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THE INTRODUCTION OF STATISTICAL RESEARCH BY PROVINCIAL AND DISTRICT ZEMSTVOS FOR AGRARIAN BRANCHES

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INTRODUCTION

The contemporary significance of the static methods for implementation and development of agrarian research and practice is the main reason for the necessity of studying the historical experience of their introduction in the general course of the history of agrarian science of Ukraine. The relevance of this topic is also due to the lack of learning interdisciplinary achievements of researches of agrarian theory and practice from the second half of the XIX century to the beginning of the XX century and the results of the research of provincial zemstvos that were using statistical methods for agricultural needs.

The study of agrarian branches by zemsky statisticians was an inseparable part of current achievements and relevant scientific research and was conditioning a cooperation with leading statisticians, soil scientists, agronomists, economists, and active participation in scientific events. Therefore, the purpose of the presented work is to study the results of provincial zemstvos that introduced statistical methods in research of agricultural practice on the area of modern Ukraine. The solution of this problem shows the main directions of research of provincial and district zemsky institutions, the results of which were having great importance for the development of agrarian science, identifies the role of research of zemstvo statisticians in addressing the needs of the national agricultural science and practice of the second half of the XIX century – the beginning of the XX century, objectively evaluates the contribution of statistical methodology to the development of agrarian science, and also fills in the gaps in the comprehensive coverage of the history of the formation and development of agricultural science in Ukraine.

The objects of the research are archival documents, zemsky statistical surveys and statistical descriptions of valuation and statistical departments,

materials from meetings of agricultural societies and other historical sources that reflect the research activity of zemsky authorities within the territory of modern Ukraine in the second half of the nineteenth century. – the first decades of the twentieth century, which is directly related to the use of statistical methods for the needs of the agrarian economy.

1. Preconditions for the Establishment of Zemstvos Statistical Institutions

The beginning of statistical work in the Imperial Russia was cured from 1837, when the governors were obliged to provide the Ministry of Internal Affairs with annual statistical and economic data on the state of the province collected by provincial and regional statistical committees, which were organized in 1835. The work of the statistical committees was initially regulated by the Statistical Department at the Ministry of Internal Affairs, and from 1875 – the Central Statistical Committee under the Ministry of the Interior. For the first decades, committee officials did not have knowledge about methods for collecting and processing statistical data but had many other duties. The intensification of the work of committees within the territory of modern Ukraine (as of 1853, there were Katerynoslavsky, Kyiv, Odesa, Poltava, Tavrichesky, Kharkiv, Chernigiv[1]) took place after their reform in 1859, when the members with relevant knowledge and experience were introduced into the committees. The updated committees developed statistical information for the governors' reports.

Gradually increased the number of performed state statistical work. Among the information that was served were data on the state of agriculture, industry, estates of the province. But information gathered locally county police departments, county councils, clergy, parishes, because they were often of poor quality. The main tasks of the provincial statistical committees were the work of streamlining and analyzing statistical information about the province.

In 1881, the Central Statistical Committee for the first time recorded the crop area for some crops and calculated the level of yield per unit area, which led to the emergence of new information about crops and crop yield. The gathering of information about the crop area lasted for two years,

[1] Елисеева И. И. История статистики. М. : Финансы и статистика, 1990. 296 с.

another year processed data and checked by comparison with the information of the land census in 1877. In spite of the slowness of these works, it was possible to organize statistics on yields from 1883. Since 1881, the crop statistics were collected by the Department of Agriculture and Rural Industry of the Ministry of Agriculture and State Property, but these materials concerned only crop yields in subordinate and private-ownership lands and were often not reliable.

Introduced "Regulations on provincial and district zemstvos institutions"[2] (1864), zemstvos as bodies of local self-government should deal with food for the population, economy, insurance, etc. The main source of funds for their activities was local taxes, which were collected on the basis of the value of the property and its profitability. Therefore, the zemstvos needed data on local farms, which the Central Statistical Committee did not receive.

Zemstvos began to form their own statistical organizations and to invite statisticians to process and analyze data which in the beginning were collected through correspondents. But the inadequacy of the information provided gave the statisticians the task of improving the collection of data. The need to provide accurate and reliable information for solving the issues studied by zemstvos led them to the formulation of the task of studying economic life, the state and prospects of the development of villages. In a short time, statistics were not limited to the definition of land yields, and data were collected seconded to the counties on questions from the research program.

