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Agriculture by-products managements in North mountainous area of Vietnam-case study in Bac Kan–Vietnam

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ABSTRACT

Agricultural solid waste is causing severe environmental pollution in rural areas of Vietnam. The result showed that in spring seasons, 65% of farmers said they burned 60% of all the rice straw they got after harvesting it. In the summer seasons, most of the farmers used their rice straw in this season to feed their livestock and burn in the fields; 61% of farmers used a large amount of rice straw they got (60%-100%) for their buffaloes and cow. At the same time, 33% of all interviewees said they burned a similar amount of rice straw in the fields. Farmers make compost from manure they got from their neighborhood. This activity was practiced by 34.3% of all farmers. Some common materials used to make compost were manure, rice residue, ash and green manure. Compost was usually used for mainly rice and vegetable. 63.6% believed compost would give them higher crop yield, while about 50% of farmers did it because it helped them save money. Besides, that compost could improve soil fertility was believed by 36.4% of all farmers involved.

After harvesting, half of the farmers interviewed often left a significant amount (60%-100%) of maize stovers and leaves, and then burn them in fields while 8.7% of farmers in the survey shared that they use more than 60% of maize stover to feed their livestock. Maize is a good food source for domestic animals because the contents of fiber and crude protein of them account for 31.5% and 7.6%, respectively. The starch sugar contents in this type of maize residue are higher than in rice straw. Up to 90% of people asked shared that they use all their corncobs for cooking.

Keywords: Agriculture by products; Residue from rice cultivation; Residue arising from maize cultivation; Waste arising from livestock; Environmental pollution

Introduction

When talking about solid waste, many people often think of this as an urgent problem in urban areas or big cities. That is true but not enough: Solid waste is no longer an urgent problem only in urban areas and big cities but has become an alarming problem even in rural areas. Along with the athletic and quick development of industries, the change in living habits makes the pressures from solid waste in rural areas increase in composition, toxicity, and generated volume [1]. The primary sources of environmental pollution in rural areas are the abuse of pesticides, chemical fertilizers, animal feed in agricultural production, solid waste from craft villages and daily life.

The research conducted a random selection of households. After that, from this selection, poor, near poor and fair families were chosen as participants of the survey. According to the criteria of household classification in the period of

2011-2015 stipulated in Decision 09/2011/QĐ-TTg of Vietnam on November 30th, 2011, a household is defined as the poor one if its monthly income is 500.000 VND or less (22.51 USD) in urban areas and 400.000 VND or less (18.01 USD) in rural areas; Households in urban areas with monthly income from 501000-650000 VND (22.55–29.26 USD) and ones in rural areas with average income of 401000-520000 VND per month (18.05–23.41 USD) are considered to be near poor [2]. The ethnic composition in Quang Chu commune includes 7 groups living in 13 villages: Dao, Tay, Kinh, Nung, San Chi, Cao Lan, H'Mong. The population of Quang Chu is distributed unevenly. The village with the highest population is Deo Vai 1. In recent years, due to good performance in family planning, population growth rate has decreased gradually. People mainly work in agriculture and forestry. Some other professions account for a very small part and a majority of labor in the locality is untrained. The status of land in Quang Chu commune is shown in Table 1.

Types of land	Area (ha)	ructure (%)		
The total area	5.035,35	100%		
Agricultural land	3.503,88	69,6		
Land for agricultural cultivation	891,86	17,7		
Land for annual crops	623	12,4		
Land for paddy rice	236,28	4,7		
Land for other annual crops	386,72	7,7		
Land for perennial crops	268,86	5,3		
Forestry land	2.590,44	51,4		
Productive forest land	2.061,62	40,9		
Protective forest land	528,82	10,5		
Land for aquaculture	21,58	0,4		
Non-agricultural land	388,13	7,7		
Residential land	29,78	0,6		
Specialized land	247,82	4,9		
Land for construction of offices, buildings	0,10	0,001		
Land for non-agricultural business	191,25	3,8		
Land used for public purposes	52,24	1,04		
Land used for defense purposes	4,23	0,08		
Land for cemeteries and graveyards	2,35	0,043		
Land for stream and specialized water surface	108,18	2,1		
Unused land	1143,34	22,7		
Flat unused land	70,31	1,4		
Sloping unused land	37,02	0,7		
Rocky mountain without forest	1036,01	20,6		

Table 1: The areas of land and the structure of land using in Quang Chu commune.

