Direction of the Rational Use of Water at the Facilities for Growing Poultry

A A Potseluev, I V Nazarov *, A K Porotkova, N V Volovikova

Azov-Black Sea Engineering Institute FSBEE HE «Donskoy GAU» in Zernograd, ul. Lenina, 21, the town of Zernograd, Russia, 347740

E-mail: * niv671@rambler.ru

Abstract. The article notes the effect of water use in the technological process of automatic drinking agricultural poultry on the quality and the quantity of outputs. At the same time, the requirements to the quality of the used water, the regimes of its consumption by the poultry and the role of mechanization of the process of automatic drinking in the rational use of the water resource, the processing and the reuse of contaminated wastes are disclosed. Within the framework of this concept, we propose constructively technological solutions of systems and means of automatic drinking agricultural poultry, providing the rational use of water as one of the important products of vital activity of agricultural poultry.

1. Introduction

At agricultural facilities for the production of poultry products, the main consumption of water and the formation of contaminated wastes occur during the technological process of drinking poultry. When carrying out some production studies in the poultry-house on 366 hen heads, it was found that the daily water consumption for the researched object is 2244 m$^3$. However, it should be noted that the quality and quantity of produced products is not only affected by the amount of consumed water, but also by its quality. At the same time, the amount of used water and the factor of its rational use directly affect the cost of produced products (eggs, meat).

The quality of water used for the needs of automatic drinking poultry and the mode of its use must meet the zootechnical requirements and we should take into account the recommendations of the scientists in this regard.

The researchers [1, 2, 3, 4, 5, 6] have established that, depending on the species of the poultry and their sex and age, the consumption of water relative to the consumed fodder varies over a wide range and can be accounted for by the water consumption coefficient of irregularity in the approximate range of 1.4 ... 2.5. It should be noted that the demand for water increases to 30% when using granulated fodder. Also, the demand for water increases depending on the content of salt, meal, molasses, fiber and protein in the fodder. The deviation of the temperature regime from the comfort temperature (up to 30 °C) can cause a surge in water consumption in 2.5...3 times relative to the stable regime of water consumption. However, despite the importance of the considered factors, the maintenance of the required water temperature regime in the systems and the means of automatic drinking, the ensuring of a necessary water quality, the decrease of the nonproduction water costs and labor costs for servicing the systems and the means of automatic drinking are the directions characterizing the level of the technological effectiveness of the process of automatic drinking and the resource saving.

2. Results and discussion

The analysis of zootechnical requirements to the process of automatic drinking hens and turkeys, constructive solutions of the systems and the means of automatic drinking at the level of their production, the research and the patent developments [7, 8, 9, 10] showed that:
1. The developed and recommended systems and means of automatic drinking chickens and turkeys do not provide a comprehensive technical and technological solution that would ensure the compliance with zootechnical requirements for the process of automatic drinking and rational use of water.

2. The comprehensive solution of the unit providing the intake and reservation of water, its treatment in view of maintaining the temperature and the physical and mechanical parameters, has not been developed for poultry farming systems. The issues of collecting contaminated water, its treatment and secondary use, as well as the parallel drug feeding of poultry haven’t been solved either.

3. In the group means of automatic drinking, the question of the universality depending on the product drunk by the poultry (water with different physicochemical properties) has not been solved.

4. In the group means of automatic drinking and the lines of group drinking, the problems of the self-purification of the drinking bowls, the withdrawal of contaminated water, its preliminary filtration, bactericidal treatment and transportation to a storage tank has not been solved.

With this in mind, we have developed a scheme for a multifunctional poultry self-drinking system Figure 1, a scheme of the technological line for distributing water by automatic drinking bowls with their periodic cleaning from contamination, and a design and technological solution for a group automatic drinking with mechanical removal of contaminants and the withdrawal of contaminated water (waste water).

One of the basic elements of the automatic drinking system for poultry is the technological line for distributing water by automatic drinking bowls Figure 2.

