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ADAPTUAL EVALUATION AND FORECASTING OF AGRICULTURAL PRODUCTS BASED ON POLYNOMIAL MODELS

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ANNOTATION

The article analyzes the indicators of the main types of agricultural production in the Surkhandarya region. And also the volume of agricultural production in the region is predicted.

Key words: food security, economic and mathematical model, agricultural products.

INTRODUCTION

The "Action Strategy for the five priority areas of development of Uzbekistan in 2017-2021", approved by the Decree of the President of the Republic of Uzbekistan dated February 7, 2017 year PF-4947, identifies important tasks for modernization and accelerated development of agriculture in the country [1]. The effective implementation of these tasks requires a comprehensive statistical study of agricultural production in our country and its regions.

Among the regions of the country, Surkhandarya region occupies a leading position in terms of agricultural production and makes a significant contribution to ensuring food security. We all know that the role of agricultural production in ensuring food security in our country is invaluable, and it has been fulfilling the task of ensuring economic security.

Because the modern economy has a variety of forecasting methods, every planner must have programming forecasting skills and be able to choose the right forecasting method to make the right decisions.

A prediction is the result of a prediction process that is expressed orally, mathematically, graphically, or otherwise about the possible condition of an object in the future.

Other features of the forecast classification can be used for specific predictions. For example, it is important to highlight a feature such as coverage of research facilities to predict food safety processes.

ANALYSIS OF THE LITERATURE ON THE SUBJECT

A lot of research has been done on food security in various sectors of the economy. The issues of food security have been extensively studied in the scientific work of domestic and foreign economists.

Scientists of our country S.S. Gulomov, D.S. Allamatova showed the state policy on food security in the regions and the role of innovations in ensuring food security in the regions [2].

G. Conway, a foreign scientist, believes that food security always guarantees that people are provided with the necessary amount of food to maintain an active and healthy life [3].

P.V. Leshchilovsky, V.S. Tonkovich, it is a guarantee that conditions have been created to keep it at the level of medical standards (requirements) [4].

ANALYSIS AND RESULTS

In the conditions of Surkhandarya region, econometric forecasting of agricultural productivity is a bit problematic. Because the hot and arid climatic conditions of the region have a negative impact on crop formation. Therefore, in the context of Surkhandarya region, the issue of forecasting the volume of agricultural production and productivity remains more relevant.

Often the problem of deciding which one is the most convenient function to recommend the development trend of row dynamics on the basis of initial data becomes complicated. In such cases, the following two different methods of determining function forms can be used: function selection by the method of minimum squared errors; function selection using the variance analysis method.

Typically, a number of different functions are selected and their parameters are evaluated based on analysis and research.

Using the data of the Surkhandarya regional statistics department, the appropriate function for the productivity of agricultural products in the region for 2010-2019 was determined.

Based on the results of the calculations using the analytical position in the form of linear relationships, the trend equation is given in Table 1 below.

Table 1

Trend equation based on the results of agricultural productivity in Surkhandarya region for 2010-2019

Product name	Linear trend equation	Product name	Linear trend equation
Wheat	y = 50,153 + 0,125t	Melons	y = 302,12 + 2,8833t
Potatoes	y = 138,4 + 8,0083t	Wet fruit	y = 72,214 + 3,275t
Vegetables	y = 206,43 + 1,0083t	Grapes	y = 61,442 + 4,6783t

To estimate the rate of change of differentiation, Table 1 presents the regression equations corresponding to the Fisher F-criterion based on statistical data for Surkhandarya region.

It should be noted that the parameters "a" of the regression equations given in Table 1 represent the rate of change of the function. Accordingly, during the period under review, the growth of agricultural production in the region increased by 50 quintals of wheat, 138 quintals of potatoes, 206 quintals of vegetables, 302 quintals of melons, 72 quintals of fresh fruits and 61 quintals of grapes.

Using the trend equations defined in Table 1 for the productivity of agricultural products in Surkhandarya region, we generate the results of the analysis of the trends in the dynamics of the rows of yield indicators and variance. The results are presented in Tables 2 and 3.

