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THE ANALYSIS OF DYNAMICS OF FRUIT AND BERRY PRODUCTIVITY GROWN IN UZBEKISTAN

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ABSTRACT

In this article the productivity of the fruit and berry that grown in the republic during the 2003-2018s was analyzed mathematically, statistically as discreet $\{Y_t, t \in T\}$ dynamic range and its real productivity overviewed by statistical, with a 95% guarantee interval evaluations. Due to trend and the frequent part around the trend, seasonal effect and random part are the main constituents of dynamic line evaluated on statistical data for dynamic productivity of fruit and berry quantities. Statistical hypothesis were checked on studying dynamic ranges related with the parametric criterion by Pirson, Jack-Berra, Shapiro-Vilkakson. Conclusion has been come on the base of dynamic range of statistical analysis.

KEYWORDS: *dynamic, trend, random, linear, parameter, the least quadratic, autocorrelation, coefficient, criterion, hypothesis, normal, dispersion, asymmetry, kurtosis, interval.*

INTRODUCTION

President of Uzbekistan in his instructions and orders on rationalized reforms of fruit grown in the republic, in terms of quality, to be rich in health-related vitamins, and mentions its difference by its unique gusto in the world, to produce competitive fruit in the world market as well as to export the yield.

In the performance of these tasks a great deal of work is being done.

In the article average yield of fruit and berry that grown in the republic in the past 16 years (based on the data of the statistical government) have been studied as dynamic range and statistically analyzed its medium developing rate, random, seasonal and periodical peculiarities. Fricative average value, limited distinctions and other methods were used to identify the tendency of dynamic range.

The unknown parameters of the trends characterizing the main direction of the dynamic ranges are evaluated by statistical data using the least quadratic method and this model was adequate and checked by the help of statistical criterion.

MATERIALS AND METHODS

The average fruit and berry productivity in our republic which produced during 2003-2018s was analyzed (on the republican statistical government data) statistically as dynamic range.

The average annual productivity of fruit and berries is based on datum interval statistical estimates and the average productivity has been prognosticated for the coming year. Generally, the creation of an unstable dynamic with a fertility autocorrelation link was determined by a 95% guarantee with Darbin Watson criterion.

The difference of dynamic range from other statistical observations is to conduct check-outs at certain arranged (month, quarter, year) intervals. For instance, it is supposed to be the same discreet of dynamic range of annually produced wheat productivity length. The result of each observation of dynamic range is random quantity and they are trend, frequent part around the trend, seasonal effect and random parts and that is complex accidental process, and there have been a lot of scientific and text books which are devoted to study its genuine statistical principles: Anderson T. [1],

Kendal M., A.Stuart [2], Krendjer K., M,Khatanaka [3], Lux K.D. [4], Vaynu Y.Y [6].

It is known, that seasonal circulation of fruit cultivation in certain periods can be the basis for analyzing the discreet $\{Y_t, t\in T\}$ as a random dynamic series.

RESULTS AND DISCUSSION

In the article the fruit yield that grown during 2005-2018 $\{Y_t, t\in T\}$ (table 1, column 2,3) was statistically analyzed as dynamic series and the point of its actual productivity, statistical estimating of guaranteed interval and different process-related statistical hypotheses were verified.

It is known [1]-[3] that time series can be comprised by the followings:1) trend showing the main direction 2) frequent part around the trend 3) seasonal effect 4)random part

In the republic the fruit-berry yield $\{Y_t, t\in T\}$, that produced in 2003-2018, based on geometrically in coordinate system, can be supposed to have linear combination $y = a_0+a_1t$