It can be seen from Table 1 that there is a huge source of land in the locality. Primarily, the land is used for agricultural and forestry production [3]. The use of sloping land for forestry production accounts for up to 51.4 percent. In addition, flat land is used for the production of rice and some vegetables.

In Chu Quang commune, agriculture plays a key role. It has favorable soil conditions, terrain which is not too steep, many areas of land which are raised the levels by silt from Cau River. This facilitates the development of agricultural production [4]. In the large area of farmland, paddy rice, maize is mainly grown. Other crops such as beans, peanuts, sugar cane, cassava accounting for a small proportion, are generally planted in areas which is not convenient for irrigation (Table 2).

Crops	Area (ha)	Yield (tonne)			
Rice in spring	140	625			
Rice in summer	241	1156.8			
Maize in spring	213	745.5			
Maize in summer	105	336			
Maize in winter	50	125			
Soybean in summer	6	7.8			
Soybean in spring	10	14			
Peanut in summer	5.5	8.3			
Peanut in spring	6	9			
Tobacco	14	28			
Cassava	20	240			

Table 2: Area, yield of the cops in Quang Chu commune.

The structure of domestic animals in Quang Chu commune is somewhat inclined to pig feeding. A majority of households raise pigs, but in small scale. Each household feeds only 3-5 pigs. The high quality of pork brings more economic efficiency, so now in Quang Chu, the scale of pig feeding is being expanded (Table 3).

 Table 3: The quantity of livestock in Quang Chu commune.

Types of livestock	Quantity (head)
Buffalo	833
Cow	100
Goat	733
Pig	3222
Cattle	15881

Stemming from the above issues, surveying the generation, composition, volume and management of agricultural solid waste in Quang Chu commune, Cho Moi district, Bac Kan province, is a job of practical significance to properly assess the status of agricultural solid waste in the area. These research results help to create a basis for proposing feasible and reasonable solutions to improve the efficiency of solid waste management, contributing to reducing the environmental pollution caused by solid waste in the study area [5].

Materials and Methods

Interview through questionnaires

This is a method of providing updated information to the study site and reflecting many current issues such as rice and maize cultivation as well as the present state of agricultural residue collection and use. Additionally, the formal survey was in conjunction with informally interviewing the local authorities.

The quantity of respondents: 35 house holds representative of people in Lang Dien and Deo Vai 1 villages in Quang Chu commune, Cho Moi district, Bac Kan province. Lang Dien is typical for rice, while Deo Vai 1 is typical for maize in the locality.

Participatory Rural Appraisal (PRA)

Participatory Rural Appraisal (PRA) is an assessment process with the participation of farmers. The aim is providing the community with the status, management of agricultural by-products, advantages and disadvantages that the community is facing with [6]. This will be the basis for people to discuss and find appropriate solutions to develop

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themselves and their communities (SFDP).

Data analysis

The data of the survey was processed by quantitative analysis software Microsoft office excel. Descriptive statistics in the software SPSS 20.1 (Statistical Package for the Social Sciences) is the primary method used to process data. The results are shown in Tables.

Results and Discussion

Background information

The survey was carried out among 35 farmers in Lang Dien and Deo Vai villages. The general background of them is summarised as follows.