Provincial and district zemstvos admitted that the level of development of the agrarian sector, as a leading, is of great importance for the further development of society, so the main focus in the studies of rural statisticians devoted precisely to agriculture. At that time, agricultural statistics had the following structural trends: land (territory, climate, soils, land tenure, land use, land prices), rural population (size, composition, etc.), agriculture and livestock farming (land, crops, equipment, processing, fertilization, crops, harvests, cattle), trade in agricultural products (prices, movement, etc.) [3].

[2] Ковальченко И. Д. Аграрный строй России второй половины XIX – начала XX в. / И. Д. Ковальченко ; Историко-филологическое отд. РАН. Комиссия по наследию акад. И. Д. Ковальченко. М. : РОССПЭН, 2004. 504 с.

[3] Фортунатов А. Сельскохозяйственная статистика Европейской России. М. : Типо-Литогр. Тов. И. Н. Кушнеров и К., 1893. 250 с.

2. Study of Soils by Zemsky Statisticians

The study of the soils of the provinces became the first task in the works of zemsky statisticians. Moreover, the study of soils was a component of valuation and statistical work, so they performed work on this task from the beginning of the activity of zemstvo statistical institutes to the liquidation of zemsky institutions. The main result of these studies was the maps of soils of counties and provinces.

The first such map was a map of soils of Novozybkivsk district of Chernihiv province, created by V.E. Varzer (1880). The map, according to a statistical research, reflected the diversity and complex distribution of soils in the county. It gave an opportunity to substantiate yields, explaining the obtained values of average crops, first of all, by the type of soils. Territorial distribution of the main types of soils V.E. Varzer led to four categories (black soil, gray earth, average earth, bad land, which had a division into two varieties) indicating that the position (mountain, bottom), ground, etc. can produce different effects on one type of soil.

As a result of studying the soils of the Borzny county of Chernihiv province, the statisticians have characteristics of soils regarding yield and moisture production. After the construction of different types of soils in the countryside, they indicated the villages in which dry or wet weather required for the best crops.

It was in the Chernihiv province that data on yield statistics began to be grouped according to the established soil strips and to show the average yield of soil varieties in the county. The idea of using grouping by type belonged to D.P. Zhuravsky. In his papers “About the sources and use of statistical information”[4] (1846) and “The Statistical Description of Kiev Province”[5] (1852), he built tables for a combination of two groups and used methods of statistical analysis.

Developing the ideas of D.P. Zhuravskii, statisticians of Chernihiv region widely used groupings from the first studies. In the description of Novozybkivsky county V.E. Warzer conducted a statistical study of soils for the first time based on a survey of the owners and certain territorial units. The results of such study allowed A.P. Shlykevich to make a map of the provinces of the province.

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[4] Журавский Д. П. Об источниках и употреблении статистических сведений. К. : Тип. И. Вильнера, 1846. 212 с.

[5] Елисеева И. И. История статистики. М. : Финансы и статистика, 1990. 296 с.

Although according to the statisticians A.S. Semyanovsky and A.P. Shlykevich, the classification of soils was imperfect (occurred in the review), the division into soil bands was of great importance for the weakening of the influence of chance on the general conclusion in the study of crops. The conclusion of the statisticians and their widespread use (in the form of data grouping for further research – the analysis of connections, allocation of type) substantiated the idea of typological grouping, which is widely used in modern researches of agrarian experimental data.

The statisticians of Chernihiv province represented aggregated tables containing the values of average yields drawn by the allocated digits, where the notes indicated the types of soils, crop rotation. Such tables were built on the basis of the division of counties on homogeneous soil bands by statistical study of soils and the grouping of yield data for established soil bands, by which the average yield of the soil varieties of the county was calculated. It was the basis for calculating the yields of each field, calculated according to the proportion of soil types.

Using the development of V.V. Dokuchaev, statisticians of Chernihiv province examined the grounds of the province and identified six main types of soils, got their characteristics and determined the territorial distribution, namely, the soil areas (for example, in Konotopsky district A.S. Semeanovsky and A.P. Shlykevych distinguished three soils regions). Results of research of soils of counties and division into subsoil areas allowed A.P. Shlykevich to make a soil map of the province in the late 1880's.

