DOI https://doi.org/10.36059/978-966-397-100-1/49-67

FORMATION AND DEVELOPMENT OF THE SCIENCE OF ANIMAL FARM FEEDING (THE SECOND HALF OF 19th – EARLY OF THE 21st CENTURIES)

Borodai I. S.

INTRODUCTION

At the present stage, the guarantor of food security and stability of the national economic complex of Ukraine is the further development of animal husbandry, which, while meeting the needs of the population in food, contributes to the preservation of the health of the nation. Basis for raising the competitiveness of livestock, the growth of the export potential of the country is the feeding of farm animals, which encompasses, in the first instance, theoretical developments and technological methods of providing a rational nutrition that promote normal growth and development, achievement of the genetically determined level of productivity of farm animals and the necessary quality of products, health and a high reproductive ability for eco-friendly feed consumption

Ukrainian scientists have developed the basics for determining the nutritional value of forages, balanced feeding standards and feed rations for different types of farm animals, optimized feeding techniques and organization, and so on. The achievements of scientists in the field of feeding farm animals show the real cultural potential of the Ukrainian community, its ability to self-representations in the world of science and information space. That is a powerful theoretical and methodological basis for developing a further strategy for animal husbandry development in Ukraine.

During the statehood in Ukraine, there were no fundamental researches, which would comprehensively cover the formation and development of scientific foundations for the farm animal feeding as a basis for increasing their productivity, profitability of the livestock industry. It determines the theoretical and practical significance of our research.

On the basis historiographical analysis it was established that certain issues of the formation and development of scientific knowledge about the feeding of farm animals are covered in the scientific works of

G. Bogdanov[1], M. Tomme[2], V. Kandyba[3], in our previous publications[4]. The aim of the research is to integrate scientific and historical analysis and to allocate periods of formation and development of farm animal feeding in the context of the world industry scientific thought. General scientific and interdisciplinary methods used to solve research tasks. Particular attention paid to special historical methods, source analysis. The source base of the study includes a complex of diverse documents, the basis of which are archival materials.

The article is prepared in accordance with the tasks of the state budget theme 0116U002102 "Scientific-organizational and regulatory bases of innovative activity in the system of agrarian science: theoretical and methodological, historical and scientific studies, archival, bibliographic aspects of research".

1. Prerequisites for the Forming of Scientific Concepts of Farm Animal Feeding

As the analysis showed, the prerequisite for the formation and development of the science of farm animal feeding was the development of foreign and domestic scientists in the fields of physics, chemistry, physiology, biology, biochemistry and other related sciences, which formed its theoretical and methodological basis. In particular, the discovery of oxygen by Pristlie and Sherl, clarifying its significance for life by Lavoisier made it possible to formulate the notion of the organism and its livelihoods. The role of protein was first investigated by F. Maghandi in 1816, initiating the development of scientific foundations of protein feeding of animals. The animal need in mineral substances was substantiated by O. Rubets. M. Lunin and K. Funk have established the presence of vitamins in products that have became indispensable in the feeding of farm animals[5].

The scientific schools of domestic physiologists and biochemists also made a decisive contribution to the formation of the theory of farm

[1]Богданов Г. А. Кормление сельскохозяйственных животных. Москва, 1990. 624 с.

[2]Томмэ М. Ф. Кормление сельскохозяйственных животных. *Большая Советская Энциклопедия*. 3-е изд. Москва, 1973. Т. 13. С. 530–533.

[3]Кандиба В. М. Досягнення вчених інституту тваринництва УААН в розвитку науки про повноцінну нормовану годівлю сільськогосподарських тварин і пріоритетні напрями досліджень у сучасних умовах. *Науково-технічний бюлетень*. Харків, 2009. Вип. 100. С. 269–277.

[4]Бородай І. С. Теоретико-методологічні основи становлення та розвитку вітчизняної зоотехнічної науки. Вінниця, 2012. 416 с.

[5]Богданов Г. А. Кормление сельскохозяйственных животных. Москва, 1990. 624 с.

animal feeding. In particular, the problems of physiology of feeding were developed in the research by I. Pavlov and his pupils who discovered the mechanism of digestion and the most favorable conditions for the passage of this process. I. Sechenov substantiated the connection of the organism with the external environment. During the 19th – early 20th centuries German scientists made decisive contribution in formation of the theoretical foundations of the science of farm animal feeding. Its founder was A. Teyer, who formulated the theory of "hay equivalents". In the book "Basis of rational agriculture" (1809), he first expressed farm animals need in feeds in uniform rules, while its nutritional value brought in the calculation of hay. He has developed feed tables and norms for fattening cattle[6].