- Genders of respondents: In the survey, there were 40% of respondents who are male. The rest of them were female.
- The role of the respondents: 91% of interviewees in the baseline survey were the primary labor of their family. They participated directly in the production and were primary earners for their family.
- Ages: The number of people who were from 30-40 years old accounted for 48.6% and 22.9% of all the people surveyed was over 50 years old.
- Ethnic groups: Almost respondents were from Kinh (57%) and Tay (40%) ethnic groups.
- Education background: Most of the interviewees in the survey were sent to schools. Of them, more than 50% farmers stopped their study at the secondary level while 11.4% of respondents could go to high school. 3% of all people surveyed were illiterate. No one in the survey had higher educational attainment.
- Economic status and monthly income: Of the households surveyed, the poor, near-poor and average household accounted for 23%, 46% and 23%, respectively. The remaining respondents did not know or had no answer for this question.
- Main economic activities: There were 94.3% of the households whose income were only from agriculture. The rest respondents (5.7%) were traders. This indicates that the site in which the survey was carried out were agricultural. The other careers included in the questionnaire were chosen by none of the interviewees.

Current status of agricultural by-products

Current status of residue arising from rice cultivation: The current release of byproducts from rice cultivation is shown in Table 4.

	Spring	season	Summe			
Villages	Straw	Husk	Straw	Husk	Total (tonne)	
Deo Vai 1	25.8	6.5	28.9	7.2	68.4	
Lang Dien	16.6	4.2	19.2	4.8	44.8	
Total (tonne)	42.2	10.7	48.1	10.2	113.2	

Table 4. The amount of rice by-products in Deo Vai 1 and Lang Dien in 2022.

As we can see, in general, straw accounted for a large proportion (79.8%) of byproducts from rice. The rest of rice residue (20.2%) was husk. Besides, the results of the survey in the two rural villages, Lang Dien and Deo Vai 1, also showed that to get an average of 1 ton of unmilled rice, there would be about 0.8 tons of straw produced. Depending on the type of rice, the rate of husk released from unhusked rice would be from $15\% \div 25\%$ (equal to about 20% of the total weight).

Thus, about 200 kg of husk could be obtained from an average of 1 ton of rice after milling. These figures make no difference from the results of Hue's research based on the survey's results, we can estimate the volume of rice residue each year and forecast their amount in the following years in Quang Chu (Table 5).

	Spring	season	Summ		
	Straw	Husk	Straw	Husk	Total (tonne)
Quang Chu commune	500	125	925.44	231.36	1781.8

Table 5: The amount of rice by-products in Quang Chu in 2022.

Current status of residue arising from maize cultivation: Byproducts from corn cultivation include stovers, leaves, husk leaves and corncob. The amount of maize residue is performed in Table 6.

Table 6: The amount of maize residue in Deo Vai 1 and Lang Dien in 2022.

Villages	Areas (ha)	Amount of residue (Tonne)
Lang Dien	5.7	17.7
Deo Vai 1	2.4	7.5
Total	8.1	25.2

The survey's results showed that every hectare of maize after a harvest could make about 3 tons of its byproducts. This is similar to the results in the research of Nguyen Xuan Ba and Hoang Thi Hue. We can calculate the amount of waste from maize in Quang Chu. Data is presented in the following Table 7.

Table 7: The amount of maize residue in Quang Chu in 2022.

Quang Chu	Maize					
	Areas (ha) Amount of residue (tonne)					
	368	1104				

Current status of waste arising from livestock: From the number of animals in Quang Chu, the amount of manure from cattle and poultry in the commune in 2015 could be estimated. The amount of waste from pigs, buffaloes and cows, goats, and cattle was 1.5 kg, 15 kg, 0.5 kg and 0.2 kg/head/day respectively Table 8.

Table 8: The amount of waste from breeding in Quang Chu in 2022.

Livestock	Amount of manure (tonne)				
Buffalo	4560.7				
Cow	547.5				
Goat	133.8				
Pig	1764.0				
Poultry	1159.3				
Total	8165.3				

Together with the growth of the breeding in the commune currently, the emissions of the waste from this activity will

also rise in the coming years [7]. Therefore, the effective solutions are necessary for waste treatment in breeding. It will bring many benefits such as limited epidemics, economic efficiency in livestock production, sustainable breeding development.

Agricultural residue collection and treatment in Quang Chu commune: Forms of agricultural residue applied in Quang Chu are summarized in Table 9.

