

# Study on Measures and Policies to Reduce Pollution in Raising Livestock and Poultry in Jiangsu Province

Yonghong LIANG<sup>1</sup>, Yongxiang GUAN<sup>1\*</sup>, Hao WU<sup>1</sup>, Zichen WANG<sup>1,2</sup>

1. Jiangsu Agricultural Environmental Monitoring and Protecting Station, Nanjing 210036, China; 2. Recycling Agricultural Center of Jiangsu Academy of Agricultural Science, Nanjing 210014, China

**Abstract** As a developed province in China, Jiangsu Province is competitive in the livestock and poultry production industry. With the development and growing intensity of livestock and poultry industry, animal pollution has become the major source of panel agricultural pollution. This paper studied the characteristics of livestock and poultry industry in Jiangsu Province: large amount of livestock poultry, imbalanced development of livestock and regional differences, large pollution, large amount of pollution emission, uneven distribution of livestock and great pressure on reducing pollution. Besides, the ways to deal with pollution in Jiangsu Province were analyzed: fertilizer accumulation, biogas process technology, animal stools disposal center, ferment bed technology, and comprehensive disposal technology. Governments' policies on pollution reduction were expounded. In the end, several suggestions were put forward, such as strengthening management, innovating treatment, intensifying governments' responsibility, enlarging financial input and creating favorable atmosphere to protect environment.

**Key words** Pollution emission, Raising livestock and poultry, Technological mode, Political suggestion

In recent years, Jiangsu Province has made great achievements in livestock and poultry as the modern livestock and husbandry industry system has been constructed. As a result, livestock and husbandry industry has become the major pillar industry of agricultural and rural economy in Jiangsu Province. With the development and growing intensity of livestock and poultry industry, animal pollution, however, has become the major source of panel agricultural pollution. In June 2011, China included reducing pollution in livestock and poultry industry as an important way to reduce pollution. Besides, Jiangsu Province issued concrete plans to control pollution. Measures to study pollution reduction, policies on reducing pollution, work on pollution prevention and the win-win aim have become the major subjects for governments at all levels to solve.

## 1 Characteristics of animal husbandry industry in Jiangsu Province

### 1.1 Development of animal husbandry

**1.1.1** Large amount of domestic animals and high industrialization. The domestic animals in Jiangsu Province in 2010: 31.413 million heads of pigs, 1 213.505 million heads of poultry, 201.486 5 million heads of layers, 205.5 thousand heads of cows, which all together accounts for 60.4096 heads of pigs<sup>[2]</sup>. The industrialization of poultry, layer and cow has passed 90%. In the sense of standard pig unit, the industrialization in Jiangsu Province was 86.94%<sup>[3]</sup>.

**1.1.2** Unbalanced development of poultry and different regional distribution. In 2010, there were 164 062 farms in Jiangsu Province, among which 84 939 farms raising pigs. There were 35 450, 42 642 and 1 031 farms raising poultry, layers and cows, which accounted for 21.61%, 25.99% and 0.63% respectively<sup>[3]</sup>.

**1.1.3** General scale farms raising pigs and medium and large farms raising poultry, layer and cow. With regard to the number of domestic animals, there were 13.246 7, 6.346 8 and 5.804 2 heads of pigs in general scale, medium scale and large scale of companies, which accounted for 52.16%, 24.99% and 22.85% of the general raising amount. While in terms of poultry, the amount of general, moderate and large scale of farms took up about 20.90%, 27.26%, and 51.85%, and the percentage of layers was 13.35%, 54.06%, 32.58% accordingly. The percentage of different scales of farms raising cow accounted in all farms was 14.46%, 13.53%, 72.01%<sup>[3]</sup> respectively.

### 1.2 Characteristics of production and discharge of pollutants

**1.2.1** Large amount of pollution. According to speculation<sup>[4-6]</sup>, 38.890 5 million ton deserts was produced in Jiangsu Province in 2010, and in general, there were 3.220 3 million ton, 101.5 thousand ton, 69.1 ton and 311.7 ton COD, ammonia nitrogen, phosphorus, and nitrogen being produced.