Too small landholdings in Chernigov region became the reason for the implementation of zemstvo statisticians detailed soil and geographical surveys of counties. After consultations with the leading statisticians of the country (M.F. Anensky, M.O. Kablukov, M.M. Kislyakov, V. Ostrovsky, O.V. Peshekhonov, F.A. Shcherbina) the decision about detailed soil studies in the province was approved by the provincial zemsto in 1902. The presence, since 1901, in the estimated-statistical bureau of Chernihiv provincial zemstvo the soil scientist-statistician (B.B. Polinov) allowed to perform such works. The result was the receipt of soil maps in a 1-verst measure – the first card was created by V.E. Varsar in 1903. Then soil maps were made in the 1-verst dimension of Nizhyn, Kozelets, Oster, Chernihiv, Sosnitsky, Horodnya, Borznensky districts.

The significance of the works of zemsky statisticians on the study of the soils of the provinces is partly highlights by V.A. Vergunov. He points out that the first textbook on soil science in Ukrainian language of A.G. Ternichenko (1919) was built on the results of zemstvo statistical studies. In the their study V.A. Vergunov also gives an estimation of the outstanding soil scientist G.G. Makhov, which states that the study of soils evaluatived-statistical bureau of Chernigiv provincial zemstvo in 1903–1911 was "most significant for the establishment of soil science in Ukraine"[6].

In Poltava region soil studies also became an important area of activity of zemsky statisticians in studying the province. According to the information received on the type of soils and other soil characteristics for a particular area, the statisticians performed the division into stripes and districts (for example, the Mirgorod district was divided into three lanes along the direction of the flow of the Psel and Khorol rivers, and, according to the general character of the terrain into four districts).

If at first the statisticians of this province received the characteristics of the soils in the counties on the ground map of European Russia, issued by the Department of Agriculture and Rural Industry, taking into account the features of the soils of the areas identified by the observations of local hosts, then a few years later they used the results of soil studies by local soil scientists. So, in Kremenchuk district, which had different quality soils and was divided by statisticians into four natural areas, they considered the soil characteristics given by V.V. Dokuchaev and M.I. Arandarenko. After the end of the study of the counties for obtaining soil characteristics under the guidance of V.V. Dokuchaev, provincial statistics showed that the type of soils had a "significant effect on the system of cultivation and change of bread"[7]. The statisticians of Poltava region have divided the province into 26 districts based on the natural characteristics of the areas, which included the soil. Due to this, they received the district map of the province (1900), which fully corresponded to the hypsometric and soil maps of the soil study of counties under the guidance of V.V. Dokuchaev.

[6] Вергунов В. А. Історя грунтознавства в Україні: проблеми і методологія шляхів вирішення. *Вісник Харківського національного грарного університету ім. В. В. Докучаєва*. 2006. № 7. С. 20–37.

[7] Сборник по хозяйственной статистике Полтавской губернии. Том X. Переяславский уезд. / под ред. Н. Кулябко-Корецького. Полтава : Типо-литогр. И. А. Дохмана, 1890. 286, 482 с.

The introduction of the division into types of soil areas by the statisticians of Katerynoslav province made it possible to study the size of the density of seeding of the main crops depending on the type of soil.

Zemsky statistics of Kharkiv region carried out the study of soils, considering the geological structure and the presence of soil moisture. Their work in Volchansky district allowed in 1882 statistician I. Klingen to study the movement of heat in the soil and its distribution by periods of the year. At the beginning of the XX century, the statisticians of Kharkiv provincial zemstvo also made classification of soils based on the physico-chemical characteristics provided by soil scientists. According to statistical surveys of the province, they divided the territory into three areas by the amount of precipitation (northwest, central, south-east) set up and have solved the problem of the smallest number of experimental fields for the province.

The statisticians of Kherson region also carried out studies on the establishment of types of soils (identified 7 types of areas in the province). Considering the importance for the province of the possibility of accumulation and preservation of moisture in the zone of aeration of plants, they studied the issue of soil moisture accumulation and soil yield (for example, performance of the analysis of the moisture content of different layers of soil depending on its cultivation and on weather conditions in the long-term experiments of the Kherson experimental field). In reviews from 1910 statisticians provided statistical data on the content of nitrogen, leachate, sulfuric and phosphoric acids for all seven types of terrain.

