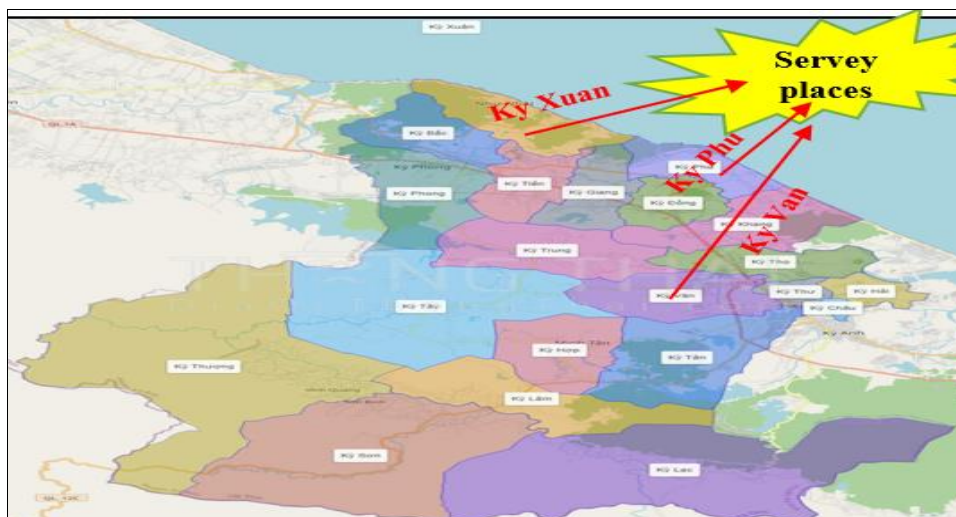


Fig 2: Survey places

Data analysis and specialist: The SPSS 20.0 software is used to process, synthesize, analyze, and present the collected data. The expert method through discussion organization is used to gather limitations and obstacles from land consolidation.

Results and Discussion

Procedure of land consolidation in Ky Anh district

Implementing Resolution No 06-NQ/TU; Decision No. 310/QD-UBND (Party Executive Committee of Ha Tinh Province, 2021b; People's Committee of Ha Tinh Province, 2022)^[16, 17], People's Committee of Ky Anh district issued Plan No. 537/KH-UBND to implement land consolidation. Land consolidation aims to overcome the fragmentation and dispersion of land; form large fields and specialized production areas; create favorable conditions for cultivation, care, irrigation, and disease prevention; apply scientific and technical advances, mechanization, and digital transformation in production; reduce costs; improve productivity and product quality. At the same time, it

attracts businesses to invest in agriculture, transfer science and technology, link production with farming households, and cooperatives, and promote the development of large-scale, modern commodity agriculture, associated with sustainable new rural construction (Ky Anh District People's Committee, 2022)^[11].

According to Plan No. 537/KH-UBND, Ky Anh district will consolidate in 53 regions of 10 communes with a total area of 1,960 hectares from 2022-2025. After consolidation, each household will only have 1-2 plots, with over 80% of households using one plot. The district aims to reorganize production by founding cooperative groups in 16 regions of 8 communes with an area of 614 hectares and re-lease 47 hectares in 6 regions of 3 communes. In the stage of 2026-2030, about 1,000 hectares will be consolidated. Apart from the aforementioned plan, the district encourages communes to select acceptable territories for consolidation. According to Plan No. 537/KH-UBND, land consolidation is carried by a 6-step procedure (Ky Anh District People's Committee, 2022)^[11].