The intensive development of organic chemistry in the 19th century contributed to the study of the chemical composition of plants and the theory of nutritional assessment of feed. In 1836, J. Bussengho proved the importance of feed nitrogen and offered to take its percentage for the nutritional value of feed. In the middle of the nineteenth century. Yu. Libich divided all the substances of feed into plastic and respiratory, substantiated the role of proteins, carbohydrates and fats in feeding. In 1866, Pettencofer and K. Voith, conducting experiments under conditions of nitrogen balance, formulated the concept of nitrogen balance. G. Gruven determined the rates of dry organic matter, protein, fat and carbohydrates for different types of farm animals, began to evaluate the nutrition content of feeds. V. Henneberg and F. Stomann proved the importance of the assimilated part of the feed compared to the nutrient, due to this E. Wolf developed the nutrient tables of the feed digestible nutrients[7].

In assessing the nutrition of feeds, much attention was paid to the method developed by O. Kelner. The scientist proposed to assess the nutrition of the feed in starch equivalents, based on the fact that 1 kg of starch fed to adult oxen, can provide an average of 0.25 kg of delayed fatty tissues. In assessing the nutrition of feed and rationing of feeding a significant contribution also made by G. Armsby. He developed a scheme of energy balance of animal organism, introduced the concept of gross,

[6]Бородай І. С. Теоретико-методологічні основи становлення та розвитку вітчизняної зоотехнічної науки. Вінниця, 2012. 416 с.

[7]Томмэ М. Ф. Кормление сельскохозяйственных животных. *Большая Советская Энциклопедия*. 3-е изд. Москва, 1973. Т. 13. С. 530–533.

digestible, physiologically useful and pure energy, proposed to estimate the total nutrition of feed in units of pure energy deposited in the body in the form of protein and fat. At the same time, N. Fjord and N. Hanson used a Scandinavian feed unit for assessing the nutritional value of feed, for which they took 1 kg of dry barley, or 0.72 of starch equivalent[8].

In 1914, L. Mendel and T. Osborne discovered the need in essential amino acids for laboratory animals, that created the basis for the development of norms for its consumption for farm animals. Since then, research on mineral nutrition has become systematic, its resulted in the determination of the indispensability of about 70 substances, elements, factors in feeding animals. Since then, research on mineral nutrition has become systematic, its result was the determination of the irreplaceability of about 70 substances, elements, factors in animal feeding[9].

In the Russian Empire at the end of the 19th– early 20th centuries scientists used fodder rules for various types of farm animals developed by German scientists. Poor funding and technical equipment of research institutions did not contribute to the establishment and development of this scientific direction.

According to the results of our research, on the Ukrainian lands the issues of farm animal feeding was raised for the first time by agricultural societies. So, the Imperial Society of Agriculture in Southern Russia developed the issues of feeding and drinking merino sheep, the best owners were given a premium for well-fed cattle. Poltava Agricultural Society carried out the first experiments on fattening pigs, on its basis they developed technologies of their bacon fattening. Kharkiv and Kyiev associations of agriculture and agricultural industry in the late 19th – early 20th centuries conducted a series of studies on control of fattening of cattle, the influence of the feed rations on the level of livestock, and so on.

As one of the most important research on feeding farm animals conducted in this period in the Ukrainian lands, we consider the master's thesis by P. Shyrokych, who studied the chemical composition of the 139 samples of winter wheat and 45 rye straw[10]. The second important work was the analysis of 150 samples of forage plants, conducted at the Poltava Researching field in 1900–1908, which took into account the influence of the terms of its harvest on yield and chemical composition.

[8]Ханссон Н. Кормление сельскохозяйственных животных. Москва: Сельхозгиз, 1936. 124 с.
[9]Богданов Г. А. Кормление сельскохозяйственных животных. Москва, 1990. 624 с.
[10] Особова справа П. О. Широких // Державний архів м. Києва. Ф. 18. Оп. 2. Спр. 290. 80 арк.

In our opinion, it is interesting to study the research by F. Rurikov of the chemical composition of steppe pirache hay, which includes the data of analysis of 36 samples of pyrite with an admixture of other herbs collected in the steppe zone of the Ukraine. The achievement of the scientist was also the first method of studying local feeds[11].

At the beginning of the 20th century the research of the nutritional and chemical composition of local feeds, its influence on the formation of farm animal productivity in various natural-climatic zones on Ukrainian lands were also conducted by I. Bel'govsky, O. Bondarenko, I. Kalugin, A. Redkin, I. Shirokykh and others.

As the analysis showed, during this period, domestic scientists had a priority in solving some problems of farm animal feeding. In our opinion, especially important were the M. Chyrvinskyi`s developments, who in 1882 proved the possibility of formation of fat from carbohydrates, that contributed to the improvement of systems for assessing the productive effect of feed. Another significant achievement of the scientist was the substantiation of the influence of the level of feeding on the growth and development of animals. It should be noted that M. Chyrvinskyi was the first who raised the question of the need of farm animal feeding in Russia at the First Congress of Agricultural Experimental Affairs in 1901[12].

No less important achievement of this period was the experimental establishment of direct and indirect participation of protein feed in the formation of fat in animal body by Ye. Bogdanov in 1903–1908. The scientist has shown that along with the overall nutritional value of the food, it is necessary to consider the protein and vitamin ones. He developed the doctrine of normalized feeding, taking into account the physiological state of animals, ecological and economic characteristics of the livestock sector of various natural and climatic zones of the country[13].