The statisticians of Tavria provincial zemstvo at the beginning of the XX century, according to the survey of the counties, also identified the ground areas. In Perekopsk district, they additionally conducted a soil study to allocate the ground area (Prisivasnaya I-a), which occupied the position between the loams of the central zone of the county and a strongly saline soils of the prysyvashna ground strip. In 1907 the statisticians of the province finished the creation of soil maps of counties on the basis of soil studies. Further works on the study of soils were as a supplement and amendments to previously obtained soil maps (for example, maps of Yevpatoriya district). Measurements and laboratory analyzes in these works were done by the soil scientist, and their results were statistically analyzed.

The statisticians of Podilsky provincial zemstvo in cooperation with the agronomist O.I. Naboki and soil scientists also engaged in the construction of a soil map of the province. From 1910, they statistically

processed a large amount of data from the laboratory study of collected samples to study the "morphological and physical and chemical properties of all types and subtypes of the soils"[8]. But military actions interrupted work, therefore the reduced version of research became the basis of the soil map of the province only in 1915.

The results of zemstvo statistician studies on the scientific research of soils indicate the high level of work, which was often recognized as a model, and turned into "bricks" for the further development of soil science and agronomy.

3. Zemstvo's Statistical Investigations in the Field of Agriculture

According to statistical descriptions of the provinces of the territory of modern Ukraine, the statisticians examined the land, the climate, cropping systems, crop yields. They studied the question of the correct determination of the value of yield, pointed to the need to obtain accurate soil and climatic data that affect the yield of land, etc. For example, P.P. Cervinsky, A.A. Rusov, V.E. Warzer was the first to develop a method for calculating average crop yields in the description of Borzny district (1877). Such a technique has not existed and their method has been widely used in other provinces. The statisticians of Chernigiv provincial zemstvo began to study the size of the crop and its quality, depending on the types of soils. They have developed a method for extracting the average yield for areas from the data of the distribution of soil varieties and their crop yields and introduced it in the review of Kozelets county. In this review, introduced consideration of variations in the values of crops for the main crops. They showed the impossibility of using the term of "natural yield"[9], which was widespread at that time, but have led to the use of the concept of crop yield.

Using the achievements of the statisticians of Chernigiv region, the statisticians of Tavria provincial zemstvo calculated the average yield and its fluctuations for the main crops in the counties for the years 1881–1888. They found that the average yield of all breads decreased in the direction from east to west in the mainland and from south to north in Crimea by

[8] Материалы по исследованию почв и грунтов Подольской губернии. Том 1. Результаты полевых и лабораторных изысканий 1914 и 1915 г.г. / Под ред. Проф. Набоких А. И. Одесса : Типогр. Акционерного Южно-Русского Об-ва Печатного Дела, 1916. 268 с.

[9] Материалы для оценки земельных угодий, собранные Черниговским статистическим отделением при губернской земской управе. Том V. Козелецкий уезд. Чернигов: Губернская типогр., 1882. 75, 101 с.

distribution of soil types and moisture. They performed a study to find out whether or not conditions were favorable for the production of hay, winter and spring breads for 19 years (1867–1885). According to the results of this study, the classification of yield levels was presented. Calculating the average yield of winter wheat and analyzing the dynamics of its change allowed them to conclude that "improvement of soil cultivation"[10] in the province.

According to the studies of grain yield statisticians of Kharkiv province found that the crop declined from northwest to south-east and reached a difference of 140%. They explained this by a large difference in soil and climatic conditions and proposed to use normal average yields in the counties to obtain the characteristics of the crop in the province for the year.

The statisticians of provincial zemstvos from the end of the XIX century constantly studied the impact on soil yield, climatic and weather conditions, the time of the beginning and the end of sowing and harvesting of different kinds of crops, and also how these terms change depending on the weather. For example, in the description of Volchansky district (1882), the statisticians studied the climate characteristics of the district (for which the long-term temperature measurements, winds, sizes and rainfall distribution throughout the year, climatic characteristics were used), and the movement of heat in the soil, its distribution for periods of the year. This allowed them to study the dependence of the time of maturation of bread crops from soil and topographical conditions, the amount of heat and moisture, the time of sowing. Subsequently, for the study of weather effects on crops, statisticians of Kherson province used numerical data from Odesa and Mykolaiv meteorological observatories, calculated the temperature and precipitation values averaged over the month, the monthly maximum and minimum, the average for the seasons and the average annual, and the first submitted the scientific characteristics of the climate of the province. At the beginning of the XX century, all agricultural reviews of zemstvos began with a detailed description of the state of the weather. The statisticians counted the average temperature, precipitation, and estimated the weather for agriculture this year. Data about temperature and precipitation began to be supplied by measurements of meteorological and rainwater stations, special observation points. For