Rate of	Leave in fields (%) Rice Maize				Leave in fields (%)						Burn in fields (%)				
residue used (%)					Rice				Maize						
	Spring		Summer			Sp	Spring		Summer						
	Straw	Husk	Straw	Husk	Stover, leaves	Corncobs	Straw	Husk	Straw	Husk	Stover, leaves	Corncobs			
0-30	81	100	94	100	91.3	100	31	100	67	100	15	100			
>30-60	8	0	0	0	4.3	0	4	0	0	0	35	0			
>60-100	12	0	6	0	4.3	0	65	0	33	0	50	0			
Rate of	Burn and mix				ith manu	re (%)	Food for livestock (%)								
residue]	Rice		Maize		Rice				Maize				
	Sp	ring	Sumi	mer		Sp	oring Summer								
	Straw	Husk	Straw	Husk	Stover, leaves	Corncobs	Straw	Husk	Straw	Husk	Stover, leaves	Corncobs			
0-30	96	100	100	100	100	96	85	100	39	100	69.6	100			
>30-60	4	0	0	0	0	0	8	0	0	0	21.7	0			
			Ŭ	-	-										

Table 9: The forms of by-products processing from cultivation (%).

Rice residue collection and treatment in Quang Chu commune

Rice straw

In spring seasons: The results of the survey show that burning rice straw in fields was the popular way in the locality when there was 65% farmers said that they did it with more than 60% of all their rice straw they got after harvesting rice. Ranking the second among the most preferred ways of residues handling, leaving more than 60% of straw in the field was applied by 12% of farmers. Besides, there were 8% of interviews sharing that they used more than 60% of rice straw in this season for their buffaloes and cows.

Summer seasons: It can be seen that most of the farmers used their rice straw in this season to feed their livestock and burn in the fields. To be specific, 61% of farmers used a large amount of rice straw they got (60%-100%) for their buffaloes and cow. At the same time, 33% of all interviews said that they burned a similar amount of rice straw in the fields. Different from spring seasons, the amount of straw was left in field relatively little. It is the results of extended period from the summer to the spring seasons so that farmers have enough time to handle most rice residue, and they need to store food for their livestock as well. Households also shared that they might either use or give their neighborhood their straw to feed the livestock so that they could have manure to apply in their fields.

Rice husk: Table 8 indicates that the percentage of people none of the listed methods to handle rice husk was in farmer's preference. It turned out that most of the farmers usually leave their rice husk in milling store. Specifically, in the spring season, all farmers did not take their rice husk from milling stores because of local habit/conception in which after finishing rice milling in milling stores, rice husk would belong to the owners of the milling stores. In the next season, farmers also use rice husk for cooking but with a low rate.

Maize residue collection and treatment in Quang Chu commune

Maize stover and leaves: After harvesting, half of farmers interviewed often left a significant amount (60%-100%) of maize stovers and leaves, and then burn them in fields while 8.7% of farmers in the survey shared that they use more than 60% of maize stover to feed their livestock. Maize is a good source of food for domestic animals because the contents of fiber and crude protein of them account for 31.5% and 7.6%, respectively. In this type of maize residue, the starch sugar contents are higher than in rice straw. A very small amount (lower than 30%) of corn stalks and leaves were also dried in fields, then taken to farmers' house to use as fuel for cooking.

Corncobs: The most widespread usage of corncobs in Quang Chu was to cook. Up to 90% of people asked shared that they use all of their corncobs in this activity. Besides, corncobs also were burned and then applied to manure but at an insignificant rate

In general, of all the ways to treat agricultural residue, it is easy to see that burning and leaving it in fields without any treatments at all in the field were the most popular. This indicated that the farmers awareness on the agricultural residue management and use was incomplete. They just took the immediate interests into their account but did not include the long-term adverse effects that this activity impacts on the environment and people's health. These activities have a high adverse effect on the environment, safety and health of the people. When burning residues in fields, particularly when near main roads or residential quarters, significant amounts of smoke and dust is emitted, which causes harmful effects on human health and safety, obstructs traffic participants on the roads, and affect adversely other plants.