The decisive role of feeding in the breed creation of farm animals has been proved by the scientific work of M. Ivanov, who repeatedly noted that the main failure of our mass improvement of livestock breeding is in the poor quality and quantitative lack of feed. The scientist thoroughly studied the features of feeding Karakul sheep in the south of the Ukrainian SSR.

[11]Бородай І. С. Теоретико-методологічні основи становлення та розвитку вітчизняної зоотехнічної науки. Вінниця, 2012. 416 с.

[12]Особова справа М. П.Чирвинського // Державний архів м. Києва. Ф. 18. Спр. 284. Оп. 2. 240 арк.

[13]Богданов Е. А. Составление кормовых дач для молочного скота. С приложением таблиц для быстрого составления кормовых дач по наиболее простому и точному способу. Москва, 1916. 72 с.

He developed the basis for fattening pigs to meat conditions for different diets and methods of keeping. He investigated the chemical composition and nutrition of local feeds, the influence of vitamins on the growth and development of farm animals[14].

Thus, prerequisite for the formation and development of the science of farm animal feeding was the development of foreign and domestic scientists in the fields of physics, chemistry, physiology, biology, biochemistry and other related sciences. The greatest achievements of farm animal feeding in the pre-Soviet period are the development of systems for assessing the productive effect of feed, the justification of the impact of feeding on growth and development of animals, the experimental establishment of direct and indirect participation of feed protein in the formation of fat in the body of animals, etc.

2. Development of Scientific Principles of Farm Animal Feeding in the Soviet Period

We found that in the Soviet Union systematic study of problem of farm animal feeding was started in 1929, when, on the initiative by Yu. Lyskun, the theme "Study of the composition and nutrition of local feeds,"All-Union Academy of Agricultural Sciences named after Lenin established as obligatory for implementation in all branch research institutions. Since then, the efforts of specialized research institutes and universities have been directed at the development of such problems: 1) the establishment of requirements for feed rations for different species, age, sex, economic use of farm animals; 2) determination of the chemical composition of feed and development of the most economically beneficial types of feeding for different natural and climatic zones; 3) the development of mixed fodders, etc.[15].

It is important to note that the complex socio-economic situation, systematic droughts and crop failure did not contribute to rational feeding of cattle. As noted by V. Ustiantsev at the first session of the Scientific Advisory Board of the People's Commissariat of Land Affairs of the Ukrainian SSR, held April 4–7, 1928, monotony and imbalance of feed caused low productivity of livestock. The main percentage of feed rations

[14]Бородай І. С. Теоретико-методологічні основи становлення та розвитку вітчизняної зоотехнічної науки. Вінниця, 2012. 416 с.

[15]Всесоюзная академия сельскохозяйственных наук им. В. И. Ленина. Ее организация, деятельность и план исследовательской работы на 1934 г. Москва, 1934. 57 с.

of farm animals was roughage (57.8%), which consisted mainly of straw [678]. The analysis of the development of the theory of farm animal feeding showed that during this period the studies focused on increasing the nutritional value of roughage on the basis of its silage, yeast, fermentation, biological and chemical processing, and others. Straw as the most economical and accessible feed steamed, quaffed, treated with quenched lime and other chemicals, enriched with minerals and microorganisms[16].

In accordance with the resolution of the Council of People's Commissars of the USSR "On the work of All-Union Academy of Agricultural Sciences named after Lenin" (July 16, 1934), the primary importance was given to the use of industrial wastes in farm animal feeding. Considerable attention was also paid to increasing efficiency of use of natural and the creation of artificial pasture during fattening of cattle. To the achievements of domestic scientists in this direction we include: 1) the development of rational methods for the use of pasture and methods for assessing of herb stock by G. Chuchko; determination of the nutritional value of local meadows and pastures, justification of efficiency of the use of lupine as a feed for livestock by I. Sytenko; introduction of schemes of green conveyor for provision of cattle with feed in spring, summer and autumn by Y. Danylenko, V. Medvedev, M. Starovierov. The foundations of the flower-nectar conveyor for the practical needs of beekeeping were also developed by N. Rotmistrov and J. Savchenko. In our opinion, the greatest achievement of this period was the development of the theoretical foundations of yeast feeding as a method of its biological preparation for feeding by B. Levitskyi in 1932. Yeast fodder in comparison with usual ones was characterized by higher fodder value, protein content and vitamins, taste qualities[17].

The successes in farm animal feeding of this period were largely attributed to advances in the technology of production, storage and processing of feed. Particular importance has been obtained research of silage forage. It is worth noting that the method of silage was known in Sweden and the Baltic countries as early as the 18th century, in Prussia and Germany in the 30's of the 19th century. It was used to store beet and sugar production waste, and in the 50's to preserve green fodder.