**1.2.2** Large amount of pollutant discharge. In 2010, the discharge of COD, ammonia nitrogen, phosphorus and nitrogen reached 377.6 thousand, 50.9 thousand, 30.9 thousand and 133.3 thousand ton respectively<sup>[3-4]</sup>. In order to find out major pollutants in Jiangsu Province, the equal discharge of COD, ammonia nitrogen, phosphorus and nitrogen was 18.9 thousand, 101.7 thousand, 309.2 thousand and 133.3 thousand ton accordingly. Therefore, though the actual discharge of COD was the largest, the equal discharge was the smallest. The influence of phos-

Received: August 1, 2013 Accepted: September 14, 2013

Supported by Jiangsu Agricultural Science and Technology Innovation Program (CX(12)3071), and National Scientific and Technological Support Program (2012BAD14B12).

\* Corresponding author. E-mail: gyx5598@126.com

phorus on water environment was the largest one, followed by nitrogen.

**1.2.3** Bad influences of pollution on the arable land and uneven distribution of husbandry. Through calculation, the mean husbandry amount in the province was 0.83, following the sequence of Xuzhou (1.92) > Yancheng (0.89) > Nantong (0.83) > Nanjing (0.76) > Suqian (0.75) > Changzhou (0.67) > Taizhou (0.65) > Huai'an (0.57) > Lianyungang (0.55) > Suzhou (0.51) > Wuxi (0.48) > Zhenjiang (0.45) > Yangzhou (0.31). In terms of land disposal load, besides of Yangzhou, the warning value in each city has passed the acceptable level (0.49).

**1.2.4** Great pressure on the cultivation of pigs. In terms of the disposal of excretion, the amount from pigs accounted for 46.66% of general domestic animal amount, and the amount of COD, ammonia nitrogen, phosphorus and nitrogen took up for 45.06%, 63.78%, 31.72% and 46.59% respectively, which ranked the top in the discharge amount.

## 2 Technological mode and policy statu quo

### 2.1 Typical technology to dispose the excretion of domestic animals in Jiangsu Province

In recent years, according to the characteristics of cultivation types, cultivation scale and region, different distinctive technologies to dispose excretion were formed according to local conditions. Great achievements have been made in regard of the disposal of excretion and use of resources.

**2.1.1** Technology of using excretion to cultivate farmland. This technology is to sell excretions or fertilizers to surrounding farmers and the sewage for cultivation of domestic animals is processed to water the farmland. It is required that the farm itself or surroundings needs enough farmlands to dispose the excretion.

**2.1.2** Technology to dispose biogas in farms. Biogas project mixed excretion and sewage together to produce biogas, which was used to produce electricity or living energy. This method gained the most support from the government.

**2.1.3** Construction of disposal center. The mode is to construct animal excretion disposal center and to collect the excretion together from scattering companies<sup>[12]</sup>.

**2.1.4** Technology to cultivate fermentation bed. This technology is also known as healthy degradable cultivation technology. Its basic principle is to put straw and sawdust on the floor as the bed for pig. The microorganism in the organic padding will degrade and digest soon.

**2.1.5** Comprehensive processing of excrete through "isolation and purification" technology. This technology is based on the reduction of emission and use of recycle technology. The concentration of COD, nitrogen, and phosphorus realized standard discharge.

### 2.2 Policy on pollution reduction

**2.2.1** National aspect. There are nine laws about the pollution prevention. The one which clearly mentions livestock and husbandry include Husbandry Law, Agricultural Law, Solid Sewage Pollution Prevention Law, Clean Production Law, Recycling Eco-

nomical Law, and Evaluation on Environment Influence. The Husbandry Law points out that the manager should take the responsibility of preventing animal diseases and protecting environment. In 2001, the Ministry of Environment Protection made some rules on the pollution prevention, environmental influences, pollution discharge standard and licensing, which is the major accordance of policy-making in China. In 2008, the State Tax Bureau of the Ministry of Finance issued notice about tax immunity. In 2010, the Ministry of Environment Protection promulgated Policy on Pollution Prevention to propose appropriate technology and requirement in air pollution prevention and sewage disposal.

**2.2.2** Provincial level. Jiangsu Province has made several policies concerning husbandry and livestock pollution. The Agricultural Ecological Environment Protection Policy in Jiangsu Province requires research and study of comprehensive technology to dispose the straw and excretion. The 29th rule specified that companies or individual should try to avoid and reduce pollution through comprehensive utilization or processing of excretion, sewage and other wastes.

