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PRODUCTION DYNAMICS AND POLLUTION AMOUNT OF LIVESTOCK INDUSTRY IN THE AUTONOMOUS REPUBLIC OF CRIMEA

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Висвітлено, що у процесі виробництва продукції тваринництва викиди сполук азоту залежать від виду, поголів'я тварин, їх раціону, способу утримання і утилізації відходів. За зберігання гною у відкритих ємностях відбувається випаровування і потрапляння в атмосферу аміаку, оксидів та інших сполук азоту. Наведено результати оцінювання стану виробництва продукції сільського господарства АР Крим та проведено розрахунок емісії хімічно активного азоту у галузі тваринництва.

Ключові слова: *ефективність використання азоту, сільське господарство, тваринництво, відходи тваринного походження, емісія сполук азоту.*

Regulation of relations in the field of protection, use and reproduction of natural resources, environmental safety, prevention and elimination of negative impact of economic activity on environment, saving natural resources, genetic fund of wildlife, landscapes and other natural complexes underlie such laws of Ukraine as «On environmental protection», «On air protection» and «On ensuring sanitary and epidemiological population welfare» [1–3].

MATERIALS AND METHODS

Researches of the animal production industry in the context of nitrogen use efficiency have been performed using materials of the State pedigree register of Ukraine and Statistics Department of Crimea. Statistical analysis of data has been made using the computer program MS Excel 2013.

RESULTS AND DISCUSSION

At the beginning of October 2013, private households held 86.6% of the total number of cattle (in 2012 — 82.8%), including cows — 92.2% (91.2%), pigs — 48.9% (46.2%), sheep and goats — 94.3% (91.0%), birds of all species — 57.5% (47.1%) (Table 1).

During January–September 2013 total production of livestock products compared with the same period of 2012 decreased by 7.7%, including agricultural enterprises — by 22.7%, in private households it rose by 2.4% (Table 2). In structure of livestock and poultry (live weight) marketing by agricultural enterprises poultry of all kinds was 82.0% (in January–September 2012 — 84.0%), including chickens — 99.1% (99.1%), cattle — 5.3% (4.8%), pigs — 12.5% (10.8%).

In January–September 2013 the total amount of livestock and poultry of agricultural enterprises decreased by 15.6% due to reduction of poultry operation by 35.4%, cattle — 10.4% and pigs — by 3.4% compared to January–September 2012. Average daily gain of cattle breeding, fattening and gain increased by 6, 1%, pigs — decreased by 0.2%. The ratio of total livestock and poultry to marketing for slaughter was 101.8% (in 2012 — 101.5%).

The total amount of production sold by agricultural enterprises in January–September 2013 compared to the same period in 2012 decreased by 25.7%, including crop production — by 20.0%, animal products — by 30.5% (Table 3).

Concentration of livestock on agricultural enterprises, use of traditional maintenance technologies and milking of cows provokes environmental pollution with livestock waste. The solution of waste problem is seen in the development of innovative technologies of

Table 1

Livestock basic types of cattle and poultry for October 1, 2013

Livestock	Husbandries		Including			
			Agricultural enterprises		Private households	
	Number (thou.)	% till October 1, 2012	Number (thou.)	% till October 1, 2012	Number (thou.)	% till October 1, 2012
Cattle	168.3	115.1	22.5	89.6	145.8	120.4
Cows	70.3	103.5	5.5	91.7	64.8	104.7
Pigs	172.8	101.7	88.3	96.6	84.5	107.6
Sheep	310.9	113.8	17.7	71.7	293.2	117.9
Poultry	10570.1	80.3	4492.9	64.6	6077.2	97.9

Table 2

Main sorts of animal production in January-September 2013

Production	Husbandries		Including			
			Agricultural enterprises		Private households	
	January–Sept. 2013	% till January–Sept. 2012	January–Sept. 2013	% till January–Sept. 2012	January–Sept. 2013	% till January–Sept. 2012
Meet, kt.	142.4	94.4	73.5	84.3	68.9	108.3
Milk, kt.	226.4	93.2	18.7	77.0	207.7	95.0
Eggs, mln.	403.0	69.7	107.4	37.5	295.6	101.3

[1]Marketing of cattle and poultry (live weight).

Table 3

Marketing of the main agricultural products by enterprises in January–September 2013

Production	Sold production		Average price	
	t	% till January–September 2012	UAH per t (thou.)	% till January–September 2012
Total crops and pulses	228634	55.7	1617.8	102.8
Including				
Wheat	121976	47.6	1446.7	98.3
Barley	65274	65.8	1474.7	97.8
Rye	846	X	1483.8	100.8
Corn	5648	73.9	1462.4	110.4
Sunflower seeds	32686	88.7	2752.3	82.8
Soybean	8072	44.0	3882.8	122.4

End of Table 3

Production	Sold production		Average price	
	t	% till January–September 2012	UAH per t (thou.)	% till January–September 2012
Rape	12458	202.0	3077.0	84.8
Cattle and poultry (live weight)	74199	84.4	12297.4	87.3
including: cattle	4118	90.1	16027.1	102.4
Pigs	9547	96.2	18296.7	100.8
Poultry	60222	82.4	11098.0	82.5
Milk	14768	72.2	3488.2	114.2
Eggs, thou.	94838	34.2	516.2	91.5

manure storage and applying, implementation of which according to international agricultural environmental requirements will provide additional competitive advantage, particularly in reducing fertilizer costs. Improvement of technologies for manure utilization towards the total use of physical weight of nutrients and manure will reduce pollution of water sources and discharge of ammonia into the environment by reducing pollutant emissions by ventilation systems of livestock and minimizing the time between spreading and sealing of manure.