[16] Бородай І. С. Теоретико-методологічні основи становлення та розвитку вітчизняної зоотехнічної науки. Вінниця, 2012. 416 с.

[17] Левитский Б. Г. Дрожжевание кормов. Москва, 1936. 64 с.

Silage became widespread in the 70's when fodder corn became widely used in France. We consider as developers of the method of silage forage the foreign scientists Lemm, Gofar. At the end of the 19th – early 20th centuries silage has spread rapidly in America, Russia, Switzerland and England[18]. In the Ukrainian lands, the first experiments on silage forage were conducted by K. Veresenko, I. Kalugin, F. Rubin, F. Rurikov, S. Serapin, V. Ustiantsev, they proved the effectiveness of local feed ensilage ensilage, developed technologies of combined and long-term ensilage. O. Zubrilin, a scientifically based system for preserving green fodder, developed the theory of "sugar minimum". To his achievements should also include the theoretical substantiation of the "haymaking"[19].

At development of rations balanced with nutrients, minerals and biologically active substances, the idea of its replacing with mixed fodders was implemented. In the USSR the first recipes of mixed fodders at the beginning of the 20th century were proposed I. Bel'govskyi, A. Redkin, V. Smirnov, I. Shirokykh. Thus, I. Belgovskyi developed general questions of the theory and practice of production of mixed fodders, the development of the mixed fodders industry, the neutralization of some waste products for the purpose of its use in farm animal feeding. A. Redkin made a significant contribution to the development of mixed fodders for different ages and groups of pigs, their types of fattening. Most of his proposed recipes after the test were accepted as state standards and intensively used in industry[20].

In prewar years the domestic scientists have studied the chemical composition, digestibility, caloric content of local feeds, established the nutritional requirements for farm animals. I. Popov initiated a study on the nutritional value assessment, and he published the book "The USSR's fodder, composition and nutrition" in 1933. M. Bogoyavlenskyi and P. Pshenychnyi in 1936 studied and developed methods of assessing the nutritional value of forages for the Forest-Steppe of the Ukrainian SSR, I. Zakharchenko and E. Kalenych for whole republic in 1948. These studies allowed to find out the change in the composition and nutrition of

[18]Герчиков Н. П. Силосование и его роль в системе кормодобывания сельскохозяйственных мероприятий. *Вестник сельского хозяйства*. 1929. № 1–2. С. 20–22.

[19]Зубрилин А. А. Научные основы консервирования зеленых кормов. Москва, 1947. С. 47–59.

[20]Овсянников А. И. Пятьдесят лет советской зоотехнической науки. *Животноводство*. 1967. № 10. С. 23–34.

feeds under the influence of climatic conditions and agrotechnics of cultivation, methods of harvesting, preservation and storage[21].

In the 30–40s, Ukrainian scientists set requirements for feed rations of farm animals of some species, age, sex, and economic use. They studied the ability of some breeds to fatten, developed standard terms for some types of fattening. The norms and rations of cattle feeding were developed by M. Bazylevych, S. Erler, I. Zaderius, M. Starovierov and others. Priority studies on digestion of feeds, peculiarities of gastric secretion and pig nutrition, which became the theoretical basis for the development of feeding norms and rations for these species, were conducted by O. Bakieva, V. Borovskyi, O. Kvasnitskyi and etc. O. Bondarenko offered the first technology of bacon fattening pigs in the USSR.

Research on normalized feeding in livestock farming has become systematic in the first half of the 20th century. It should be noted that scholars and specialists in feeding their rationulas used the reference "Fodder Norms and Feed Tables" (1932), prepared by I. Popov. They calculated the need for feed on the factorial principle, developed on the basis of classical studies of foreign and domestic scientists G. Armsby, E. Bogdanov, M. Dyakov, O. Kelner, K. Nering, M. Rubner et al. It provided the determination of daily standards on energy, protein, calcium and phosphorus based on the need for them to support basic metabolism, milk production, pregnancy, changes in live weight during lactation, and so on[22].

We found that in the second half of the 20th century Ukrainian scientists paid special attention to the development of problems of amino acid nutrition, protein feeding of animals, studying the possibilities of using non-protein nitrogen feed. Valuable developments in this direction were proposed by G. Bogdanov, M. Guly, O. Dmytrochenko, M. Dyakov, I. Popov, P. Pshenichny, M. Tomme and others. In particular, Ukrainian scientists have investigated the effectiveness of daily rations of ruminants which included mineral and organic salts of ammonium (sulfate, bicarbonate, acetate, lactate), urea, biuret, and others. Experiments on feeding bicarbonate of sodium with the addition of trace elements as a rich

[21] Кандиба В. М. Досягнення вчених інституту тваринництва УААН в розвитку науки про повноцінну нормовану годівлю сільськогосподарських тварин і пріоритетні напрями досліджень у сучасних умовах. *Науково-технічний бюлетень*. Харків, 2009. Вип. 100. С. 269–277.