Figure 1

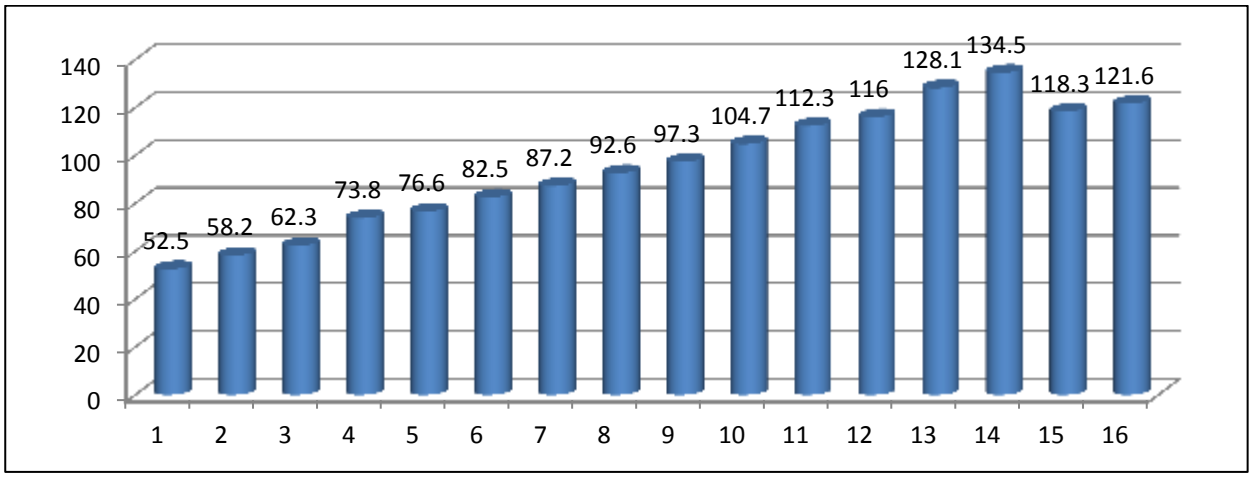
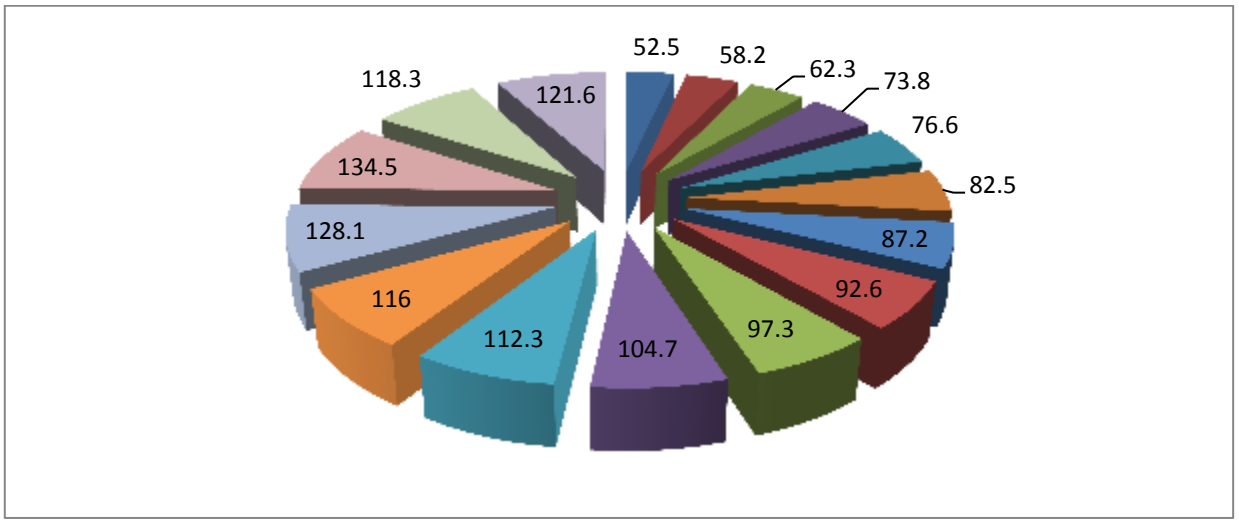


Figure 2



We make up this table on statistic data:

Table 1

№	Periods	Y_(t) centner/ha	t	t^2	yt
1	2003	52,5	-7	49	-367,5
2	2004	58,2	-6	36	-349,2
3	2005	62,3	-5	25	-311,5
4	2006	73,8	-4	16	-295,2
5	2007	76,6	-3	9	-229,8
6	2008	82,5	-2	4	-165,0
7	2009	87,2	-1	1	-87,2
8	2010	92,6	0	0	0
9	2011	97,3	1	1	97,3
10	2012	104,7	2	4	209,4
11	2013	112,3	3	9	336,9
12	2014	116,0	4	16	464,0
13	2015	128,1	5	25	640,5
14	2016	134,5	6	36	807,0
15	2017	118,3	7	49	828,1
16	2018	121,6	8	64	972,8
Total		1518,5	8	344	2550,6

In this linear model for the evaluation of unknown parameters by the least quadratic method, the following normal equations system is solved on experimental data

$$\left.\begin{aligned} b\sum_{i=1}^{n} x_i + a\sum_{i=1}^{n} x_i^2 &= \sum_{i=1}^{n} x_i y_i \\ bn + a\sum_{i=1}^{n} x_i &= \sum_{i=1}^{n} y_i \end{aligned}\right\}$$

We will evaluate unknown parameters with calculations in tables in the linear combination $y = a_0 + a_1 t$:

$$\sum y_t = 1518{,}5\ ,\ \sum yt = 2550{,}6\ ,\ a_0 = \frac{1518{,}5}{16} = 94{,}91\ ,\ a_1 = \frac{2550{,}6}{344} = 4{,}42.$$

Consequently, the representational equation of the yield produced in 2003-2018s as the following y (t) = 94, 91 + 4, 42 t

With this model we can safely evaluate the productivity of the yield of the coming years.

Autocorrelation coefficient is important to study time series properties.

When we calculate RL autocorrelation coefficient with the given formula in [3], we see all R_1, R_2, R_3, R_4, R_5 value differentiated from zero. (According to calculation of Table 2)

This statement is based on to suppose that dynamic series has autocorrelation link.