[10] Сельско-хозяйственный обзор Таврической губернии за десятилетие 1899–1908 г.г. Симферополь : Типогр. Таврического Губернского Земства, 1911. 167 с.

example, in Yelisavetgrad county in the description of 1911, there were data from two meteorological stations and 17 observation points, and in 1912 the data was processed according to the data of 4 meteorological stations of the county and 26 observation points. The data on average temperatures and precipitation for Kherson province statisticians were taken from the data of 13 stations of the main physical observatory and many rain-storied stations. The zemsky statisticians of Tavria province calculated the average temperature for months, seasons according to data from 12 meteorological stations (in 1889 they had data for the period from 4 to 52 years).

On the basis of the statistics introduced by the statisticians the concept of the normal value of the indicator and statistically obtained normal values of weather factors, the statisticians of Kherson province began to analyze deviations from the norm of indicators, fluctuations of temperatures and precipitation, measurements of freezing of the soil. The large uneven precipitation in the province for seasons and their character, which were discovered, contributed to the study of the influence of rainfall on the value of crops of different cultures, considering other weather factors. The statisticians of Tavria province in their works analyzed the average temperature by months, seasons for comparison of the provinces. Taking into account the climatic specifics of the province in the data about the precipitation, they gave information about the time and amount of precipitation. They submitted distributions of average values of precipitation for months and seasons, measured at 8 locations in the county. The obtained statistical distributions allowed to prove that the amount of annual precipitation in the province was "sufficient for agriculture"[11], but the precipitation was distributed very unevenly, which had a very negative consequence for the harvest. The statisticians carried out an analysis of data relating to seeding of winter, spring cereals, by district, county, province. They calculated the average time of sowing crops for a rather long period (for example, 9, 12 and other years). By analogous method, they performed a statistical analysis of conditions for growing crops, harvesting. From the 1890's, statisticians of Kherson province studied fluctuations in yields in counties and isolated areas based on developed techniques. This allowed them to prove that the climate

[11] Сельско-хозяйственный обзор Черниговской губернии за 1913 г. Год 10-й. Чернигов : Типогр. Губернского Земства, 1915. 74, 239 с.

conditions have an impact on the results of agricultural activity, and statistician B.Yu. Troyanovsky, after receiving data from 13 meteorological stations in Odesa region, the average, maximum, minimum values of temperature and precipitation (in months and years) and their comparison with the data of long-term observations, justify the presence of droughts. Using of statistical methods and groupings developed by statisticians of Chernihiv and Poltava allowed the statisticians of Katerinoslav province to introduce the division of counties into climatic layers. The obtained division corresponded to a significant difference in the time of the implementation of the same field work in different layers (the difference was up to 7-8 days).

The results of statistical research of the territories of Kyiv region, Volyn and Podillya at the turn of the XX century, namely the distribution of agricultural area of the South-Western region of the country for lands, allowed statisticians T.I. Osadchy to propose the division of territory into areas on economic grounds. The division was used by zemstvo statistical institutions of the respective provinces, established in the early XX century, and, like division into districts made by other provinces, was necessary for the regionalization of Russian Empire.

As for the study of the productivity of the statisticians of zemstvos in the first decades of its activities formulated and used the concept of "natural productivity of land". Thus, the statisticians of Chernihiv zemstvo under the yield of land designated understood “the average yield of rye or spring crops on the tithing of the average quality for the whole dacha, in the amount that most often was on average for the last 3, 6 or 12 years”[12]. Information on the average crop was taken in the presence of numerous, different sources of receipt of data indicated for the average degree of culture, for the average or well-known for the quality of the soil type and the average year for climatic and soil conditions, or were the result of a general reflection about the average yield for the last decade. From the beginning of the 1880s, according to these data, they began to study the influence of the sowing density per yield of the crop.