**2.2.3** Effect on the treatment of pollution in livestock and husbandry industry. During the "eleventh-five year" plan, the agriculture system in Anhui Province focus on the ecological protection and upgrading of husbandry industry. Great achievements have been made. Until the end of 2010, the comprehensive utilization rate reached 78%. There were 6.5 thousand biogas tanks, 2263 biogas projects and 400 thousand tons of promotion subsidy of organic fertilizer.

## 3 Problems and bottleneck in the treatment of pollution in the livestock and husbandry industry

With the rapid economic development, the regional layout, industrial organization and cultivation method in livestock and husbandry industry in Jiangsu Province can't adapt to the current development requirement. In 2007, according to the statistics of the source of national pollutants, the general discharge of pollution is 1.5 times of that in countryside, which ranks the first among all national key pollution discharge areas. For now, there are still many disadvantages of policies on pollution, such as low legal level, less incentive policies, more principles and less operational rules, etc.

### 3.1 With regard to the layout of farms, the agriculture industry separating from the husbandry industry

The husbandry farm in developed countries in abroad applied the most of combining raising with growing, and used large acres of lands to grow crops as a way to dispose excretions. However, compared with other provinces and countries, Jiangsu Province is densely populated and its land resources are limited. In addition to the unreasonable location and distribution of farms, it is impossible to have enough arable land to digest the wastes. The land load warning has passed normal level (0.4)<sup>[9-11]</sup>. Besides, although there are enough lands in the surroundings, most farmers can not develop husbandry industry.

### 3.2 In terms of husbandry scale, no distinct treatment in farms

Taking raising pig as an example, the number of pigs in general scale farms was larger than that in large and medium scale farms. Only few wastes are used in the farmland. Most wastes are not properly treated. The effect is outstanding, but the pollution treatment is a blank. For now, the treatment of pollution in husbandry and livestock industry in Jiangsu Province starts from large and medium-sized farms. There are 550 biogas projects in middle and large-sized farmlands. Taihu region get financial support from central and provincial government faster, but most excretion disposal centers collect excretion of chicken.

### 3.3 With regard to pollution treatment, not enough disposal treatment and serious environment pollution

With the rapid development of scale cultivation, many problems emerged: high concentration of husbandry excretion, not enough disposal treatment, increasingly serious environmental pollution. Putting excretion into the farmland is the primary way to dispose excretion in Jiangsu Province. However, many treatments failed to reach the standards in *Hygiene Standard of Excretion and Technological Norm of Excretion of Husbandry and Livestock*. Besides, the biogas and wastes after fermentation were not fully used, which would pollute the surrounding environment. In addition, there are not enough associated equipments, which may make it worse if it rains.

### 3.4 Considering policy, no unified plans and insufficient supporting policies

First of all, there are not any sets of plans and laws about the treatment of animal excretion. The present executing project is to be adjusted. Besides, the environment supervision mechanism is not sound. Although the government has issued some laws about environment pollution, most laws and regulations are difficult to implement. Furthermore, given the financial support, most small farms can not get financial subsidy from the governments of all levels. To make things worse, most farms are suffering from high disease risks and low technological level, so in order to save costs, farmers would be reluctant to put most energy on how to improve the quality and output of livestock, and neglect influences of pollutants on environment.

## 4 Suggestions on the policy to reduce pollution

The "Twelfth-five year" Plan on Energy-saving clearly states that it is necessary to promote energy reduction in agriculture and countryside. The consumption of oxygen and nitrogen is 11.9% and 12.9% respectively. The task to reduce pollution is arduous. The current agricultural departments take initiative to learn from foreign countries and to deepen people's awareness of environment protection, so as to form feasible management and supervision mechanism.

### 4.1 Ways to reduce production and to strengthen industrial management

It is necessary to compile Specific Plan to Treat Pollution in Livestock and Husbandry Industry in Jiangsu, so as to achieve the goal of ecological production in accordance to the land bearing capacity and consumption demand. The prevention of pollution from livestock and husbandry should follow the principle of

effective combination of comprehensive use of resources and prevention of second times of pollution. The fertility, nutrition and environment capacity of farmland soil should be tested to determine the amount of wastes being used in the farmland.

