Establishing a state management system for the environment in the field of agriculture to suit the reality of Vietnam

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Abstract. The GDP growth rate of the entire agricultural sector of Vietnam in the 2008-2019 period will reach 2.6% per year on average. The market for agricultural products in Vietnam has been increasingly expanded, production structure is more efficient and tied to market demand. However, at the same time, the environment is at risk of being threatened by the effects of rapid agricultural development but lacking strict management policies. This has threatened the sustainable development of agriculture as well as the health and living environment of the people. In this paper, the author will analyse the situation of agricultural environmental pollution in Vietnam, using the statistical data methods. At the same time, the proposed analysis to build a state management system in the field of agriculture ensures to bring great value of goods, high income and environmental friendliness.

1. Introduction
Vietnam starts as an agricultural country. Currently agriculture still accounts for about 15% of Vietnam's GDP structure. In particular, the export turnover of agriculture, forestry and fishery is estimated at 41.3 billion USD. However, Vietnam's agriculture still has many limitations and shortcomings such as: fragmented agricultural production, small scale, low investment in agriculture, slow application of science and technology; agricultural production is highly dependent on the weather. The market for agricultural products is still unstable. Especially, agriculture is not sustainable because it does not meet all environmental protection standards in production. This makes the value of Vietnam's agricultural products low when exported. Vietnam has many policies, to improve the management role of the state in addressing environmental pollution issues in agricultural production. However, there is a lack of uniformity and no strict measures to deal with polluting acts.

2. Current situation of agricultural pollution in Vietnam
After more than 30 years of renovation, Vietnam's agriculture has achieved remarkable achievements, Vietnam has become an exporter of nearly 10 leading products in the world. However, this position will be greatly affected if the environmental pollution problem is not resolved.

Despite of the achievements in protecting the agricultural environment, environmental pollution is still serious: Unsafe fertilizer use is having significant impacts on crops and the environment. On average, the total amount of inorganic fertilizer used is about 2.4 million tons / year, about 240 tons of packaging, boxes and most are not collected annually. The use of plant protection drugs tends to increase, lack of control. Vietnam is a country with a very high risk of water pollution from the use of chemicals in cultivation (figure 1). According to the Ministry of Agriculture and Rural Development's
statistics, Vietnam has spent an average of about US $ 600-800 million per year to import raw materials and pesticides from China. Of these, 48% are herbicides (19,000 tons), pesticides and disease control accounts for about 32% (16,400 tons), in addition to a growth regulating drug of about 900 tons. Herbicide is used on all types of plants, of which rice is the most used [5, 6].

Figure 1. Risk of water pollution due to pesticide use in the world.

According to the Crop Production Department, up to 80% of the straw, the stalks of food crops are burned or thrown away in the field. Besides organic waste, the source of solid waste generated from production activities is also quite large and increasingly alarming. Only plant protection drugs, each year our country imports 130,000 -150,000 tons. Abuse of plant protection drugs in pest control, arbitrarily failing to comply with technical processes, failing to ensure isolation time leads to consequences: food poisoning, unsafe food hygiene and safety. At a rate of 15% of the packaging, 19,000 tons of packaging are released into the environment every year, this is a hazardous waste, but most of it is not processed due to inconvenient collection and sending [5, 6].

Vietnam currently has about 12 million households engaged in animal husbandry and 23,500 concentrated livestock farms. In particular, popular in Vietnam is raising pigs (about 4 million households) and poultry (nearly 8 million households), with a total flock of about 362 million poultry, 29 million pigs and 8 million cattle. Estimated average discharge per day per pig is 1.5 kg, 15 kg of buffaloes, cows and 0.2 kg of poultry, with the total number of livestock in the country alone, the average amount of emission is more than 85 million tons per year, several tens of billions of tons of liquid waste, a few hundred million tons of gas waste. However, the management and treatment of animal waste has not been given due attention. Only about 20% is used effectively (as biogas, composting, worm farming, feeding fish, ...), the remaining 80% of livestock wastes have been wasted and most discharged into polluting environment infected.

The main reason is that the awareness and responsibility of environmental protection of the farm owners are not high. Most of the farmers do not have measures to handle liquid waste, throw poultry carcasses, indiscriminate livestock and simple drainage systems, causing environmental pollution in livestock production has not been completely overcome and tended to increase.

Sludge during aquaculture contains decomposed food sources, decomposed chemicals and antibiotics, minerals Diatomite, Dolomite, sulfur deposited, toxic substances in soil alum Fe$^{2+}$, Fe$^{3+}$, Al$^{3+}$, SO$_2$$^-$$^-$. This mud layer has a thickness of 0.1-0.3m in anaerobic submerged condition, forming toxic decomposition products such as H$_2$S, NH$_3$, CH$_4$, Mecaptan ... discharged during cleaning and dredging ponds. farming has an adverse impact on the surrounding environment, affecting the quality of aquaculture (table 1).