Accumulation of information about harvests of the main crops from 1883 allowed statisticians to consider the task of assigning average yields of crops and average crop yields. As a result of processing and analysis of

[12] Материалы для оценки земельных угодий, собранные экспедиционным способом по программе бывшего Статистического Отделения при Черниговской Земской Управе. Новозыбковский уезд. Чернигов : Губернская типогр., 1880. 62, 79 с.

a large amount of data, they obtained average yields for different types of farms for counties and provinces. Technical difficulties in determining the average yield of land were in the southern provinces, where often occurred droughts. Thus, the statisticians of Kherson region indicated that for the determination of the average yield of the land we need to have observations and exact records of "not less than 10 years for all the breads"[13], grown in different parts of the county. Subsequently, they proved that for the province this period should be increased. With the accumulation of data on the yield the statisticians began to make a comparison of the current harvest of the main bread with the harvest over a long period of time (for example, 23 years in 1909, 25 years in 1911, etc.) for the analysis of the level of the main cereals crop and farming culture.

In the early 1880s, statisticians of Chernihiv region in the study of crop rotation on the basis of taking the grouping by degrees started zoning crops. Thus, in the study of Kozelets district, they received the distribution of the main spring crops, which became the basis for the zoning of crops.

The constant use of grouping in zemstvo statistical studies has become the basis for the introduction of consolidated tables for the analysis of various agricultural tasks. If initially, with their help, they only analyzed the yield of rye and wheat in different types of farms, counties, then, in the early XX century, the statisticians compiled tables with data about the size and quality of the main bread crops per year, depending on the soil groups and districts divided into provinces and counties for all types of farms. From these tables it was possible to see which parts of the province or areas are very different in terms of yield, and to analyze what factors have affected the outcome.

Showing the difference in the levels of yields statisticians of Poltava and Kherson provinces proved that the reasons for this are: carefulness, timeliness of cultivation, better seed and varieties of crops, the influence of precursors of sowing. It was these reasons that they considered as the main ones in terms of equality of soil conditions and precipitation. The most important of the effects on the harvest recognized the precipitation, namely humidity of the soil (the method of cultivating the field affects the preservation of moisture in the field). Showing by means of statistical studies that the accumulation and conservation of moisture by appropriate

[13] Материалы для оценки земель Херсонской губернии. Т. 6. Херсонский уезд (статистико-экономическое описание уезда) / Сост. Стат. Отд. при Херсон. Губ. Зем. Управе. Херсон : Тип. О. Д. Ходушиной, 1890. XVIII, 458, 134 с.

soil treatment is essential for plants, statistics of Kherson province in the early XX century investigated the possibilities of its accumulation in the soil layers.

The study of crop rotation during the investigation in Konotopsky district allowed the statisticians to obtain the main crop rotation and, based on their analysis, to come to the conclusion: "the lack of normal steam cultivation and large land depletion"[14] is the reason for the land contamination and much less harvests. Similar conclusions were obtained from statisticians of Poltava province.

The statistics studied the distribution of the sown area of landowners and peasants by major cultures in the counties of the provinces and the selected areas. Performing the analysis of the revealed distributions, they received their compliance with the soil and climatic conditions of various parts of the province.

In the study of the proportions of crops of statisticians of Poltava province showed the certainty of the division of cultivated area used by the system of agriculture. Subsequently, the statisticians of Tavria province showed that the distribution of the sown area by crops strongly characterizes the general direction of the economy, the replacement of one culture with another indicates the transition from one system of arable land to another. The division into four districts of the territory of the province, which was conducted on geographical grounds, also discovered the patterns in the received proportions of crops (for example, due to weather differences).

In the study of farming systems, statisticians examined the introduction of crop rotations for various types of land tenure. They proposed different schemes for crop rotation based on statistical study of land exploitation methods. The statisticians of Kherson province discovered: climatic and soil conditions influenced the turnover of fields; lengthening the processing period contributed to the introduction into the system of crop rotation of potatoes and corn.

The statisticians of Poltava province studied the main places of cultures in relation to their predecessors. They showed that the natural conditions (presence of saline soils, sandy places) affect the field crop management and the change of bread crops. According to the results of statistical research of farming systems, they showed the possibility of

[14] Материалы для оценки земельных угодий, собранные Черниговским статистическим отделением при губернской земской управе. Том VI. Конотопский уезд. Чернигов : Земская типогр., 1882. 62, 93 с.

obtaining a pre-calculated crop rotation, and the methodology developed by them had a wide introduction in branch scientific works. The statisticians in the annual agricultural surveys considered the main types of bread crops, provided their general characteristics, advantages, disadvantages. The statisticians of Kherson province introduced an analysis of varieties of main bread crops. For the first time, the analysis was carried out for several varieties of main bread crops grown in 1897–1898. As a result, it was discovered that the variety of spring wheat "ulka"[15] was increasingly distributed, which proved to be more productive. In the 1910s, statisticians of Kherson region already covered many varieties of rye, spring and winter wheat, oats.