The working process of this automatic drinking line is as follows. The water prepared in the storage tank according to the temperature index and the hydrogen index (pH) flows through the piping system into the valve-float device, and enters the regulating tank and then flows along the distribution pipeline in the regime of communicating vessels to the automatic drinking bowls for poultry. To clean periodically the drinking bowls from contamination and to change the drinking water, the cleaning unit is also periodically switched on. In this case, the vacuumed pulsator provides the reciprocating movement of the cleaning device and the purification of the drinking bowls from contamination through the flexible rod and the shock absorber. At the end of the working cycle, the technological line is brought into operation by means of the distribution pipeline valve (the drinking bowls are filled with clean water).

One of the basic elements of the system of the automatic drinking is the means of automatic drinking (automatic drinking bowls). The poultry are directly in contact with the automatic drinking bowls. Therefore, the constructive solution of the drinking bowls should ensure the rapid adaptation of the poultry to the drinking bowls, exclude the cases of injury to the poultry, maintain the designated temperature regime of the drinking water and its quality, their multifunctionality and versatility, optimize the water consumption, as well as reduce labor costs for their maintenance.

On the basis of the analysis of zootechnical requirements to the process of the withdrawal of water from automatic drinking bowls and the known design solutions of the means of the automatic drinking [11, 12, 13, 14, 15, 16], we found that:

1. The designed and recommended for use means of drinking the poultry, particularly turkeys, do not provide a comprehensive technical solution that ensures the compliance with zootechnical requirements for the process of the automatic drinking;
Figure 1. Scheme of a multifunctional automatic drinking system for poultry:
1 – air intake duct; 2 – ventilation fan of the poultry house; 3 – air supply duct to the poultry house; 4 – a vacuum line; 5, 28 – electric valves; 6 – accumulator of circulating water; 7 – water supply pipeline; 8 – water storage tank; 9 – temperature sensor; 10 – valve-float device; 11 – the circulating water dump valve; 12 – partition of the storage tank; 13 – pipeline of reused, circulating water; 14, 15 – pipelines of waters divided in accordance with their pH; 16 – electrode block for water treatment; 17 – electrode block for treating circulating water; 18, 19 – water supply pipelines with different pH values; 20 – block of filtration for circulating water; 21 – tank of the water dispenser; 22 – shock absorber; 23 – drinking bowl; 24 – guide bracket; 25 – cleaner; 26 – rod; 27 – pulsator; 29 – a pipeline of water supply to drinking bowls; 30 – cage battery; 31 – a cage (section for poultry).

Figure 2. The scheme of the technological line of water distribution to the drinking bowls with periodic cleaning and the withdrawal of contaminated water:
1 – regulating tank; 2 – shock absorber; 3 – automatic drinking bowl; 4 – suspension slider, cleaning device; 5 – the actuator of the cleaning device; 6 – flexible rod; 7 – pulsator; 8 – distribution pipeline; 9 – valve (electric valve), 10 – valve-float device.
2. Speaking about the means of the automatic drinking for poultry, particularly turkeys, a constructive solution ensuring the access of the poultry to an alternative product in terms of its physico-chemical properties (a different value of pH water; water, and medicinal solution) has not been developed yet.

3. Speaking about the group means of the automatic drinking, the issue of their self-cleaning, pre-filtration and the withdrawal of contaminated water has not been solved.

4. Speaking about the group means of the automatic drinking, the issue of resource saving for the drive operation of cleaning devices has not been solved.

To eliminate these shortcomings, we have developed a constructive solution for the group automatic drinking for turkeys and chickens Figure 3.
When developing the design of the drinking bowl, the task was to improve the quality of the process of the automatic drinking for the poultry, reduce the nonproduction consumption of water and energy to maintain a given temperature regime of drinking water and labor costs for its technological maintenance.