Table 2

Trends in the dynamics of agricultural productivity in Surkhandarya region in 2011-2019

Observations	Productivity *(y)*	*T*	t^2	*y*t*	$y^{\wedge}$
Wheat					
2011	49,9	1	1	49,9	50,1356
2012	50,8	2	4	101,6	50,6638
2013	49,9	3	9	153,3	51,0606
2014	51	4	16	208	51,326
2015	51	5	25	255	51,46
2016	51,2	6	36	307,2	51,4626
2017	51,3	7	49	359,1	51,3338
2018	51,1	8	64	408,8	51,0736
2019	50,8	9	81	457,2	50,682
Potatoes					
2011	140,9	1	1	140,9	146,4083
2012	150,4	2	4	300,8	154,4166
2013	162,3	3	9	486,9	162,4249
2014	172,4	4	16	689,6	170,4332
2015	188,9	5	25	944,5	178,4415
2016	191,9	6	36	1151,4	186,4498
2017	198,5	7	49	1389,5	194,4581
2018	199,4	8	64	1595,2	202,4664
2019	201,3	9	81	1811,7	210,4747
Vegetables					
2011	201,3	1	1	201,3	207,4383
2012	210,4	2	4	420,8	208,4466
2013	212,1	3	9	650,4	209,4549
2014	215,3	4	16	895,2	210,4632
2015	210,9	5	25	1054,5	211,4715
2016	212,6	6	36	1275,6	212,4798
2017	212,6	7	49	1488,2	213,4881
2018	213,4	8	64	1707,2	214,4964
2019	214,6	9	81	1931,4	215,5047
Melons					
2011	296,4	1	1	296,4	305,0033
2012	321,2	2	4	642,4	307,8866
2013	316,8	3	9	950,4	310,7699
2014	311,4	4	16	1245,6	313,6532
2015	309,6	5	25	1548	316,5365
2016	312,4	6	36	1874,4	319,4198
2017	320,6	7	49	2244,2	322,3031
2018	328	8	64	2624	325,1864
2019	332,4	9	81	2991,6	328,0697
Wet fruit					
2011	81,3	1	1	81,3	75,489
2012	85,4	2	4	170,8	78,764
2013	82,4	3	9	247,2	82,039
2014	82,6	4	16	330,4	85,314
2015	77,8	5	25	389	88,589
2016	82	6	36	492	91,864
2017	88,7	7	49	620,9	95,139
2018	102,5	8	64	820	98,414
2019	114,6	9	81	1031,4	101,689
Grapes					
2011	70,4	1	1	70,4	66,1203
2012	76,8	2	4	153,6	70,7986
2013	74,3	3	9	222,9	75,4769
2014	75,1	4	16	300,4	80,1552
2015	78,7	5	25	393,5	84,8335
2016	81,6	6	36	489,6	89,5118
2017	93,5	7	49	654,5	94,1901

2018	104,6	8	64	836,8	98,8684
2019	108,5	9	81	976,5	103,5467

Table 3
Results of analysis of variance for trends in the dynamics of agricultural productivity in Surkhandarya region

Product name	V	V_1	V_2	S^2	S_1^2	S_2^2	F
Wheat	2,733	1,475	1,258	0,342	1,475	0,18	8,21
Potatoes	4147,36	3848,01	299,35	518,42	3848,01	72,765	89,98
Vegetables	155,4	80,355	75,036	19,424	80,355	10,719	7,496
Melons	918,49	498,82	419,663	114,81	498,82	59,952	8,32
Wet fruit	1167,39	643,54	523,85	145,92	643,53	74,836	8,599
Grapes	1552,56	1313,21	239,35	194,07	1313,21	34,193	38,41

We continue our analysis by examining the significance of regression based on Fisher's F-criterion. The value of the F-criterion in the table is 5.41 with a reliability probability of 0.95 [6]. Since the inequality F account > F for wheat, potatoes, vegetables, melons, grapes and wet fruits given in Table 3 is valid, the linear function can also be used to characterize the development trend of agricultural product row rankings in the region.

Adaptive forecasting methods are widely used in research due to the relatively convenient algorithm and ease of application in the computer in the process of assessing the productivity of agricultural products in Surkhandarya region.

The most widely used adaptive methods in statistical forecasting practice are the Brown and Holt models. These models reflect the development process as a linear trend with constantly changing parameters.