According to livestock dynamics of farm animals in recent years the amount of waste in livestock industry has been changed in Autonomic Republic of Crimea (ARC). Our calculations show that the amount of waste from cattle makes 435.4 thousand tons per year, pig-breeding adds 189.2, small cattle — 226.9 and poultry — 385.8 thousand tons per year. The total amount of waste from livestock is 1237.4 thousand tons per year (Table 4).

The volume of pollutants in the air of ARC (excluding carbon dioxide emissions) from stationary pollution sources accounts 32.7 tons, which is 0.1 tons (0.4%) less than previous year. Emissions of methane and nitrous oxide, which are greenhouse gases, were 2.8 and 0.8 thousand tons respectively. In addition, the amount of carbon dioxide emissions totaled 1.5 million tons.

So the ARC, as Ukrainian region with developed livestock industry, has a high load level of environment mainly from contamination with industrial animal waste. It leads to

Table 4

Estimated amount of waste and ammonia emissions from livestock farms of all ownership types of ARC (2013)

Species	Livestock population, thou.	Solid waste t/year	Ammonia t/year	Amount of waste per year, kg/ha of farmlands
Cattle	238.6	435445	6847.82	23.4
Pigs	172.8	189216	2730.24	10.2
Sheep and goats	310.9	226957	143.014	12.2
	10570.1	385808	3382.432	20.8
Total	–	**1237426.7**	**13103.51**	**66.6**

air pollution with nitrogen compounds and greenhouse gases, water pollution with nitrates and toxic pollutants, soil with heavy metals and deterioration of epizootic situation, biodiversity reduction and other impacts.

Nitrogen use efficiency (NUE) in agriculture depends on such indicators as specialization of agricultural enterprises, crops and animals species [4]. Thus, in crop production grain crops have high NUE but roots the same as leaf vegetables have a low one.

In animal production excess and efficiency of nitrogen use depends on technology of animals growing. Under the system of grazing and combined maintenance of dairy cattle with high milk production, low density of animals, low Nexc. and animal feeding with legumes, NUE index increases to 0.6. Under pasture system of beef cattle keeping NUE makes 0.5.

Under landless system nitrogen outcome with milk, meat and manure is equal to its income. Nitrogen excess ($N_{exc.}$) is a gaseous nitrogen loss from buildings and manure storage. Since these agricultural enterprises don't have enough land, all animal products including waste are exported. $N_{exc.}$ index. may be within 0–1000 kg per year depending on size of enterprise and gaseous nitrogen losses.

On the 01.01.2013 749 subjects of animal production according to the major types of livestock have been registered in Ukraine. Dairy farming and combined animal production are the largest industries in Ukraine by the use of land resources (60.6%) and forage (195,494.9 tons per year). Pig industry (19.3 and 46529.8 appropriately), beef cattle (19.0% and 22,169.5) and poultry (1.1% of total land area) are the next. Average dairy cattle productivity in Ukraine is 5584 kg of milk a year with 55.4 cwt. of forage, chicken egg production makes 217 eggs a year.

ARC has a great part of animal production among the regions of Ukraine by the number of breeding farms (2.1%), the area of agricultural lands (2.4) and feed consumption (1.2%) (Table 5). Average dairy cattle productivity in ARC is 5239 kg of milk a year with 50.7 cwt. of feed, chicken egg production makes 309 eggs a year. Dairy farming and combined animal production are the largest by using of land resources (43.5%) and forage (2530.0 of feed a year). Pig industry (35.5% and 696.3 t of feed a year appropriately) and poultry (21.1% of total land area) are the next.

In dairy and dairy-beef cattle production of ARC the technology provides using both grazing and combined maintenance of dairy and dairy-beef cattle. According the general approach of NUE components evaluation in this industry in ARC significant variations have been found (Table 6).

For example, the dimensionless variation coefficient (Cv_d) of milk production from 1 cow makes 22.6, with ammonia emissions of 39.4, feed consumption of 42.2 and number regarding the area of 82.6. A positive correlation (r_{xy}) has been found between milk production and feed consumption (0.676), ammonia emissions and number regarding the area (0.826), and negative correlation (–0.442) — between feed consumption and ammonia emissions.