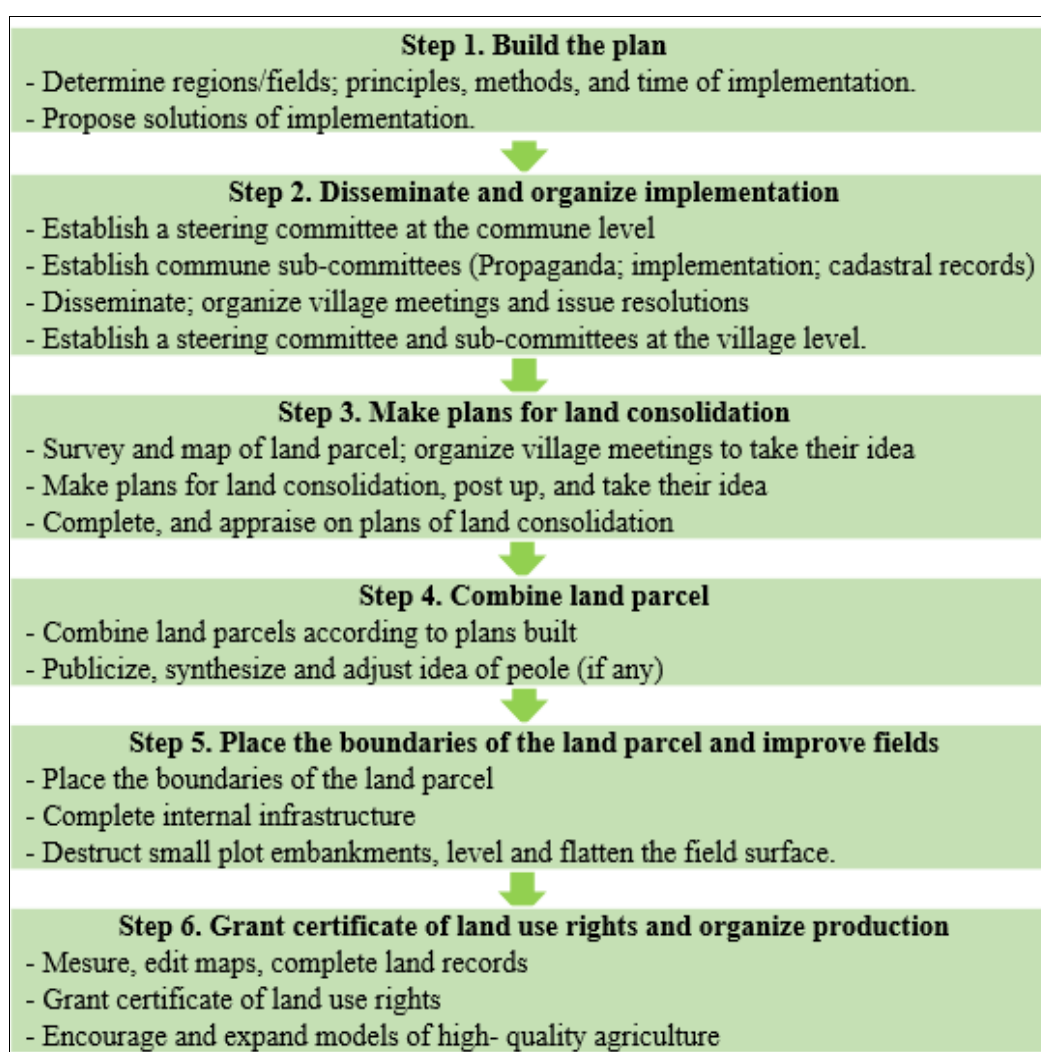


Fig 3: The procedure of land consolidation

Result of land consolidation in Ky Anh district

According to Department of Agriculture and Rural Development of Ky Anh district (2024), by the end of 2023, 4,047 households in 18 regions of 9 communes have

consolidated with an area of 887.94 hectares. Data in Table 1 shows that the number of land plots/households decreased from 3.11 to 1.01; the average area of each land plot increased from 705.44 to 2,181.67 square meters.