### 4.2 Innovative treatment mode and engineering construction to boost pollution treatment

The construction of new pollution treatment project has been considered as the reference of national pollution reduction. Each year, certain amount of engineering project would advance the realization of pollution treatment and carbon emission. Considering the effect of pollution treatment in Jiangsu province and the successful experience in other countries, it is suggested to implement the policy of "three isolations-reconstruction—utilization". First, the layout of farms should be optimized. Second, the ecological fermentation bed is developed. Third, the biogas is strengthened. The three supporting facilities include construction of collective farms to raise livestock together, construction of excretion disposal center, and construction of conservation equipment.

### 4.3 Strengthening government's leadership and construction of long-term management mechanism

It is imperative to form a complete set of laws, regulations and technological norms to effectively control the environment pollution. So far, Zhejiang and Shanghai governments have promulgated *Methods to Manage Pollution in livestock and Husbandry Industry*. In order to further protect environment, *Ways to Control Pollution in Livestock Industry in Jiangsu* has been drawn up.

First of all, local government should fully understand its responsibilities and live up to people's expectation. To achieve those aims, government at all levels made plans to upgrade industrial transformation or to readjust the layout and structure. For example, Jiaying government formulated the *Plan to Deal with Pollution in Livestock and Husbandry Industry in Jiaying* (2008–2010), so as to specify the financial direction.

Besides, assessment mechanism is constructed. Government at each level connect pollution prevention with reduction of carbon emission and ecological construction. Responsibilities of environment protection are assigned to each individual groups and group leaders are hold responsible.

Furthermore, supervision and service mechanisms are constructed. Agricultural and environment protection departments unite together to carry out examination and to link farmers with raisers.

### 4.4 Enlarging capital investment and making rewards and punishments policy

It is imperative to strengthen financial support of the construction of ecological husbandry industry. In the financial aspect, it is important to do research on the treatment of excretion of domestic animals and to enlarge investment. Policies on the following aspects have been made.

Compensation policy. The functioning farms in the forbidden zone specified in laws and regulations would be closed down or moved to other places and the government would compensate some money for the loss caused during this process.

Land policy. It is necessary to implement the *Notification on the Policies Relevant to Land Use in Industrialized Livestock and Husbandry Industry* (No. [2007] 220). *Five Modes of Cultivation Zone* are constructed to explore the mechanism of increasing lands for raising livestock in groups and reducing farmers' lands.

Subsidy policy. Scale cultivation is encouraged to meet the demand of disease prevention and to make life convenient to dwellers. Based on the trial in Jiangxia region in Wuhan City, different levels of subsidy standards have been set. The larger scale, the more subsidy.

Economic policy. Experiences in domestic provinces suggest that it is feasible to charge pollution fee from the raisers in densely-populated areas to fully reflect the rule of "whoever pollutes the air should resolve the environment pollution issue".

**4.5 Strengthening publication and creating favorable atmosphere of protecting ecological environment** It is suggested to publicize processing of animal excretion by stressing relevant laws and the importance of recycle use of energy, and by giving examples to help farmers to understand the importance of environment policy. Meanwhile, the government can give farmers some training about environment protection to encourage them to reduce pollution and to be responsible to themselves and to their descendents by protecting environment now.

**References**

[1] Jiangsu Agriculture Committee. Jiangsu Rural Statistical Yearbook, 2011 [M]. Jiangsu, 2011. (in Chinese).  
 [2] GB 18596-2001, Discharge standard of pollutants for livestock and poultry

(From page 92)

nature, it indicates that the flora are of obvious temperate nature, and typical characteristics of transition from subtropical zone to temperate zone; there is close relationship between the flora in this region and the flora in North Temperate Zone and East Asia.