[22] Бородай І. С. Теоретико-методологічні основи становлення та розвитку вітчизняної зоотехнічної науки. Вінниця, 2012. 416 с.

source of CO_2, used for organic synthesis in the body of animals, conducted by M. Gully.

It is worth noting that for the first post-war decades, as in the previous stage, scientific searches for additional sources of compensatory feeding of animals were characteristic. Scientists worked at the time of nearly total seizure of grain in the union fund. That is why scientists gave increased attention to scientific topics on the use of urea, phosphate shale, defecate in feeding animals. Not compatible with the satisfaction of the biological needs of animals, they sometimes caused their death. Under such conditions feeding, animals should not only survive, but also increase their productivity in accordance with the developed five-year plans.

A characteristic trend of this period is the search for new methods for assessing the overall nutrition of the feed. Thus, after the critique of bourgeois biological science at the 35th plenum of the Animal Husbandry Section of All-Union Academy of Agricultural Sciences named after Lenin in 1951, which became a kind of continuation of the July session of the Academy in 1948, there was a refusal from the factorial and the transition to unified norms. In 1959 the manual “Fodder Norms and Tables” was edited by M. Tomme and published, in which the daily norm in feed units, the digestible protein was expressed in total, without its distribution for the maintenance of animal life, for the production of products and reproduction[23].

By the decision of March Plenum of the Animal Husbandry Section in 1963, they considered it expedient to assess the total nutrition of the feed by exchange energy. The development of a new system for assessing feed and rationing for animal feeding was carried out by P. Victorov, V. Georgievskyi, M. Denisov, M. Kleimenov, V. Kulikov, K. Solntsev, V. Fisinin, V. Shcheglov under the leadership of Academicians O. Dmytrochenko and O. Kalashnikov. In 1983, new norms were developed and approved by the Presidium of All-Union Academy of Agricultural Sciences named after Lenin, and in 1985 they were published in the manual "Norms and diets of feeding farm animals". Since then, the main indicator of energy nutrition of feeds and rations is the content of exchange energy expressed in megajoules, in the unit of natural feed and dry matter of feed or ration. By the decision of March 1963 to the plenum

[23] Томмэ М. Ф. Кормление сельскохозяйственных животных. *Большая Советская Энциклопедия*. 3-е изд. Москва, 1973. Т. 13. С. 530–533.

of the Animal Husbandry Section, they considered it expedient to assess the total nutrition of the feed by exchange energy. The development of a new system for assessing feed and rationing for animal feeding was carried out by P.I. Victorov, V.I. Georgievsky, M.I. Denisov, M.I. Kleimenov, V.M. Kulikov, K.M. Solntsev, V.I. Fisinin, V.V. Shcheglov, for the leadership of Academicians All-Union Academy of Agricultural Sciences named after Lenin O.P. Dmytrochenko and O.P. Kalashnikov. In 1983, new norms were developed and approved by the Presidium of VASHNIL, and in 1985 they were published in the manual "Norms and diets of feeding farm animals". Since then, the main indicator of energy nutrition of feeds and rations is the content of exchange energy expressed in megajoules, in the unit of natural feed and dry matter of feed or ration[24].

Thus, in the Soviet period, domestic scientists have made significant progress in the development of scientific foundations for feeding farm animals. They set the requirements for feed rations for different species, age, sex, economic use of farm animals; determined the chemical composition of forages and developed the most economically advantageous types of feeding for different natural and climatic zones; developed methods for assessing the total nutrition of feeds, etc.

3. Development of Theoretical and Methodological Foundations for the Farm Animal Feeding of During the Period of Ukraine's Independence

In recent decades, Ukrainian scientists have developed the basics of mineral nutrition in animal husbandry. In particular, the metabolism of phosphorus and calcium in the body, the influence of microelements on animal development was studied by G. Bogdanov. G. Klytsenko investigated the influence of salt and phosphorous feeding on cattle productivity. According to the results of many years of research, he published a monograph "Mineral Food of Agricultural Animals" (1980), in which he proposed new rules for feeding various types of farm animals of macro- and microelements, and determined its impact on productivity, growth, development and reproduction functions[25].

[24]Томмэ М. Ф. Кормление сельскохозяйственных животных. *Большая Советская Энциклопедия*. 3-е изд. Москва, 1973. Т. 13. С. 530–533.

[25]Клиценко Г. Т. Минеральное питание сельскохозяйственных животных. Киев: Урожай, 1980. 167 с.

The influence of mineral compounds on the health and productivity of poultry was substantiated by I. Ratuch, on stimulation of the synthesis of biologically active compounds (vitamins, amino acids, antibiotics, etc.) by symbiotic microbial associations in the prehistoric ruminants by F. Palfyi. Research on the effects of quantitative changes of phosphorus compounds in the cow's rumen fluid during the feeding of essential amino acids on the metabolic processes in the pig's body and their productivity, conducted by J. Slabitskyi, have not lost its significance to our days. The scientific work of G.P. Zapadniuk and P.Z. Labodiuk was directed at the development and implementation of technologies of high-grade protein nutrition of various types of farm animals, and the study of the possibility of replenishing protein deficiency in rations of lactational cows due to the use of synthetic non-protein nitrogen compounds. The influence of lysine and methionine on the health and productivity of poultry was investigated by I. Ratych[26].