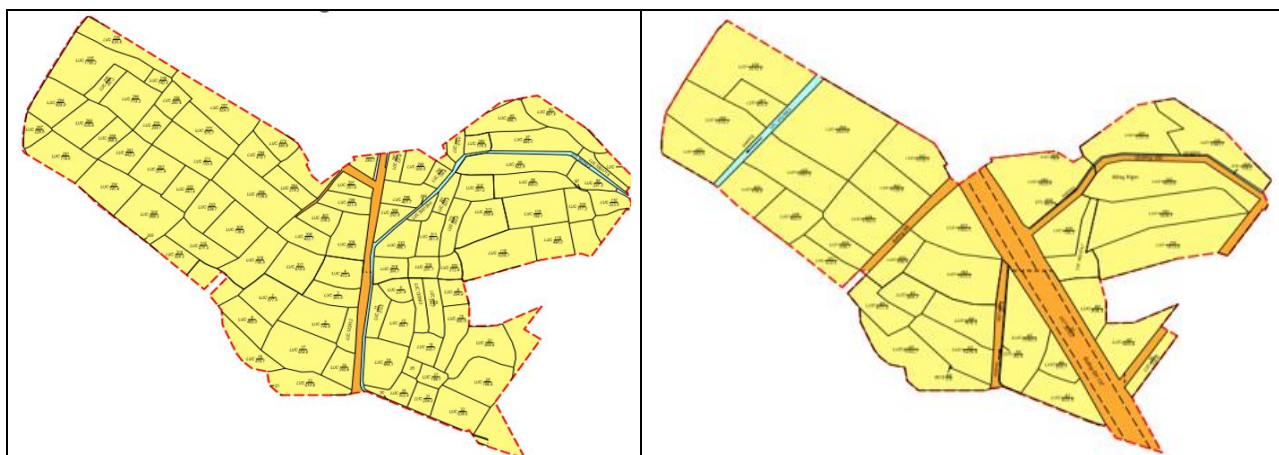
Table 1: Result of land consolidation in Ky Anh district

Communes	Number of households	Area	Before land consolidation		After land consolidation		
			Number of plots/households	Average area of each plot (m ² /plot)	Number of plots/households	Average area of each plot (m ² /plot)	Area of the biggest land plot (m ² /plot)
1. Ky Phong	457	125.0	3.67	745.8	1.21	2,268.60	6,009.62
2. Ky Bac	416	68.9	2.17	762.2	1.10	1,510.96	4,150.60
3. Ky Tien	642	112.46	2.30	763.0	1.20	1,460.52	5,406.73
4. Ky Giang	523	108.39	2.73	758.0	1.21	1,709.62	10,731.68
5. Ky Xuan	308	65.7	5.04	423.3	1.18	1,814.92	4,266.23
6. Ky Van	697	145.8	3.26	642.0	1.00	2,091.82	4,909.09
7. Ky Hai	405	91.50	3.16	715.4	1.16	1,955.13	7,561.98
8. Ky Phu	482	125.19	6.80	381.7	1.24	2,086.50	6,167.00
9. Ky Tho	117	45.0	4.79	803.6	1.21	3,169.01	5,232.56
Total	4,047	887.94	3.11	705.44	1.01	2,181.67	5,750.91

(Source: Department of Agriculture and Rural Development of Ky Anh district, 2024)

Land consolidation solves the situation of scattered land, creates large fields, encourages enterprises, cooperatives, cooperative groups, and other economic sectors to invest in commodity agricultural production; and enhances the application of high technology associated with digital transformation to improve land use efficiency, productivity, and producer income. Additionally, the irrigation and

transportation infrastructure in the fields were excavated and rebuilt. According to Department of Agriculture and Rural Development of Ky Anh district (2024), the irrigation and transportation systems in the fields have been newly constructed and excavated, which is a favorable condition for the development of agricultural production. In particular, organic farming models are increasingly expanding.

**Fig 4:** Land plots before and after land consolidation

According to Plan No. 537/KH-UBND, 10 communes in Ky Anh district will be consolidated, including Ky Phong, Ky Bac, Ky Tien, Ky Xuan, Ky Giang, Ky Dong, Ky Phu, Ky Khang, Ky Tho, and Ky Van. However, at the end of 2023, two communes Ky Dong and Ky Khang have not yet

consolidated. Ky Hai commune consolidated 91.50 hectares despite not being included in the 2022-2025 land consolidation plan. Ky Tien and Ky Xuan communes exceeded the plans, reaching 281.15 and 115.26% respectively (Table 2).

Table 2: Comparison of land consolidation results with the plans

Communes	Plans from 2022 to 2025 (ha)	Result (ha)	Ratio (%)	Communes	Plans from 2022 to 2025 (ha)	Result (ha)	Ratio (%)
Ky Phong	531.00	125.00	23.54	Ky Hai	0.00	91.50	
Ky Bac	72.00	68.90	95.69	Ky Phu	270.00	125.19	46.37
Ky Tien	40.00	112.46	281.15	Ky Tho	126.00	45.00	35.71
Ky Giang	307.00	108.39	35.31	Ky Dong	90.00	0	0.00
Ky Xuan	57.00	65.70	115.26	Ky Khang	65.00	0	0.00
Ky Van	402.00	145.80	36.27	Total	1,960.00	887.94	

(Source: Ky Anh District People's Committee, 2022; Department of Agriculture and Rural Development of Ky Anh district, 2024).

