

ASSESSMENT OF POTATO GROWING POTENTIAL IN UKRAINE DUE TO ZONAL SPECIALIZATION AND RAW MATERIAL SOURCES

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Abstract

The paper studied the assessment of potato growing potential on organizational and economic bases in Ukraine. The materials presented according to specificity of production rates and conditions from 1940 to 2018. On the basis of the gross potato production indicator in Ukraine for 78 years (from 1940 till the current state), indicators and tendencies of potato growing development are determined. From the standpoint of potential vectors of zonal specialization (ZSP) and standardized raw materials sources (RMS) such realization was investigated. The survey has found, that the main principles of end-to-end coordination in potato growing industry of Ukraine depend on agricultural enterprises and farms input in the short and medium term and on households in the long term perspectives. The data showed that the technologies involved in potato growing still need systemic improvement and development towards convergent ones with the level of realization of the genetic potential of productivity for more than 70%.

Key words: potato growing, production, productivity, assessment, sources.

INTRODUCTION

Potato production and marketing in Ukraine are unique because, despite annual yields and consumption rates, the market prices of potatoes fluctuate significantly during the season and from year to year.

Cropping seasons and harvesting times may differ by several months between the south and north regions of Ukraine. Fresh table potatoes can easily outprice storage table potatoes as twice on the market. Such tendencies also exist in many European countries involved in the potato growing industry [11]. That is why the system of innovative transformations of the agro-industrial complex of Ukraine, as the potato growing industry is in need to be improved and highlighted with a perspective of further development. In current market conditions,

the effective functioning of potato growing potential acts as a component of crop production and raw material basis for food, feed, and processing industries [4, 16]. Within the implementation framework of the innovative development model for the agricultural sector, the importance of the analytical, forecast, and logistic vectors is significantly increasing [17].

As of 2017, apart from Ukraine, only four countries produced more than 20 million tons of potatoes annually, namely Russia, America, China, and India. However, among the productive countries of this agricultural crop, only a few other countries are determined with exports of more than 1.5 million tons per year, such as France, Germany, and the Netherlands [9].

Among the main negative factors that hinder the development of the product market - small

volumes of production in private farms, diversity of varietal composition, and different quality indicators of products grown. Simultaneously, with the industry's technological backwardness and the lack of modern facilities for collecting, storage, transportation, and processing manufactured products.

On the other side, the positive dynamics are characterized by an increase in the area under organic potato production. Already in 2015, the area under organic production of this crop was 1,200 hectares, maintaining the trend of further growth. Thus, in terms of the number of areas under organic potato production, Ukraine is in the world's top ten countries.

In spite, of need to develop environmentally sound fertilizer systems for crops, with an accent on the quality of products, environmental protection, with maximum use of natural factors. Integrated application of organic fertilizers (both traditional and manufactured) is also in process in such fertilizer systems of new technologies) and microbiological preparations [13].

Among the other positive signs of growth in the potato production market in Ukraine is the increase in the number of potato varieties from 37 to 150 (more than 4 times from 1991 to 2018), while the share of domestic varieties has increased from 22 to 72 [20].

Given the fact that potato is actively integrated into the system of nutrition, feed production, and processing, it becomes clear its potential compliance with the levels of development of raw material sources (RMS) [7].

At the same time, the presence of sufficiently formed potato growing zones and processing facilities is the basis for a dynamic growth of deep processing products. Also, retrospective monitoring and economic indicators of potato growing indicate the need for systematic work with zonal specialization, local technologies, and logistics system on the one hand and methodological and analytical support of the potato industry on the other [2].

Yet, there is a strong need for appropriate monitoring of the nature of such growing production and areas of use to justify and identify effective management decisions.

In the system of innovative development model for Ukrainian agribusiness, the dynamics of processes of transition from production at the expense of resource of sown areas and outdated technologies to zonal specialization and a role of crops as objects of transfer at the level of standardized raw materials noticeably increases in time [8].

The potato growing industry can reasonably be considered as a representative model object for the study of market transformations in crop production in Ukraine. It is the levels of diversification and integration that determine the need to assess potatoes as a standardized raw material resource (RMS) [15, 7].

Advanced science and high technology are an integral part of a competitive economy in modern conditions. The deformed structure of lands is characteristic of modern crop production in Ukraine [6].

The plowing rate of agricultural land is 0.778, and the use of arable land 0.852 [12]. During 2007-2016, there was an increase in the area of sunflower by 68.5% and a decrease in the area of potatoes by 9.7% (with an increase in production by 7%) [19].

Characteristic features of the development of domestic crop production are the use of high-cost energy-intensive technologies, technically and technologically obsolete equipment, inefficient forms of management [17, 18].