Table 5

The structure of animal production subjects in ARC on 01.01.2013

Animal production	Subjects	Total area of agricultural land, ha	Comparative land area, %	Feed consumption per year, t
Dairy and cattle production	7	29355.62	43.5	2530.0
Pig production	5	23901.39	35.5	696.3
Chickens	4	14150	21.0	
Total	**16**	**67407.01**	**100**	**3226.3**

Table 6

Statistical analysis of NUE components in dairy and dairy-beef cattle production in ARC on 01.01.2013

NUE index	ARC statistics							
	M±m	min	max	Cv_d	Median	r_{xy}		
Milk production of 1 cow, kg/year	5239±447.3	4071	6844	22.6	4901	0.676		
Feed consumption for 1 animal, cwt./year	50.7±8.7	32.6	91.0	42.2	48.6		−0.442	
Ammonia emissions, t/year	23.4±3.5	12.3	37.1	39.4	21.8			0.826
Number regarding the area, num./100 h	24.7±9.1	2.9	52.9	82.6	21.3			

Table 7

Statistical analysis of NUE components in pig production in ARC on 01.01.2013

NUE index	ARC statistics						
	M±m	min	max	Cv_d	Median	r_{xy}	
Feed consumption for 1 animal, cwt./year	6.3±0.2	6.1	6.5	4.5	6.3	−0.827	
Number regarding the area, num./100 ha	187.4±98.9	13.8	531.0	118.0	62.2		−0.402
Ammonia emissions, t/year	34.9±15.9	11.2	97.3	102.0	19.3	–	

Table 8

Statistical analysis of NUE components in poultry production in ARC on 01.01.2013

NUE index	ARC statistics						
	M±m	min	max	Cv_d	Median	r_{xy}	
1 chicken egg production, eggs/year	309±6.9	295.0	321.7	4.5	309.6	0.810	
Number regarding areas, num./ha	1049±128.2	795.5	1403.7	24.5	997.7		−0.999
Ammonia emissions, t/year	11.9±1.5	8.9	15.9	24.9	11.3		

The same researches have been done in the field of pig (Table 7) and poultry production (Table 8).

CONCLUSIONS

Actions have to be aimed to reduce ammonia emissions into environment by improving the design technique of microclimate systems, development and adoption of standards of hazardous substances from buildings, transition to closed microclimate systems due to the use of biological heat of animals, using drying elements, cleaning and deodorization of air, development of highly efficient

technical microclimate ways of modular type livestock buildings with control based on microprocessor technology. Implementation of environmental requirements for animal production should be based on results of systematic monitoring of livestock enterprises areas, identifying indicators of anthropogenic pollution.

REFERENCES

1. Про забезпечення санітарного та епідемічного благополуччя населення: [Закон України] / Відомості Верховної Ради України. — 1994. — № 27. — 219 с.
2. Про охорону навколишнього природного середовища: [Закон України] / Відомості Верховної Ради (ВВР). — 1991. — № 41. — 546 с.
3. Про охорону атмосферного повітря: [Закон України] // Відомості Верховної Ради (ВВР). — 1992. — № 50. — 678 с.
4. Проект решения о принятии Руководящего документа о предотвращении и сокращении выбросов аммиака из сельскохозяйственных источников // Материалы 31 сессии Европейской экономической комиссии. — Женева, 2012. — 122 с.

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АГРОЭКОЛОГИЧЕСКАЯ И РЕСУРСОСБЕРЕГАЮЩАЯ РОЛЬ СЕВООБОРОТОВ (НА ОСНОВЕ ЛИЗИМЕТРИЧЕСКИХ ИССЛЕДОВАНИЙ)

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На основі лізиметричних досліджень встановлено закономірності міграції ґрунтової вологи і деяких біогенних елементів за межі кореневмісного шару ґрунту залежно від типу рослинності і системи удобрення. Показано еколого-агротехнічну і енергозберігаючу роль багаторічних трав, які дають змогу регулювати втрати найбільш лабільних елементів (азоту, кальцію, магнію) і збільшити продуктивність культур у сівозміні. Наведено оптимальну модель вузькоспеціалізованої зерно-картопляної сівозміни, що сприяє підвищенню коефіцієнта використання поживних речовин та удобрень рослинами на дерново-підзолистих ґрунтах в умовах зони Полісся.

Ключові слова: *лізиметричні дослідження, сівозміна, тип рослинності, волога, біогенні елементи.*

Научно обоснованное чередование культур в земледелии, а также оптимальная структура их, позволяет в системе «почва — растение» максимально эффективно использовать влагу и биогенные элементы. Одновременно севооборот успешно выполняет фитосанитарную роль и естественным путем обеспечивает минимальную засоренность посевов.

В севообороте поражение растений болезнями может снижаться в 2–4 раза относительно бессменных посевов.

При несоблюдении севооборотов или нарушении научно обоснованного чередования культур для поддержания заданного урожая возникает необходимость дополнительного внесения удобрений и химических средств защиты, что в свою очередь порождает экологические проблемы почвы и качества продукции. В последние