M. Karpus, Yu. Savchenko and others made a significant contribution to the development of the theory of carbohydrate feeding. Thus, Yu. Savchenko found the need for sugars of different age and physiological groups of cattle, the effect of sugar content and the type of sugars on metabolism and cattle productivity. M. Karpus has developed standards for feeding different age groups of pigs of sugar feed for different levels and quality of protein, fiber and minerals.

The research on the development of the bases of vitamin nutrition of farm animals, the influence of vitamins on their health and the formation of productive qualities were conducted by I. Avramenko, G. Bogdanov, A. Zverev, I. Ionov, G. Kiseliov, S. Payenok, I. Ros, M. Sakhackyi and others. Thus S. Payrnok studied the influence of different sources of carotene and vitamin A on metabolic processes and meat productivity of pigs. He introduced into the production of forage forms of vitamins and developed water dispersants of fat-soluble vitamins. I. Ionov developed the theoretical bases of vitamin feeding in poultry, the principles of rationing of vitamins in rations and recipes of vitamin and mineral premixes, new methods for analyzing the content of vitamins in feed and biological material.

In our opinion, the above-mentioned works constitute the basis for the implementation of control over the full value of farm animal feeding on the

[26] Влізло В. В. Федорук Р. С., Ратич І. Б. та ін. Історія Інституту біології тварин (1960–2010). Львів-Дрогобич, 2010. 324 с.

basis of the study of feeds on the content of protein, minerals and carotene, as well as the state of protein, mineral and vitamin metabolism in productive farm animals.

At the end of the 20th century, the study on normalized farm animal feeding has also been intensified. For the first time, detailed norms for farm animals feeding for the Polissya, Forest-Steppe and Steppe regions of Ukraine have been developed, according to which the dietary ratios of cattle are monitored for 20–24, pigs for 27–30 indicators. Rationing of feeding allowed to significantly increase the efficiency of nutrient use of rations and reduce feed costs per unit production by 10–15%[27]. In the development of the theory of normalized feeding significant contributions were made by G. Bogdanov, V. Karavashenko, M. Karpus, M. Lapa, G. Martynyuk, M. Noszdrin, G. Provatorov, V. Slavov and others.

Ukrainian scientists established the peculiarities of rationing feeding of farm animals of various age and sex groups, of economic purpose. Thus, the system of rational feeding and keeping of bulls was developed by M. Volkoboi, E. Danilevskyi, S. Efimenko, D. Savchuk and others. The norms of consumption of carbohydrates, fats and other components in dairy cow diets were proposed by M. Knyga. Progressive technologies of intensive fattening of young cattle were introduced by R. Kavka, V. Koshelev, P. Stoliarchuk, A. Zvigun and others.

M. Kovalenko, M. Noszdrin, I. Tronchuk and other scientists developed the theory of full feeding of pigs. T. Gorb, O. Gorlov substantiated the rational system of feeding sheep for various natural-climatic zones. The bases of complete feeding of poultry as an important factor of increasing its productivity were proposed by Yu. Batyuzhevskyi, M. Dakhnovskyi, V. Karavashenko and others. Yu. Zheltov, V. Movchan, V. Prosyany, G. Shpet performed a considerable amount of research on the development of the foundations of full feeding in fish farming[28].

Ukrainian scientists conducted a series of studies on the effects of limited, variable and other types of feeding. In particular, Yu. Batyuzhevskyi for the first time in the poultry farming of Ukraine organized a multifaceted research on the limited feeding of young animals of various kinds of poultry that provides a significant saving of feed on its breeding without adversely affecting future productivity. The technology of forced

[27] Бородай І. С. Теоретико-методологічні основи становлення та розвитку вітчизняної зоотехнічної науки / І. С. Бородай. Вінниця, 2012. 416 с.

[28] Інститут рибного господарства / за ред. І. І. Гриціняка. К., 2010. 352 с.

fattening of waterfowl poultry was developed by E. Dyunov, I. Ivko, V. Melnyk and others.

In recent decades, new, effective recipes of feed additives, premixes and feed supplements have developed. So, L. Podobed offered compound feed and feed supplements for cattle, pigs and poultry, as well as the technology of preparation soy substitutes for milk feed for calves. Regional premixes for beef cattle, taking into account the peculiarities of the natural climatic and soil zones of Ukraine, the zoo chemical composition of feed and the type of animal feeding; contribute to lower feed costs, increase average daily increments, were developed by V. Kebko, V. Slavov, G. Shkurin and others.