We perform our analysis based on the Brown model by calculating the structure of the flexible polynomial coefficients of the exponential averages in the forecast. In our study, a linear trend was used for forecasting (Table 1).

Typically, according to Brown-Meyer's theorem, the parameters of the linear trend are related to the exponential values of the first-order Q_i^1 and second-order Q_i^2 commands [7]. These indicators are calculated by the following formula:

$$Q_i^1 = a_{cp} + \frac{1-\alpha}{\alpha} b_{cp}; \qquad Q_i^2 = a_{cp} + \frac{2(1-\alpha)}{\alpha} b_{cp};$$

Accordingly:

$$a_{cp} = 2\,Q_i^1 - Q_i^2; \qquad b_{cp} = \frac{\alpha}{1-\alpha}\,(Q_i^1 - Q_i^2);$$

To calculate the ustel values, we need to determine the initial state of $Q_0^1 - Q_0^2$ from the formula.

Prerequisites are given in the form of the following formulas:

$$Q_0^1 = a - \frac{1-\alpha}{\alpha} b; \qquad Q_0^2 = a - \frac{2(1-\alpha)}{\alpha} b;$$

However, the main problems of their application are the selection of the appropriate method for the object under study, as well as the determination of the numerical values of the relevant instrumental parameters.

The flexible parameter "α" is defined by the following formula:

$$\alpha = \frac{2}{n+1}$$

The forecast is made according to the model in the following form:

$$y_t = a_{cp} + b_{cp} * k;$$

where: k – is the leading period.

Using the given formulas, we consider the productivity of agricultural products of Surkhandarya region for 2011-2019. The forecast is formed only on the basis of trend equations for 2020, which correspond to the index of productivity of agricultural products, given in Table 1. The results are presented in Table 4.

Table 4

Flexible polynomial coefficients and forecast of exponential average values of agricultural productivity indicators of Surkhandarya region

Product name	Q_i^1	Q_i^2	a_{cp}	b_{cp}	Q_0^1	Q_0^2	Real	Forecast			2019 y. 2022 y, %
							2019 y	2020y	2021 y	2022y	
Wheat	49,97	49,58	50,38	0,1	49,65	49,15	50,8	51,403	51,53	51,66	102
Potatoes	127,1	101,5	152,8	6,41	106,4	74,33	201,3	218,49	226,5	234,5	116
Vegetables	205,1	201,8	208,2	0,81	202,4	198,4	214,6	216,51	217,5	218,53	102
Melons	298,1	288,9	307,3	2,31	290,6	279,1	332,4	330,95	333,8	336,72	101
Wet fruit	67,63	57,15	78,11	2,62	59,11	46,01	114,6	104,97	108,2	111,51	97
Grapes	54,89	39,92	69,87	3,74	42,73	24,02	108,5	108,23	112,9	117,58	108

The results of the forecast calculations show that in 2022, the yield of wheat in Surkhandarya region will increase by 2% compared to 2019, potatoes by 16%, vegetables by 2%, melons by 1%, grapes by 8%, wet. and fruit production may decrease by 3% (Table 4).

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, adaptive methods make it possible to take into account the different information values of the sequence levels, which have significant features in the short-term forecasting of agricultural production. The adaptation process is repeated for each new point of the examined period, providing a simulation of the development trend in each period.

The flexibility parameter to changes in the dynamics of the model is characterized by a, which at the same time provides a sufficient representation of the trend in the detection of random deviations typical of the arid zone due to the hot climatic conditions of Surkhandarya region.

Based on the above data, we can conclude that in order to further develop the productivity of agricultural products in Surkhandarya region, the restoration of agricultural land production capacity, implementation of reclamation measures, scientific substantiation of the use of mineral fertilizers and various additives will ensure high yields.

Based on this information, it is necessary to work in several areas to further improve food security in Surkhandarya region. Including:

- improving the legal framework to ensure regional food security;
- formation of regional norms of consumption of average types of food per capita;
- development of measures to support import substitution, including domestic goods, to reduce the dependence of the domestic food market on imports based on increased competitiveness;
- increasing the attention of regulatory authorities to the problem of poor food quality.

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