To achieve this technical and technological result, a two-channel supply of drinking water with different pH values or drinking water and medicinal products is provided in one of the two isolated containers of the drinking bowl closed with removable lids with water-filled windows for the maintenance of the livestock and water drinking glasses with brush working parts for the periodic cleaning drinking bowls from contamination, which are connected through the spacers with the jet organ, ensuring their periodic rotation together with the lid. At the same time, the presence of perforation in the bottoms of the drinking bowls, pollutant removal chambers, a cascade-type detachable filter and a contaminated water discharge pipeline make it possible to reduce labor costs for sanitation of the drinking bowls and provide the treatment and secondary use of purified water.

3. Conclusions
1. The proposed technical and technological solutions due to the stability of the process of the automatic drinking in terms of the quality of water preparation and its temperature regime make it possible to reduce the irregularity of the water consumption by the poultry depending on some external factors and thereby make it possible to reduce the total water consumption per unit of produced products;
2. The availability of filtration units for nonproduction water (contaminated effluents) and its electrothermal treatment in the proposed systems and means of the automatic drinking allow it to be reused in the structure of technological processes of servicing poultry, which ensures its rational use with respect to the final product (egg, meat, feather);
3. The presence of the water activating unit in the system of the automatic drinking (division according to the hydrogen index, pH) and the use of periodically acidified water additionally reduces the incidence and the mortality of the poultry, which is especially characteristic when growing turkeys in the first temporary technological cycle;
4. In the proposed development an additional positive effect is the reduction of labor expenditures (the use of manual labor) in the process of the maintenance of the means of the automatic drinking (the cleaning and the washing of drinking bowls) and, as a consequence, the reduction of irreversible water losses.

References
[1] Kavtarashvili, A.Sh. Water quality is the most important condition for the health and the productivity of the poultry / A.Sh. Kavtarashvili - M.: GNU VNITNP Rosselkhozakademiy; 2013.
[2] Kornilova V.A. Efficiency of growing turkeys of heavy and medium crosses in their different ways of keeping / V.A. Kornilov – Diss. of Cand. of Agricultural Sciences, Samara, 2001.
[3] Maevska Teresa. Turkeys are not chickens / Teresa. Maevska – Faculty of Poultry, UVM Olshtyn.
[4] Ageev A.A. Efficiency of ways of growing young turkeys in the conditions of the peasant farm economy «Mars» in Zelenodolsk district of the Republic of Tatarstan. / A.A. Ageev, V.I. Shilova – FSBEE of the Higher Professional Education of the KSAVM.
[5] Shevchenko A.V. History of the turkey farming / A.V. Shevchenko – Poultry farming, 5 - LLC Intervesa, 2010.
[6] Fisinin V.I. Development of the poultry farming / V.I. Fisinin / Moscow: Kolos / Poultry farming # 2. – 2009.
[7] Standards of the technological design for poultry enterprises. Scientific and Technical Advance of Agroindustrial Complex 1.10.05.001-01 M. : Ministry of Agriculture of the Russian Federation, 2001.
[8] Requirements for the drinking water: State Standard P 51232-98, State Standard 2874-82, State Standard 2761-84.
[9] Potseluev A.A. Water supply of agricultural facilities / A.A. Potseluev – Zernograd: Publishing House of FSEE HPO Azov-Black Sea State Agroengineering Academy, 2005.
[10] Technologies and Equipment for Poultry Farming: Reference Book / V.T. Sklyar, A.V. Sklyar, T.N. Kuzmina, V.A. Gusev. – Moscow: FSBSE "Rosinformagrotekh". 2014. 188 p.
[11] Means of Mechanization for the Production and the Processing of Agricultural Products in Small Forms of Management. / Catalog – Moscow: FSBSE "Rosinformagrotech", 2008.
[12] Drinking machine. Patent No. 2573329 dated December 17, 2015.
[13] Drinking bowl for poultry and small animals. Patent No. 2242121, December 20, 2004.
[14] Drinking bowl for poultry and small animals Patent No. 1367929, January 23, 1988.
[15] Drinking bowl for poultry. AC # 738564, Newsletter No. 2, 1986.
[16] Drinking bowl for poultry. AC # 321238, Newsletter No. 35, 1971.