In studying the methods of cultivating land for main crops, the statisticians conducted the division into groups regarding the methods of cultivating the land for winter and spring crops, depending on the properties of the soil in localities (for example, the presence of viscous soil) and the agricultural tools used.

From the end of the XIX century, the statisticians explored the technical aspects of farming: the use of tools to perform various operations in the process of growing crops, taking into account the soil conditions (preparation of arable land for sowing) the action of plowing plow species, harrows and the like; dates of agricultural work for various grain crops. Thus, the statisticians of Kherson province showed that a great unevenness of the crop was not only due to the lack of sufficient and timely rainfall, but also from the cultivation of soil and crop rotation. Based on studies of arable land, analysis of crops, the rural economic system, statisticians of Poltava region, and subsequently other provinces, concluded that "trial field system is not effective for the population"[16], it is necessary to move to more intensive farming systems.

The statisticians of Kherson province revealed that without using manure and fixed crop rotation, the owners focused on soil cultivation and selection of the field. This led to their study at the end of the nineteenth century. methods of cultivating and using lands, studies of the dependence of grain yield for various types of fields and methods of cultivation, allowed to prove the importance of a thorough tillage.

[15] Статистико-экономический обзор Херсонской губернии за 1898 год. Херсон : Паровая Типо-литогр. О. Д. Ходушиной, 1900. 300 с.

[16] Дувин С. Гадячское районное опытное поле. *Полтавские агрономические известия*. 10 авг. 1913 г. Полтава: Типо-Литография И. Л. Фришберга, 1913. С. 16.

The statisticians of Poltava Zemstvo on the information about grain yields proved the advantage of plowing the land. They showed that the crop yields for the use of the wooden plow was kept at an average height, not even in the best years of such size as when using a plow. They are studying for plowing, processing of the land, plowing depths by plow. In the description of Lokhvytsky county, they showed the connection between the use of advanced and complex agricultural machines with the achievement of higher yields of crops. In the description of Lokhvytsky county, was showed the connection between the using of advanced and complex agricultural machines with the achievement of higher yields of crops.

The gathering of data for county inspections about the presence of fertilization fields at the beginning of the XX century turned into a study of the influence of fertilizer on the yield of crops, and the statisticians of Chernihiv and Poltava provinces set the task of studying the influence of soil conditions for fertilizin. The statisticians of Katerinoslav province investigated the effect of precipitation on fertilizer results, the dynamics of fertilizer action, types of fertilizer.

The work of statisticians was also important for the implementation of collective experiments of zemstvos. For example, statisticians of Kharkiv province in the collective experiments analyzed data on the study of the effect of mineral fertilizers under different conditions (weather, soil) and in the initial tests of varieties.

During the years of the work of statistical Zemstvo institutions the programs, methods of data collection and processing were continuously improved, which allowed to consider more difficult questions. If in the first decade of their work achievements were the introduction of groupings, consolidated tables, then subsequently offered a methodology for calculating average yields of crops, and in the early XX century statisticians began processing and analyzing the data of collective experiments, experiments of agricultural societies, where they studied the task of rational organization of agriculture, contributed to the development of the methodology of agricultural research. The statisticians showed that the amount of fertilizer, the degree of suitability of the means of labor, the method of farming are significantly different in different farms, but in each locality we can establish a typical farming system, the average amount of fertilizer, the average suitability of the funds. Accordingly, income, defined by the average (normal) value of all

the impacts, they called the “average income”[17]. The statistics of the Chernihiv province showed that the average income varies quite slowly, therefore the value determined by the survey may be its norm during a certain period. They developed methods for calculating gross profitability of arable land and proved that without data on local farming systems and crop rotation, without the information on the local systems of agriculture and crop rotation, without the data on the proportion of crops, fertilizers can not determine the gross profitability of arable land, and without information about the technique of cultivation can not count the cost of cultivation.