**References**

[1] WU ZY, WANG HS. Chinese nature geography ——Plant geography (Vol. 1)[M]. Beijing: Science Press, 1983: 1-125. (in Chinese).  
 [2] CHENG HM. Geographical composition of vascular plants in Dashu Mountain in Hefei, Anhui Province[J]. Plant Science Journal, 2011, 29(3):288-295. (in Chinese).  
 [3] WU ZY, ZHOU ZK, SUN H, et al. The areal - types of seed plants and their origin and differentiation[M]. Kunming: Yunnan Science & Technology

breeding[S]. (in Chinese).  
 [3] Jiangsu Agriculture Committee. Statistics of Animal Husbandry Bureau, 2011 [Z]. (in Chinese).  
 [4] Handbook about the 1st national survey of pollution discharging coefficient of national pollution sources livestock and poultry industry[Z]. 2009. (in Chinese).  
 [5] DONG HM, ZHU ZP, HUANG HK, et al. Pollutant generation coefficient and discharge coefficient in animal production[J]. Transactions of the Chinese Society of Agricultural Engineering, 2011, 27(1): 303-308. (in Chinese).  
 [6] CHEN HY, GUO JB, ZHANG BG, et al. Pollutant producing coefficients in animal Production[J]. China Biogas, 2012, 30(3): 14-16. (in Chinese).  
 [7] YANG ZL, ZHAO J, SHAO JX. Livestock manure load of farmland and its conversion method[J]. Seminar of Ecology of Domestic Animals Branch, Chinese Association of Animal Science and Veterinary Medicine, 382-386. (in Chinese).  
 [8] LI RG, XIA YL, WU AZ, et al. Pollutants sources and their discharging amount in Taihu Lake area of Jiangsu Province[J]. Journal of Lake Science, 2000, 12(2): 147-153. (in Chinese).  
 [9] YE F, HU M, ZHOU QW. Analysis on livestock manure nutrient load condition of cultivated land in Tianjin[J]. Agro-Environment and Development, 2007(6): 39-41. (in Chinese).  
 [10] WANG XY, WANG QP. Livestock manure load of farmland in Miyun County and its environmental risk assessment[J]. Rural Eco-environment, 2005, 21(1): 30-34. (in Chinese).  
 [11] NIU JL, QIN L, ZHENG BG, et al. Waste load of farmland and risk assessment for the development of scale breeding in Henan Province[J]. Journal of Agro-Environment Science, 2008, 27(5): 2105-2108. (in Chinese).  
 [12] WANG ZC, SHEN JN, GUAN YX, et al. Discussion on comprehensive treatment thinking of small scattered field waste of livestock and poultry——taking the case of livestock and poultry industry in Wujin District Lijia - Luoyang District [J]. Agro-Environment and Development, 2013(2): 11-14. (in Chinese).

Press, 2006. (in Chinese).  
 [4] WU ZY. The areal - types of the world families of seed plants[J]. Acta Botanica Yunnanica, 2003, 25(3):245-257. (in Chinese).  
 [5] WU ZY. Revise of the areal - types of the world families of seed plants [J]. Acta Botanica Yunnanica, 2003, 25(5):535-538. (in Chinese).  
 [6] Editorial Board of Flora Reipublicae Popularis Sincae, The Chinese Academy of Sciences. Flora Reipublicae Popularis Sincae (Vol. 1) [M]. Beijing: Science Press, 2004. (in Chinese).  
 [7] Institute of Botany, The Chinese Academy of Sciences. Iconographia Cormo - phytorum Sinicorum (Vol. 5(1), Vol. 5(2)) [M]. Beijing: Science Press, 1972-1976, 1982, 1983. (in Chinese).  
 [8] LI XW. Floristic statistics and analyses of seed plants from China[J]. Acta Botanica Yunnanica, 1996, 18(4):363-384. (in Chinese).  
 [9] LIU SX. Hubei Qizimeishan nature reserve scientific survey and research report[M]. Wuhan: Hubei Science and Technology Publishing House, 2006. (in Chinese).

EBSCO Publishing, headquartered in Ipswich, Massachusetts, is an aggregator of premium full-text content. EBSCO Publishing's core business is providing online databases via EBSCOhost to libraries worldwide. EBSCOhost is used by libraries, schools, academic institutions, medical institutions, and corporations. The company is a subsidiary of Birmingham, Alabama-based EBSCO Industries. EBSCO Industries is located at number 196 of the top 200 privately held companies in the United States by Forbes Magazine. The company's core business is providing online databases via its proprietary software, EBSCOhost, to libraries. EBSCO provides over 350 full-text and secondary databases. Content for these databases include full-text journals, magazines, books, monographs, reports, ebooks, business book summaries and various other publication types. It also provides databases for reference to the health and business sectors, such as DynaMed.