Waste collection and treatment in breeding in Quang Chu commune

The forms of waste collection and treatment in breeding are shown in Table 3. As clearly seen from the figure, the most popular treatment for waste from breeding was gathering in a place and apply directly to fields. This form of treatments was chosen by 50% of farmers feeding livestock. The second most common treatment was making compost because up to 34.3% of farmers asked wanted it. The number of interviewees said that they take their domestic animals' waste directly to ditches or canals was 5.7%. The rest of farmers in the survey stated that they use the waste of their livestock for others purpose (feeding fish). In fact, most of the households just breed livestock in small quantities only, from 5-10 heads of cattle or poultry, so they have no regular cleaning cages, manure treatments (Figure 1).



Figure 1: Forms of waste treatment in breeding in Quang Chu.

The survey results indicated that people's awareness of responsibility for environmental protection is limited. Without measures to handle waste from livestock breeding, people's living environment, water, land and the results of livestock production will be adversely affected.

Although some farmers did not breed livestock, they could make compost from manure they got from their neighbourhood [8]. This activity was practiced by 34.3% of all farmers. Some common materials to make compost were manure, rice residue, ash and green manure. Compost was usually used for mainly rice and vegetable. 63.6% of them believed that compost would give them higher crop yield while about 50% of farmers did it because it helps them save money. Besides, that compost could improve soil's fertility was believed by 36.4% of all farmers involved.

Conclusion

Through the survey in Quang Chu, the situation of local agricultural by-product management and use that was still limited in small-scale were found out. So far, there were no plans to collect waste products from agricultural sources as well as projects to supply the methods to use this waste efficiently regarding both economic and environment.

The main forms of processing agricultural by products were burning in the fields. Other types of treatment such as fuel for cooking or mixing with manure were useful but rarely used in the locality. As for livestock production, a majority of animal waste was gathered and applied directly to the field and composted.

With the high speed of agricultural development in the commune currently, the by-product emissions from farming activities and livestock production will also rise in the coming years. Therefore, practical solutions to contribute to processing of agricultural by-products, bringing economic benefits to the people and environment are necessary.

The survey results show that Quang Chu has huge potential in the development and use of agricultural by-products. However, as people's awareness is not very high, the collection and processing of waste byproducts were still in many shortcomings. Therefore, there should be measurements to manage and use them effectively in line with local conditions and the ability of people, change people's perceptions and agricultural residue using habit.

References

- 1. Herold P, Markemann A, Zarate AV (2011) Resource use, cattle performance and output patterns on different farm types in a mountainous province of northern Vietnam. Anim Prod Sci 51:650-661
- 2. Pucher J, Mayrhofer R, El-Matbouli M, Focken U (2015) Pond management strategies for small scale aquaculture in northern Vietnam: Fish production and economic performance. Aquac Int 23:297-314
- 3. Son HN, Kingsbury A, Hoa HT (2021) Indigenous knowledge and the enhancement of community resilience to climate change in the Northern mountainous region of Vietnam. Agroecol Sustain Food Syst 5:499-522
- 4. Lemke U, Zarate AV (2008) Dynamics and developmental trends of smallholder pig production systems in North Vietnam. Agric Syst 96:207-223
- Van DT, Markemann A, Herold P, Zarate AV (2012) Beef cattle keeping by smallholders in a mountainous province of northern Vietnam in relation to poverty status, community remoteness and ethnicity. Anim Prod Sci 53:163-172
- 6. Lemke U, Mergenthaler M, Rossler R, Huyen LT, Herold P, et al. (2008) Pig production in Vietnam-a review. CABI Reviews 30:15
- 7. Pucher J, Mayrhofer R, El-Matbouli M, Focken U (2016) Effects of modified pond management on limnological parameters in small scale aquaculture ponds in mountainous N orthern Vietnam. Aquac Res 47:56-70
- Xuan DD, Szalay I, Su VV, Tieu HV, Vang ND (2006) Animal genetic resources and traditional farming in Vietnam. Anim Genet Resour Inf 38:1-7