We can see high scientific level of statistical research of zemstvos in an attempt to organize farms with a predetermined level of economic productivity in Poltava province. This task solved in cooperation with the Poltava Agricultural Society, which developed the organization of the estate for the estate in order to obtain the highest permanent income. As a result of the estimated economic assessments of various branches of agriculture, the statisticians concluded that farms needed a reorganization. It should consist in the fact that “feed will be produced in the fields”[18]. This will expand plowing for bread crops and at the same time increase the number of productive livestock. As a result, in conditions of rising rents and an increase in the population, it will be profitable to introduce a more intensive system, which requires intensive soil exploitation, but will give high payments on invested capital and labor. In coopperation with the Poltava Agricultural Society, statisticians also showed the obtaining pre-calculated crop rotations.

Statistics of Kharkiv province collected data on the results of the use in 1908 of the rolling seven-rowed sowing machines of 13 agricultural societies of the province, according to the processed data, proved that there was a saving on the use of ordinary crops, which was reflected in saving the seeds and obtaining higher yields. Their confirmation of a significant increase in yield when using the seeder (for a large amount of statistical data) allowed to scientifically finalize the issue of the advantage of ordinary seeding and was of great importance for its introduction into use.

[17] Червинский П. П. Земледельческая программа, приспособленная к собиранию сведений для оценки земледельческих угодий. Чернигов : Тип. губернского земства, 1881. Вып. 1–4. 26 с.

[18] Дувин С. Гадячское районное опытное поле. *Полтавские агрономические известия.* 10 авг. 1913 г. Полтава: Типо-Литография И. Л. Фришберга, 1913. С. 16.

CONCLUSIONS

The main achievements, which had an impressive impact on the future development of agrarian science, are shown as a result of analysis of statistical research made by zemsky staticticians for agricultural branches. In the direction of studying the soils staticticians received the first maps of the soils of counties and provinces. For densely populated areas like Chernihiv province the maps were 1-verst measurement. These maps had a high importance for practical and research agricultural activity in the first decades of XX century, especially for soil science.

In agricultural task's analysis zemsky statisticians studied actual issues: the definition of the magnitude of land productivity; the effect of soil types on the level of crop and its quality; obtaining characteristics of climatic and weather conditions; the study of systems of arable land, crop rotation, varieties of sown bread, methods of cultivating land for main crops, the impact on fertilization on yields of crops, the search for ways to restore the fertility of lands; etc. As a result of these studies, statisticians offered a method for determining the value of crop yields that was widely used in agrarian science and practice. They set up and began to study the important task for science: how to determine the dependence of yields and its quality on the types of soils. They introduced the concept of normal average yields solving this problem.

The achievements of zemsky statisticians were important for the development of agricultural science in representing the characteristics of the climate, the zoning of the crops, as well as recommendations for the transition from a trial field system to more intensive systems of arable farming. Statisticians proved that the system of arable land and bread change is influenced by natural and soil conditions, showed the possibility of obtaining a pre-calculated crop rotation and proposed sound crop rotation schemes.

Zemsky statisticians began to study and to analyze varieties of basic breads and methods of cultivating land for them, a complete sequence of operations and technical aspects of cultivation of bread taking into account the soil conditions and using the statistical data. Studying the ways of fertilizing the fields became a statistical investigation of the impact of fertilizer on the yield of crops.

Statisticians made a zoning of territories, which was important for the future construction of approaches to regional management of agriculture,

according to natural and economic conditions as a result of statistical and economic study of various types of farms. The statisticians proved that the crops are the general result of action: land, labor, livestock, working capital, etc. It was proved that it is impossible to determine the gross yield of arable land without information about the systems of arable farming and crop rotation, the proportions of crops, fertilizers and it is also impossible to calculate the costs of cultivation without data on the technique of arable farming, methods and techniques of culture. Their methods of calculating the yields for different systems of the economy and the selected areas allowed them to implement a comparative analysis of the yield of crops and the study of the economic feasibility of crop rotation and profitability of cultivated varieties.

SUMMARY

It is presented an analysis of agricultural research from the second half of the XIX century to the beginning of the XX century by the statisticians of the provincial and counties zemstvos on the territory of modern Ukraine. Different directions of statistical work of zemsky statisticians are considered and their main achievements, which had a significant influence on the further development of various branches of agrarian science, were shown. Moreover, a significant role of the achievements of zemsky statisticians in solving actual scientific problems of the national agricultural science and practice of the designated period are shown, the contribution of the statistical methodology to the development of soil science, agronomy, agriculture and agricultural research are evaluated.

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