The development of the agricultural sector of the Ukrainian economy at a competitive level is possible only on the basis of an effective combination of all elements of innovation [3, 7, 14]. Legislatively, such relations are regulated by the Laws of Ukraine "On Innovation" and "On state regulation of activities in the field of technology transfer".

Potatoes as a raw material per unit area provide 1.5-2 times more carbohydrates than grains and are a crop that actively accumulates energy. In this regard, there is an insufficient in some aspects theoretical and practical justification of organizational and economical ways to increase the economic efficiency of potato production, taking into account the regional characteristics of the industry [21].

RESULTS AND DISCUSSIONS

Simultaneously, if an increase in gross production characterized the 74-year period of 1945-1978 as a whole, the period of 1980-2011 was characterized by reduced production relative to the average long-term.

From 2012, gross potato production began to grow and show the dynamics typical of the period 1945-1978. This can be explained by different types of economies and positions of potatoes in the consumer and raw material segments before and after Ukraine gained independence in 1991.

Also, if in the first case, the factors of sown areas and state regulation mainly worked, in the second case, organizational, market, and technological factors began to intensify. And it is in the second option that the directions of diversification and in-depth processing of potatoes intensified, especially in the areas of obtaining native and modified starches and greater approximation of the quality of raw materials to the requirements of processing technologies.

In turn, the above is of practical importance for the optimization of logistics systems of zonal specialization by type of raw material processing zones on the one hand and the effective use of zonal agro-climatic conditions as specific factors in implementing a set of existing competitive advantages, on the other. At the same time, from the standpoint of sustainable production, there is a systematic need for integrated technological solutions. Which, in turn, increases the relevance of methodological support of the transfer process. The significant changes that have taken place in the consumer sphere for potatoes, the destruction of economic ties, political processes, and global climate and political and economic transformations necessitate a systematic approach when considering potato culture as an object of transfer in barter tradings. Notably, as an object of transfer in several positions at the USSR level, potatoes lose to cereals. Therefore, to ensure the functioning of potato growing at a practical level, the formation vectors of specialized agro-processing clusters

and technologies on a modular basis may have increased relevance.

Examples include the "Comprehensive program of innovative development of the crop industry of Kharkiv region in the period up to 2025" and the formation of a system of agricultural holdings focused on foreign markets. All this should be taken into account and practically used to form and provide appropriate innovation-oriented educational and research programs.

Simultaneously, such an approach quite reasonably allows in the medium term to approach the transformation of higher education institutions (HEIs) into consulting and information-analytical centers for the transfer of integrated technological solutions close to convergent.

The distribution of years with gross potato production above and below the long-term average for 74 accounting years was 56.7:43.3, or in the formalized model form 60:40 (3:2). That is, there is reason to talk about the rather variable nature of agro-climatic conditions on the one hand and the insufficient level of zonal specialization and efficiency of the technologies involved on the other.

According to the average indicators of gross potato production for 74 accounting years (1940-2018), the deviations in the gradations of maximum (max) and minimum production to the average level were 16.2 and 21.0%, respectively, or in the formalized model form is close to 40:60% (2:3).

This can also be seen as a manifestation of the rather variable nature of agro-climatic conditions on the one hand and the insufficient level of zonal specialization and efficiency of the technologies involved on the other.

A more detailed block analysis of the nature of potato production for 74 years of monitoring (1945-2018) identifies 6 complete 10 annual blocks and 2 incomplete (5 annual - 1940-1949 and 9 annual - 2010-2018) (Table 1). (calculated on the basis of the State Statistics Committee of Ukraine [18])

Table 1. Potato production rates for 74 years of monitoring (1945-2018)

№	Periods	Number of years	Levels of gross production, mln.t						Number of years for the period with production	
			(\bar{x})		The scope of variability				above the average	below the average
			Average for group $(\bar{x} \pm s_x)$ mln.t	Variation coefficient $(V \pm s_v)$ %	max		min			
mln.t	% to \bar{x}	mln.t	-% to \bar{x}	above the average	below the average					
1	1940-1949	5	18.80±1.66	19.73±6.48	22.26	18.40	13.77	26.80	3	2
2	1950-1959	10	18.67±0.98	16.57±3.81	23.13	23.90	14.68	21.40	4	6
3	1960-1969	10	19.35±0.62	10.09±2.28	22.49	16.20	16.45	15.00	5	5
4	1970-1979	10	21.44±0.78	11.43±2.59	23.92	11.60	16.47	23.20	6	4
5	1980-1989	10	18.63±0.92	15.59±3.57	21.41	14.90	13.13	29.60	8	2
6	1990-1999	10	16.66±0.82	15.58±3.57	21.01	26.10	12.72	23.70	5	5
7	2000-2009	10	19.03±0.39	6.49±1.46	20.76	9.10	16.62	12.70	7	3
8	2010-2018	9	22.16±0.55	7.46±1.77	24.25	9.43	18.71	15.60	6	3
	Total	74	-	-	-	-	-	-	44	30
	Average		19.34	-	22.40	16.20	15.32	21.00	59.46%	40.54%

Source: authors calculations.