Table 1. Composition of industrial shrimp sludge.

| Substance in sludge | Weight        |
|---------------------|---------------|
| Si                  | 27.852mg/kg   |
| Ca                  | 13.246 mg/kg  |
3. Predict the level of water pollution under the impact of agricultural activities

In the research, the author took samples and observation at 35 stations on estuary area of Red River of North Vietnam (figure 2) for determining the level of water pollution under the impact of agricultural activities, and then predict the possibility of water pollution in the following years [7-11].

For determining the level of water pollution under the impact of agricultural activities and predicting the possibility of water pollution in the following years we used the calculation, that was based on the formula [7-11]:

\[
TWQI = 100 \cdot \left( 1 - \frac{\sum_{i=1}^{m} W_i (q_i - 1)}{\sum_{i=1}^{m} W_i q_i + \sum_{i=1}^{m} W_i (1 - q_i) + \sum_{i=1}^{m} W_i (q_i - 1)} \right)
\]

where:

In addition, aquaculture wastewater also contains toxic components that may pollute the environment and need to be treated. Industrial shrimp wastewater has a high content of organic substances (BOD5 12 - 35mg/l, COD 20 - 50mg/l), nutrients (phosphorus, nitrogen), suspended solids (12 - 70mg/l), ammonia (0.5 - 1mg/l), coliforms (2.5.102 - 3.104 MNP/100ml). Wastewater with BOD5 56mg/l, COD 118mg/l, N 11.50 mg/l, P 5.02 mg/l. The wastewater of Pangasius farming has BOD5 50mg/l, COD 112mg/l, N 4.81 mg/l, P 2.17 mg/l. Wastewater source for aquaculture in one crop (shrimp farming is usually 2 crops / year, fish farming with 1 crop / year) can reach 15,000 - 25,000 m3 / ha depending on the aquaculture process ... contains many toxic ingredients and disease sources must be thoroughly treated before being discharged into receiving sources.

Waste in aquaculture is sludge containing feces of aquatic species, decomposed food sources decomposed, residues of materials used such as chemicals, lime, minerals, sulfur deposits ... Increasing environmental pollution is one of the reasons for the widespread epidemic diseases of farmed fish and shrimp.

Contamination of aquatic products not only causes food safety problems, but Vietnam’s image as a quality exporting country may be affected. Vietnam’s exports are more tightly controlled than products for the domestic market. And refusal of trade is associated with detecting high levels of veterinary drugs or pathogens when selling to Japan, the EU, Australia and the United States (table 2).

Table 2. Vietnam’s rejection of fish and seafood products from major export markets, 2010–2018.

| Marketing | Value denied (Million USD) | Rank of Vietnam | Period |
|-----------|---------------------------|----------------|--------|
| USA       | 72.8                      | #2             | 2010-2018 |
| Japan     | 17.7                      | #1             | 2014-2018 |
| EU        | 14.2                      | #2             | 2012-2018 |
| Australia | 3.7                       | #2             | 2011-2018 |
| Total     | 108.4                     | #1             |        |

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\]

where:
TWQI - general water quality index;

\[ W_i \] - the weight coefficient of the indicator, \( q_i \) – a particular quality indicator, \( m_1, m_2, k \) – the number of parameters respectively having \( q_i \) is equal to less than and greater than 1;

\( q_i \) - individual quality indicators value for each ingredient (parameter).

![Figure 2. Positions of observation stations on estuary area of Red River of North Vietnam.](image)

Results of the research were presented in table 2 [7-11].

**Table 3.** The weight coefficients of the indicators of TWQI and WQI.

| №  | Parameters | \( C_i \) | \( C_{0i} \) (A) | \( C_{0i} \) (B) | \( q_i \) (A) | \( q_i \) (B) | \( W_i' \) (A) | \( W_i \) (A) | \( W_i' \) (B) | \( W_i \) (B) | \( W_i^* \) |
|----|------------|-----------|-----------------|-----------------|-------------|-------------|----------------|-------------|----------------|-------------|-----------|
| 1  | pH         | 8.1       | 6-8.5           | 5.5-9           | 0.84        | 0.74        | 1.20           | 0.09        | 0.86           | 0.11        | 0.11      |
| 2  | DO         | 6.8       | 5               | 4               | 0.74        | 0.59        | 1.11           | 0.08        | 0.89           | 0.11        | 0.11      |
| 3  | BOD\(_5\) | 8         | 6               | 15              | 1.33        | 0.53        | 1.75           | 0.13        | 0.70           | 0.09        | 0.11      |
| 4  | NO\(_3^-\) | 0.58      | 5               | 10              | 0.12        | 0.06        | 1.50           | 0.11        | 0.75           | 0.09        | 0.1       |
| 5  | PO\(_4^{3-}\) | 0.1       | 0.2             | 0.3             | 0.50        | 0.33        | 1.25           | 0.09        | 0.83           | 0.10        | 0.1       |
| 6  | Dry residue | 113      | 30              | 50              | 3.77        | 2.26        | 1.33           | 0.10        | 0.80           | 0.10        | 0.07      |
| 7  | Pb         | 0.04      | 0.02            | 0.05            | 2.00        | 0.80        | 1.75           | 0.13        | 0.70           | 0.09        | -         |
| 8  | Cd         | 0.008     | 0.005           | 0.01            | 1.60        | 0.80        | 1.50           | 0.11        | 0.75           | 0.09        | -         |
| 9  | Fe         | 6.8       | 1               | 1.5             | 6.80        | 4.53        | 1.25           | 0.09        | 0.83           | 0.10        | -         |
| 10 | E. coli    | 2400      | 5000            | 7500            | 0.48        | 0.32        | 1.25           | 0.09        | 0.83           | 0.10        | 0.16      |