According to the study's findings, the most challenging aspect of land consolidation is harmonizing the technique of land redistribution so that everyone has the same piece of land. Therefore, propaganda and mobilization play an important role in getting consensus and support from the

people. Furthermore, scarce funds for the consolidation and planning of the field are major obstacles to enhancing land consolidation.

Assessment of economic efficiency

The efficiency of agricultural land use is an indicator that measures agricultural productivity and represents the input-output mix of agricultural production. It is determined by the interaction of physical, socioeconomic, and technological factors (Reddy & Ramanaiah, 1985) ^[18]. Improving the organization of agricultural regions relies heavily on increasing the efficiency of agricultural land usage (Kustysheva *et al.*, 2018) ^[10]. Economic efficiency is a complex notion that describes the effectiveness of an economic activity about the expenses incurred, or the effort expended to attain it. So, the achieved result on a spent value unit is bigger, and the economic efficiency is higher (Chiran A. *et al.*, 2002) ^[4]. Kelly *et al.*, (1995) ^[9] stated that an agricultural farm obtains economic efficiency when the marginal value of inputs equals their corresponding unit costs. If the marginal value is higher, the farm can increase profits by producing more, resulting in greater efficiency. The farm should reduce production to boost profitability if

the marginal value is lower.

Table 3 shows that there are changes in LUTs and Sub-LUTs. Before land consolidation, there were 3 land use types (LUTs) and 5 Sub - LUTs (Winter Spring Rice - Summer Autumn Rice; Winter Spring Rice; Spring Peanuts - Summer Rice; Rice - Vegetable; Rice - Climbing Perch). After land consolidation, Sub-LUT of Winter Spring Rice is converted to Sub-LUT of Summer Rice - Climbing Perch - Wild rice in Phu Minh village, Ky Phu commune; Sub-LUT of Winter Spring Rice - Clam Worm is regenerated to grow in Dau Giang village, Ky Khang commune. The area of Winter Spring Rice - Clam Worm in Dong Lang region, Dau Giang village, Ky Khang commune, was a low-lying place with brackish and salty water, where there was a lot of Clam Worm. Over time, pesticide use by humans led to the extinction of Clam Worm and other living organisms in fields. Organic agriculture has allowed for the restoration and cultivation of Clam Worm alongside organic rice.

Table 3: LUTs and sub-LUTs in Ky Anh district

LUTs	Sub-LUTs	
	Before land consolidation	After land consolidation
I. Rice only	1. Winter Spring Rice - Summer - Autumn Rice 2. Winter Spring Rice	1. Winter Spring Rice - Summer-Autumn Rice
II. Rice - cash crop	3. Spring peanuts - Summer Rice 4. Summer Rice - Vegetable	2. Spring Peanuts - Summer rice 3. Summer Rice - Vegetable
III. Rice - aquaculture	5. Summer Rice - Climbing Perch	4. Winter Spring Rice - Climbing Perch 5. Winter Spring Rice - Clam Worm
IV. Rice - aquaculture - cash crop		6. Summer Rice - Climbing Perch - Wild rice

The study results suggest that, after land consolidation, the district has pushed organic rice production practices. The pilot model of " Winter Spring Rice - Clam Worm " in Dau Giang village, Ky Khang commune, with an area of 5 hectares, has shown to be economically efficient, motivating farmers to expand to approximately 20 hectares. To develop this model, Ky Anh district is continuing to mobilize all resources to focus on building synchronous infrastructure; transferring techniques for properly caring for, regenerating, and exploiting Clam Worm; and collaborating with businesses to develop production models of rice- Clam Worm of Ky Anh district. Data in Table 4 show that the value added of all LUTs/Sub-LUTs is higher than before land consolidation, ranging from 1.2 to 8.4 times. Sub-LUT

of Winter Spring Rice - Clam Worm has the highest value added (152.19 million VND per ha) and Sub-LUT of Summer Rice - Climbing Perch - Wild rice has the highest capital efficiency (8.4 times). Many scholars across the world and in the country have confirmed that land consolidation can boost agricultural production efficiency and raise farmers' revenue (Chen *et al.*, 2024; Do *et al.*, 2023; Sklenicka, 2006; Van Dijk, 2007) ^[3, 5, 21, 25]. Furthermore, enterprises have linked organic agricultural practices to create a closed chain of high-quality organic rice production, preservation, and consumption. This increases people's income while also ensuring environmental hygiene in the fields.