Also, it should be noted that deviations from the average level of potato production were higher in the minimum output gradation (min - 21.0%) against the maximum output gradation.

(max -16.2%). What can be considered as increased actualization of the stable nature of potato production at a reasonable level due to both regulatory market and technological factors in optimal zones selection and the transition to the level of standardized raw materials (SSR).

It is significant that this approach coincides with the main directions of innovative transformations in the crop sector and highlights the increased role of end-to-end coordination.

A more detailed analysis showed that in general, the nature of the maximum (max) and minimum levels of gross potato production in Ukraine relative to the average during 74 years of monitoring was typical and reflected the trends inherent in the potato industry of Ukraine. Starting from the period 2000-2009, the average and maximum levels were closer

than in other periods, which determines the relevance and strategic nature of the system analysis at the factor level (Fig. 1).

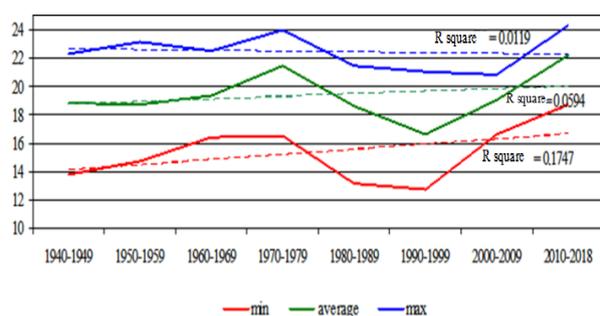


Fig. 1. Dynamics of gross potato production in Ukraine at the maximum (max), minimum (min) and average levels, 1945-2018, million tons (to Table 1).

Source: authors calculations.

During the monitoring period, the gross production of potatoes at the minimum and average levels showed an upward trend, and at the maximum (max) - a decrease, but the accuracy of the approximation (R square = 0.0119, 0.0594, 0.1747) on the short term was too low. On the one hand, the beginning of the launch of improving the efficiency of the technologies involved and spontaneous

market-driven optimization of production areas and increasing the realization of genetic productivity potential (RGPP) in the medium term on the other.

The block analysis of the dynamics of gross potato production by the coefficient of variation

(V% - point method) for the monitoring period of 1940-2018 looks quite indicative in this respect (Fig. 2).

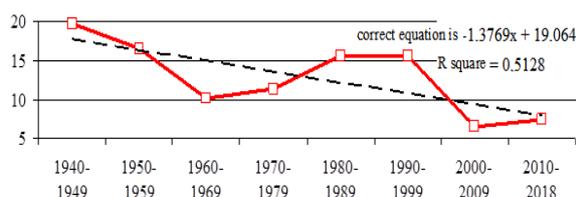


Fig. 2. Block analysis of the dynamics of gross potato production by the coefficient of variation (V%), 1940-2018 (to Table 1).

Source: authors calculations.

The coefficient of variation of the gross potato production in Ukraine during the monitoring period showed sufficient stability (variability $V = 6.49-19.73\%$), which can be explained by the predominant localization of production in the household sector and rapid response to consumer demands. According to the trend of decreasing coefficient of variation of gross

production (V%) and accuracy of approximation ($R^2 = 0.5128$) in the near future, the question of activation of vectors of zonal specialization, standardized raw materials, and integrated technological solutions can be considered justified. Simultaneously, the gross production of potatoes in the short term in the medium term should be progressively ensured by the yield factor.

Notably that in market conditions from the standpoint of processing problematic issues remain the optimal ratio between the table and technical (highly starchy > 19%) varieties on the one hand and quite problematic logistics of a reliable raw material base (SSR type) on the other. Significant prospects in this regard can be traced in the formation of specialized agro-processing clusters and land reform in the declared system of innovative development of the agricultural sector of Ukraine.

For a clearer understanding of the motivation at development trend of potato growing in Ukraine, an analysis of the main positions of the balance of potatoes for 2014-2018 was conducted (Table 2) State Statistics Committee of Ukraine [18]).