The recipes of feed additives for pigs, which take into account peculiarities of metabolism and energy in farm animals, provide maximum manifestation of productivity, were developed by M. Nozdryn. Fodder with a limited content of protein of animal origin, substitutes of whole milk, as well as the technology of production of protein concentrate from juice of green plants was proposed by O. Zverev. In poultry farming physiologically substantiated norms of feeding full-fodder mixed fodders contributing to increased nutrient assimilation in the bird organism, were developed by M. Lemesheva[29]. The methods of improving the quality of granules of mixed fodders for growing fish in ponds, basins and gardens were grounded by Yu. Zheltov, who conducted experiments with non-traditional components suitable for fish feeding in compound fodders[30].

The author has established that during this period a new direction of scientific research was substantiated namely the substantiation of the effectiveness of dietary feeding, the study of its effect on increased resistance in animals. Theoretical and methodological basis for its development is the scientific works of domestic scientists V. Alikaiev, B. Levitskyi, A. Onegov, A. Solun, I. Khrabustovskyi and others. In particular, I. Khrabustovskyi prepared "Methodological recommendations for determining the natural resistance of animals in conditions of their intensive use" (1974), in the formation of which he devoted an important role to feeding[31].

In recent decades, comprehensive study have launched on the assessment of the quality of farm animal fodder. In our opinion,

[29] Головко В. О. Історія Харківської державної зооветеринарної академії. 155 років. Х., 2006. 500 с.
[30] Інститут рибного господарства / за ред. І. І. Грициняка. К., 2010. 352 с.
[31] Головко В. О. Історія Харківської державної зооветеринарної академії. 155 років. Х., 2006. 500 с.

V.I. Gnoyevyi made important contribution on the formation of this direction, determined the quality indices of coarse and concentrated feeds in relation to its supramolecular physico-chemical and anatomical-morphological structure by zootechnical, physiological and biochemical methods. He investigated the relationship between the biomorphological structure of feed and its energy nutrition, the laws of improving the feed quality and developed methods for increasing the effectiveness of its use by ruminants[32].

For further development of farm animal feeding the scientific developments by V. Kebko, O. Mamenko, Yu. Savchenko, V. Slavov, T. Shkurin, on the study of the possibility of using livestock in zones affected after the accident at the Chernobyl Nuclear Power Plant, fodder crops accumulated radionuclides are practically significant. The scientists have substantiated the effective technological methods of reducing the level of contamination of livestock products with radioactive cesium to environmentally safe norms.

Thus, the last decades are the most fruitful period of development of scientific principles of farm animal feeding. Its introduction into the practice of livestock breeding contributes to the achievement of the genetically determined level of productivity of farm animals and the necessary quality of products, ensures their health and high reproductive ability for the economical consumption of feed.

The analysis of the development of the science of farm animal feeding has shown the following directions need to study in today's extreme conditions:

1. The improvement and wide-scale introduction of stable annual system of the same type, balanced on the detailed norms of farm animal feeding with high-quality feeds from storage tanks in the farms of different zones of Ukraine.

2. The introduction into the production of domestic premixes of a new generation with increased biological and productive effects, anti-stress, immunostimulants, antiradionuclide qualities.

3. The development of zonal prescriptions of available protein-vitamin and mineral supplements using local vegetable protein feeds, slowly cleavable protein scavengers in synthetic sources, heat-treated legumes.

[32] Русько М. П. Гноєвий Віктор Іванович // Вчені у галузі тваринництва. Київ : Аграрна наука, 1999. С. 95–97. (Серія «Українські вчені-аграрії XX ст.»; кн. 2).

4. The solving the problem of normalizing the amino acid nutrition of highly productive dairy and beef cattle using scarred proteins and protected indigenous amino acids.

5. The search for alternative, ecologically clean, energy, land and resource saving, using the energy of the sun, wind and biodegradable manure, a system of stable all-year-round, biologically complete, dietary feeding of animals with green fodders grown without the use of land from grain-growing crops for biohydroponic technology.

CONCLUSIONS

Thus, prerequisite for the formation and development of the science of farm animal feeding was the development of foreign and domestic scientists in the fields of physics, chemistry, physiology, biology, biochemistry and other related sciences, which formed its theoretical and methodological basis. The foundation for the establishment of farm animal feeding of in the Ukrainian lands was laid in the late 19th century – at the beginning of the 20th centuries. In the first half of the 20th century domestic scientists developed the basics of assessing the nutritional value and chemical composition of local feeds, its influence on the formation of farm animal productivity was studied, the requirements for the rational composition of feed rations for animals of different species, age, gender, economic use were established. The research on mineral, amino acid, carbohydrate and vitamin feeding of cattle was initiated; the concept of balanced and normalized feeding was formed. In the second half of the 20th century study on the effects of protein feeding, the possibility of using non-protein nitrogen feed, the growth of the biological value of protein, the role of amino acids and mineral nutrition in feeding animals was carried out. In recent decades, the study on the assessment of feed quality, the study of the effects of feeding on the formation of resistances in animals have become systematic. Detailed norms and economically profitable types of livestock feeding for various natural and climatic zones of Ukraine have been developed.