Table 4: The economic efficiency of LUTs/Sub-LUTs

LUTs/Sub-LUTs	Before land consolidation			After land consolidation			Comparison* (times)
	GO	VA	CE	GO	VA	CE	
I. Rice only	53.34	26.52	1.0	95.36	59.03	1.6	2.2
1. Winter Spring Rice - Summer - Autumn Rice	72.02	37.33	1.1	95.36	59.03	1.6	1.6
2. Winter Spring Rice	34.65	15.71	0.8				
II. Rice - cash crop	94.62	57.16	1.5	108.17	71.88	2.0	1.3
3. Spring peanuts - Summer Rice	106.24	59.96	1.3	117.94	72.23	1.6	1.2
4. Summer Rice - Vegetable	83.00	54.36	1.9	98.40	71.53	2.7	1.3
III. Rice - aquaculture	99.41	51.81	1.1	210.70	134.49	1.8	2.6
5. Summer Rice - Climbing Perch	126.8	66.29	1.1	199.10	116.79	1.4	1.8
6. Winter Spring Rice - Clam Worm	72.02	37.33	1.1	222.30	152.19	2.2	4.1
IV. Rice - aquaculture - cash crop	34.65	15.71	0.8	218.67	132.20	1.5	8.4
7. Summer Rice - Climbing Perch - Wild rice	34.65	15.71	0.8	218.67	132.20	1.5	8.4

(Note: * is the difference between the added value after land consolidation and before land consolidation).

The success of land consolidation in the Ky Anh district was proved when several large fields applied advanced technologies through value chains in production. The agricultural sector has increasingly evolved from small-scale traditional production to large-scale commodity production. Many models of linked production and organic production have resulted in high economic efficiency by creating a spreading effect, expanding the area and orientation, improving productivity and product quality, gradually producing high-quality goods, ensuring food safety, and meeting standards for domestic and foreign markets. However, the area for organic cultivation in Ky Anh remains limited. The primary reason is that people prefer to farm using traditional methods; organic farming productivity is often lower than conventional farming, resulting in greater operating expenses; and farming practices are more carefully regulated.

Conclusion and Recommendation

By the end of 2023, the total of households is consolidated their land is 4,047. After land consolidation, over 80% of households have 1 plot/household contributing remarkably to decreasing fragmented land, orienting large-scale commodity production. The value added of LUTs/Sub-LUTs is higher than before consolidation, ranging from 1.2 to 8.4 times. In particular, models of organic cultivation not only greatly increase the income value per unit of product, but also create a sustainable ecosystem. However, their area remains limited. The primary reason is that people prefer to farm using traditional methods; organic farming productivity is often lower than conventional farming, resulting in greater operating expenses; and farming practices are more carefully regulated. Furthermore, organic farming incurs higher beginning costs.

Land consolidation has been confirmed to play an important role in the agricultural production of Ky Anh district. Therefore, it is necessary to carry out land consolidation to complete the targets according to Plan No. 537/KH-UBND. Appropriate policies must be implemented to encourage households and individuals to consolidate agricultural land and apply organic agricultural production. The state must set aside sufficient funds immediately to accomplish agricultural land consolidation. In addition to capital sources from the State, it is necessary to promote the mobilization of capital sources from the people, businesses, and other organizations. Furthermore, preferential lending policies must be used to consolidate agricultural land and invest in equipment and machinery for agricultural product production and post-harvest processing to boost product value.

Expanding agricultural cooperative ventures and organizations based on the value chain. Cooperatives and the common economy are being developed and strengthened. The application of science and technology in agriculture must be concentrated. Industry 4.0 technologies must be prioritized, particularly those that enable digital transformation in agriculture at critical points such as trading, traceability, and agricultural product consumption. Training to assist farmers in gaining faster access to advanced science and technology, market knowledge, production and business management, etc.

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