Although we check the yield equation of berry-fruit with Dubrin-Vatson criteria the following hypothesis y(t)= 94,91 + 4,42 t. is observed in linear association

$$d_{kuz} = \sum_{t=1}^{T-1} (Y_{t+1} - Y_t)^2 / \sum_{t=1}^{T} {Y_t}^2.$$

We can see that all d_{kuz} values, found out in [1]-[3] special table, it is seen that

$d_{krit} = 1.08$ critical value is small from $d_{kuz} < d_{krit}$

So, with a 95% guarantee, the hypotheses has been accepted as random autocorrelation of quantities has $y_t = \rho y_{t-1} + \varepsilon_t$, ρ=COV (y_t,y_{t+1}) combination .

The fruit yield that will be produced this economic year is connected with the previous year's yield.

Table 2

№	Periods	Y_(t) c/ha	Y_t^2	ΔY_t	ΔY_t^2	$\Delta^2 Y_t$	$\Delta^2 Y_t^2$	$\Delta^3 Y_t$	$\Delta^3 Y_t^2$
1	2003	52,5	2756,25						
2	2004	58,2	3387,24	5,7	32,49				
3	2005	62,3	3881,29	4,1	16,81	-1,6	2,56		
4	2006	73,8	5446,44	11,5	132,25	7,4	54,76	9,0	81,0
5	2007	76,6	5867,56	2,8	7,84	-8,7	75,69	-16,1	259,21
6	2008	82,5	6806,25	5,9	34,81	3,1	9,61	11,8	139,24
7	2009	87,2	7603,84	4,7	22,09	-1,2	1,44	-4,3	18,49
8	2010	92,6	8574,76	5,4	29,16	0,7	0,49	1,9	3,61
9	2011	97,3	9467,29	4,7	22,09	-0,7	0,49	-1,4	1,96
10	2012	104,7	10962,09	7,4	54,76	2,7	7,29	3,4	11,56
11	2013	112,3	12611,29	7,6	57,76	0,2	0,04	-2,5	6,25
12	2014	116,0	13456,00	3,7	13,69	-3,9	15,21	-4,1	16,81
13	2015	128,1	16409,61	12,1	146,41	8,4	70,56	12,3	151,29
14	2016	134,5	18090,25	6,4	40,96	-5,7	32,49	-14,1	198,81
15	2017	118,3	13994,89	-16,2	262,44	-22,6	510,76	-16,9	285,61
16	2018	121,6	14786,56	3,3	10,89	19,5	380,5	42,1	1772,4
Total		1518,5	154102,1	69,1	884,45	-2,4	1161,9	21,1	2946,2

We have identified that the hypotheses about annual average fruit yield produced in the republic has normal distribution: $H_0 : P(X < x)$=$\Phi_{a,\sigma}$(x) has been checked by Jack-Berra, Shapiro-Vilkakson, Pirson parametric criterion that resulted in being presence of normal distribution with a 95% of guarantee.

Based on the fact that a statistical assessment of the annual yield of the fruit was made using the following formula

$$\overline{Y}_{T+i} - t(T-2;\alpha)\overline{\sigma}_y \le a_0 + a_1(T+i) \le \overline{Y}_{T+i} + t(T-2;\alpha)\overline{\sigma}_y$$

Based on the statistical analysis of the dynamics of annual fruit yields produced in our country we have the following information:

We get the below information by analyzing statistical dynamics of annual average fruit yield that produced in the republic (Table 3).

Table 3

Important characteristics of the selected sample	Statistical evaluation of selected characteristics of fruit and berry
Average yield $\bar{y}_T$ c/ha	94,91
Dispersion	665,765
Square siding of the selected σ_T	25,802
Variation coefficient v (%)	25,96%
Asymmetric A_{ς}	-0,143
Excess $E_{K_{\varsigma}}$	-1,1698
Mistake of average value $\overline{X}_T$ of the selected m_x	$m_x=\frac{\sigma_x}{\sqrt{n}} = 6,451$
Limit mistake m'_x	$m'_x=tm_x=2,15\cdot6,451=13,87$
Mistake of average square siding m_σ	$m_\sigma=\frac{\sigma}{\sqrt{2n}}=\frac{25,802}{5,66} = 4,56$
Statistical evaluation with intervals (95%) $\overline{X}_T \pm tm_x$	$\bar{y}_T \pm tm_x$=94,91±13,87 (81,04; 108,78) ц/га
Statistical hypothesis $H_0 : P(X < x) = \Phi_{a,\sigma}(x)$	With a 95% guarantee H_0 hypothesis was accepted

CONCLUSION

Statistical analyzing based on the time series of the fruit yield produced in 2004-2018s can be concluded as the followings:

The fruit yield that produced in 2003-2018s in the republic is a connected process with a number of random factors;

The part of trend that characterizes the main direction of fruit producing process has linear connection of y(t)= 94,91 + 4,42 t , so, the fruit yield grown in the republic, in 2019, will be around 99,33≈100 c/ha with 95% guaranteed.

In general, the average fruit yield based on the applied statistic criterion that above mentioned has $\overline{y(t)} \sim N(94{,}91; 25{,}802)$ parametric normal distribution, the yield will be about (81,04; 108,78) c/ha with a 95% guarantee in 2019;

The fruit yield has autocorrelation combination that means presently yield will be linked $y_t = \rho y_{t-1} + \varepsilon_t$; in previously received yield;

In common, annual fruit yield produced in the republic makes up unstable dynamic series.

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