Based on results of the research, the author determined the map of water pollution on the North of Vietnam for period 3 years from 2017 to 2020 (figure 3) [7-11].

![Figure 3. Map of water pollution in the estuary area of the Red River in 2016 by TWQI.](image)
4. Enhancing the current system of agricultural environment management in Vietnam

Vietnam needs to have a coordinated system of organization, management and handling of environmental issues to offer comprehensive solutions to environmental issues at the national level. The agricultural environment is facing many difficult issues, while the work done in the agricultural sector has stopped at national programs and projects to restore the ecosystem and agricultural environment declaration of small and specific models of industrial waste treatment. The national target program on rural clean water and environmental sanitation also focuses primarily on the field of rural clean water supply, supporting the construction of latrines and partially solving rural environmental issues such as garbage collection... These programs and projects are very necessary, but also need solutions to address key issues in the face of pollution that is increasingly threatening the production environment and the living environment of farmers.

Addressing environmental pollution treatment in agriculture covers many environmental protection issues that the agricultural sector must undertake: overcoming pollution, degradation, restoring and improving the environment, exploiting and using reasonable natural resources, biodiversity protection… In addition, the development of environmental standards for agriculture to manage the problems that arise and exist in reality, Development of agricultural waste treatment technologies should also be considered. Besides, it is also necessary to have a coordinated coordination with related ministries and sectors such as Ministry of Natural Resources and Environment. Local authorities also need to be proactive in budgeting for this work, and have mechanisms and policies for the whole society to participate in solving environmental issues. In fact, many localities have solved environmental problems from the socialization mechanism of environmental protection. Some specialized institutes have environmental centers or departments that carry out research and technology transfer activities to the environment. In addition, the specific provisions of responsibilities, including responsibility for compensation, responsibility to restore the environment in the case of production facilities in the agricultural sector cause pollution, causing damage to the environment is also very important.

Replicate models that have been successfully implemented in production and environmental protection. The collection of plant protection drug packages must be conducted on the principle of compulsory collection with the State's management role. Depending on the specific conditions, each locality can apply one of three packaging collection models, namely: dispersed collection: implemented in tanks near production fields; centralized collection: collection and treatment tanks are located at the beginning of the way to the village; centralized collection and management of real protection drugs: the collection tank is located right next to the water tank used to make drugs. After reconstitution, can immediately put the cover into the bin. After collection, each locality continues to handle in various forms such as preserving and waiting for concentrated destruction, burning together with daily-life garbage. This model has brought about significant environmental efficiency, reducing odor pollution, water pollution and air pollution. Collection model will raise awareness and attract the real attention of the people, encourage them to actively participate in the collection and handling of pesticide packaging. If these measures are implemented in a synchronous manner, the rural agriculture environment will soon be improved, new agriculture can develop towards sustainability and new people will ensure health and peace of mind live.

5. Conclusion

So far, achievements in protecting the agricultural environment: legal institutions and policies have been formed and gradually improved; the management of agricultural environment has initially brought certain results. In order for the environmental protection in agricultural production to be effective, in the coming time, Vietnam needs to carry out a number of contents: restructuring the agricultural sector in the direction of raising the value, developing sustainably in association with environmental Protection; restrict and eliminate types of production that may cause environmental pollution. Developing green and environment-friendly agriculture. Promote communication, raise awareness about agricultural environment protection. To develop and perfect mechanisms and policies, encourage the use of cleaner production technologies and environmentally friendly technologies in production, business and service
activities in the branches and domains under its management according to regulations of the Law. At the same time, promoting the application of farming techniques, gradually reducing the use of plant protection chemicals and chemical fertilizers, comply with technical requirements when using plant protection chemicals, chemical fertilizers in agricultural production, etc.

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