Ukrainian scientists have developed the theoretical foundations of balanced, rational feeding of farm animals which based on the determination of nutritional value of forages, the establishment of feeding standards, the development of feed rations, the optimization of equipment and organization of feeding, etc. In today's extreme

conditions the following directions need to study: the introduction of stable annual system of the same type, balanced on the detailed norms of farm animal feeding; the production of domestic premixes of a new generation with increased biological and productive effects, the development of zonal prescriptions of available protein-vitamin and mineral supplements; the search for alternative, ecologically clean, energy, dietary feeding of animals.

SUMMARY

The aim of the research is to integrate scientific and historical analysis and to allocate periods of formation and development of farm animal feeding in the context of the world industry scientific thought. Author used the general scientific and interdisciplinary methods to solve research tasks. Particular attention paid to special historical methods, source analysis. The source base of the study includes a complex of diverse documents, the basis of which are archival materials.

The author argues that the foundation for the establishment of feeding of farm animals on Ukrainian lands was laid in the late 19th century – at the beginning of the 20th centuries, identifies the main periods of its development. Theoretical and methodological basis for the formation and development of the science of farm animal feeding are research of domestic and foreign scientists in the fields of physics, chemistry, physiology, biology, biochemistry and other related sciences.

It was shown that the basics of assessing the nutritional value and the chemical composition of local feeds were developed by Ukrainian scientists in the first half of the 20th century, and its impact on the production of farm animals was studied. One of the directions of scientific development of this period was the establishment of requirements for the rational composition of feed rations for animals of different species, age, sex, economic use. Generalized research on mineral, amino acid, carbohydrate and vitamin feeding of cattle, which formed the basis of balanced nutrition. It was established that for the second half of the 20th century. There were characteristic studies on the effects of protein feeding, the use of non-protein nitrogen feed, the growth of the biological value of protein, the role of amino acids and mineral nutrition in feeding animals.

REFERENCES

1. Богданов Г. А. Кормление сельскохозяйственных животных. Москва, 1990. 624 с.
2. Богданов Е. А. Составление кормовых дач для молочного скота. С приложением таблиц для быстрого составления кормовых дач по наиболее простому и точному способу. Москва, 1916. 72 с.
3. Бородай І. С. Теоретико-методологічні основи становлення та розвитку вітчизняної зоотехнічної науки. Вінниця, 2012. 416 с.
4. Влізло В. В. Федорук Р. С., Ратич І. Б. та ін. Історія Інституту біології тварин (1960–2010). Львів-Дрогобич, 2010. 324 с.
5. Всесоюзная академия сельскохозяйственных наук им. В. И. Ленина. Ее организация, деятельность и план исследовательской работы на 1934 г. Москва, 1934. 57 с.
6. Герчиков Н. П. Силосование и его роль в системе кормодобывания сельскохозяйственных мероприятий. *Вестник сельского хозяйства*. 1929. № 1–2. С. 20–22.
7. Головко В. О. Історія Харківської державної зооветеринарної академії. 155 років. Х., 2006. 500 с.
8. Зубрилин А. А. Научные основы консервирования зеленых кормов. Москва, 1947. С. 47–59.
9. Інститут рибного господарства / за ред. І. І. Грициняка. К., 2010. 352 с.
10. Кандиба В. М. Досягнення вчених інституту тваринництва УААН в розвитку науки про повноцінну нормовану годівлю сільськогосподарських тварин і пріоритетні напрями досліджень у сучасних умовах. *Науково-технічний бюлетень*. Харків, 2009. Вип. 100. С. 269–277.
11. Клиценко Г. Т. Минеральное питание сельскохозяйственных животных. Киев: Урожай, 1980. 167 с.
12. Левитский Б. Г. Дрожжевание кормов. Москва, 1936. 64 с.
13. Овсянников А. И. Пятьдесят лет советской зоотехнической науки. *Животноводство*. 1967. № 10. С. 23–34.
14. Особова справа М. П.Чирвинського // Державний архів м. Києва. Ф. 18. Спр. 284. Оп. 2. 240 арк.
15. Особова справа П. О. Широких // Державний архів м. Києва. Ф. 18. Оп. 2. Спр. 290. 80 арк.

16. Русько М. П. Гноєвий Віктор Іванович. // Вчені у галузі тваринництва. Київ : Аграрна наука, 1999. С. 95–97. (Серія «Українські вчені-аграрії XX ст.»; кн. 2).

17. Томмэ М. Ф. Кормление сельскохозяйственных животных. *Большая Советская Энциклопедия*. 3-е изд. Москва, 1973. Т. 13. С. 530–533.

18. Ханссон Н. Кормление сельскохозяйственных животных. Москва: Сельхозгиз, 1936. 124 с.

Information about the author:
Boroday I. S.,
Doctor of Historical Sciences, Professor,
Depute Director,
National Scientific Agricultural Library of NAAS
10, Heroiv Oborony St., Kyiv, 03127, Ukraine