Table 2. Rates of the main positions of the balance of potatoes for 2014-2018

№												
	2014		2015		2016		2017		2018		Average	
	mln.t	%	mln.t	%								
1	23.69	100	20.84	100	21.75	100	22.21	100	22.50	100	22.20	100
2	0.040	0.17	0.017	0.08	0.027	0.12	0.024	0.1	0.028	0.12	0.027	0.12
3	0.017	0.07	0.015	0.07	0.005	0.02	0.018	0.08	0.022	0.09	0.015	0.07
4	5.60	23.6	5.42	25.9	5.49	25.2	5.57	25.0	5.57	24.8	5.53	24.9
5	6.97	29.4	6.54	31.4	6.77	31.1	6.82	30.7	6.91	30.7	6.80	30.6
6	3.82	16.1	3.80	18.2	3.17	14.6	3.36	15.1	3.80	16.9	3.59	16.2

Source: State Statistics Committee of Ukraine and author's calculations.

From the standpoint of segmentation and to establish the dynamics and trends, the assessment was conducted in relative terms to the level of production (Fig. 3 and 4).

According to statistics, Ukraine has produced 523 kg of potatoes per capita in recent years, with an average consumption of 140.2 kg.

That is, the share of consumption reaches 26.8%. On average, the leading segments in the balance of potatoes are: the use for feed purposes - 30.6% of the level of production; for planting - 24.9% and for processing - 16.2%.

It is also necessary to allocate a much larger

share of imports (0.12%) compared to exports (0.07%), which indicates the increased relevance of selection and seed production patterns, young and exotic potatoes, and products of in-depth processing. Given the traditions and system of domestic consumption of potatoes in Ukraine and, in particular, the potential to enter foreign markets (system of external consumption), the domestic potato industry should quickly develop strategic areas of methodological support for innovative development; selection of genetic and technological directions based on end-to-end coordination, standardized raw material resources (SSR) and transfer of integrated technologies close to convergent ones. In the field of agricultural production, the priority is zonal specialization, state regulation, integration and diversification into other areas.

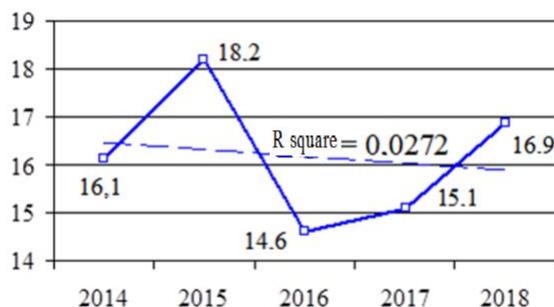


Fig. 3. The ratio between the share of potatoes for processing and production capacity, %
 Source: authors calculations.

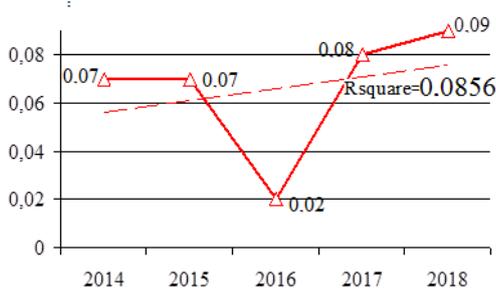


Fig. 4. The ratio between the share of potatoes for export and production capacity, %
 Source: authors calculations.

Marker positions include: yield to the level of break-even potatoes (yield ≥ 3.0 t/ha); increasing the segment of in-depth processing; formation of specialized agro-processing clusters; formation of a system of analytical-forecasting and consulting centers of transfer.

At the same time, the prospects for concentrating efforts in the areas of increased economic efficiency and intellectualization also look quite expected. The analysis of economic indicators did not take into account the implementation on the level of some farms and agriculture enterprises technological features to combat erosion to increase the yields of vegetable or other crops [5]. These features may also include not only the selection of tillage, but also the integrated use of seeds, organic fertilizers and microbiological preparations in modern agricultural technologies [1, 10]. From this point of view, speaking of potato growing as an industry, all the main emphasis should be concentrated on the principles of end-to-end coordination due to zonal specialisation and available raw resources in regions. This in turn necessitates a change of point of view from ordinary local managerial agriculture administration to corresponding departments in government and state authorities.

CONCLUSIONS

At present, in the potato industry of Ukraine we can talk about the beginning of market-based zonal specialization, which only fragmentarily corresponds to the principles of end-to-end coordination. In the area of standardized raw material resources in the short and medium term, the focus on "agricultural enterprises" and "farms" is more effective, and in the long run on "households". In such conditions, on our opinion, potato production in the categories of "agricultural enterprises" and "farms" can be stabilized and increased only by the yield factors.

That fact systematically identifies state of things as the leading trends of the medium term development of holistic technological solutions. However, the technologies involved in potato growing still need systemic improvement and development towards convergent ones with the level of realization of the genetic potential of productivity $\geq 70\%$. In the present situation, systemic development of potato growing as an industry very much in need of a methodological and analytical-forecast support in the system of end-to-end

coordination between zonal production specialisation and available raw resources characterized by a limited number of producers types (farms, households, enterprises) and their cooperation. For better development of potato growing in Ukraine, such situation needs to be corrected in nearest future.

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