COMPARATIVE STATISTICAL ANALYSIS OF VEGETABLE AGRICULTURAL PRODUCTION IN ROMANIA IN THE PERIOD 2009-2021

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Abstract:
In this paper, a statistical analysis of vegetable agricultural production in Romania is made in the period 2009-2021 and a comparative study is carried out regarding the average productions per hectare for certain crops obtained at S.C.D.A. Simnic, respectively in Dolj county and at the national level. It is thus found that there are no significant differences between the average productions per hectare for wheat, sunflower, barley and pea crops from a statistical point of view, at a significance level of 5%. On the other hand, the level of average production per hectare of corn silage and colza in the period 2009-2021 at the S.C.D.A Simnic is significantly lower than at the national level. Comparing the average agricultural production per hectare of oats, it is found that at S.C.D.A Simnic it is significantly higher than the average production obtained in Dolj county and the national level. The work ends with recommendations regarding production management and measures to optimize it.

Keywords: vegetable production, comparative study, statistical analysis, *production management.*

1. Introduction

Agriculture is a very important sector in the Romanian economy and we can say about the cultivation of cereals, especially wheat and corn, that they occupy the main places. However, although our country has a high agricultural potential, with fertile agricultural lands, they cannot be capitalized well enough due to insufficient mechanization, the lack of irrigation systems, the fragmentation of agricultural lands, as well as the lack of capital and human resources. The financial support offered by the EU and the Romanian state by attracting European projects can lead to an increase in agricultural production through the association and merging of land, but also through the mechanization of agriculture, according to Barbu (2011), Anghelache (2018), Radu (2018), Buliga-Stefanescu (2019).

We can say that Romania generally has an agricultural profile, being among the best placed countries in terms of agricultural land. Our country has 13.3 million hectares of agricultural land, approximately 0.7 hectares per capita, which places it at the top of the EU countries. Considering this, it is found that agriculture does not make, as expected, a significant contribution to the gross domestic product.

Romanian agricultural crops are dependent on the vagaries of the weather, especially precipitation, considering the fact that irrigation systems are very few in most of the country. The reasons are multiple and generated low values of the average productions obtained in our country compared to those in the European Union, so that there is no positive correlation between the large cultivated areas and the productions obtained. Our country is in the first place in terms of the size of the areas cultivated with corn and wheat, however, the analysis of the production obtained per hectare places us towards the bottom of the ranking in the EU, according to Grigoras (2016), Radu (2018).

In general, agricultural production can be influenced by several factors such as climatic conditions, access to irrigation systems, soil quality, the quality of the seed used, the quantity and quality of fertilizers, treatments to combat pests, the technologies used, access to technology and investments, such as and other economic and social problems.

The Șimnic Agricultural Research and Development Station was established on January 1, 1957, with the aim of deepening regional scientific agricultural research issues. It has a total of 2155 ha, where approximately 2000 ha are arable, used in research and development and approximately 250 ha have irrigation systems. The soil is poor in nitrogen, but is well supplied with phosphorus and potassium. It has developed as a zonal research center, targeting cereals and technical plants, here addressing a complex topic in the field of seed improvement and production in parallel with the research topic of technologies specific to the culture of corn, sunflower, wheat and legumes for grains, with the theme of plant protection and animal improvement and nutrition. Annually in the area of S.C.D.A. Simnic, there are approximately 540-550 l/m_2 of precipitation, totally unevenly distributed during the growing season.

The current work aims to make a statistical analysis of the average production per hectare for the wheat, silage corn, sunflower, oat, barley, colza and pea crops, in the period 2009-2021 at S.C.D.A. Simnic also compares it with the average productions per hectare obtained at the level of Dolj county and the entire cultivated area in Romania. The analyzed data were obtained from S.C.D.A. Simnic and from the National Institute of Statistics. We consider this study necessary because we want to identify the causes that generated higher or lower production at the level of the research station and to propose certain measures that can be taken in order to increase and optimize the production of agricultural crops analyzed at S.C.D.A. Simnic. The novelty of the study consists in the comparative statistical study carried out between the three entities, from which management measures can be derived, through which productivity per hectare can be increased and agricultural production optimized.

The work is structured as follows. The introductory part presents the new elements of the work and the necessity of the study. In the second part, the specialized literature is studied, presenting the conclusions drawn from other studies and what our analysis adds to the current state of knowledge in the field. In the third section, the methods and statistical tests used in the comparative study carried out in the paper are mentioned. The fourth part of the work contains the new elements of the study, which consist of a statistical analysis and a comparative study on plant production, for certain crops at S.C.D.A. Simnic, at the level of Dolj county and the entire cultivated area in Romania. The paper ends with the conclusions section,

which also contains a series of proposals to increase productivity at S.C.D.A. Simnic, as well as possible further studies.

2. Literature Review

In his work, Anghelache (2018) found that after 1989 the share of agriculture in the formation of the gross domestic product decreased and shows that in this field Romania regressed because the farms (agricultural cooperatives or state agricultural enterprises) disappeared. In the last decade, receiving subsidies from the European Union, in Romania there is the prospect of a reorientation in the creation of farms to make agricultural activity much more efficient. The author also studied how agriculture faces some difficulties, but also the idea that a better situation can be reached in the future. The analyzed data highlighted the concern for the restoration of agricultural holdings to an adequate surface size that would ensure the efficiency of agricultural exploitation.

Buliga-Stefanescu (2019) compares the average production obtained for the main crops in agriculture in the period 1995-2006 from the years prior to the accession to the EU, with the average agricultural production from the period 2007-2018 and finds that there were significant improvements after the accession. The increase in production is due to EU subsidies, which enable farmers to purchase the latest farm machinery, equipment and technology. Also, higher yields are obtained by large producers who can use modern technical equipment, who can apply appropriate technologies and who use fertilizers and herbicides. However, even if the quantities increased for all crops, the average productions per hectare remained lower than the European average.

In the work of Barbu (2011) an analysis was made of the performance of Romanian agriculture compared to that of the EU based on the data provided by Eurostat - European Commission Statistics and national statistics and it was found that Romanian agriculture was, in its historical evolution, in a European marginal area in terms of economic performance and has failed to ensure food security and increase the export of value-added agricultural products. At the same time, the global demand for agricultural products is much higher than the supply and some EU countries have reached their maximum productivity, while in Romania we have a low productivity.

Grigoras (2016) found that on the domestic market there are many imported agricultural products at a lower price that affect local producers. The financial support provided by the EU through the Horizon 2014- 2020 program was to be used to increase agricultural production. It is suggested that farmers pool their capital and develop their businesses in associative forms that could help them obtain agricultural products at lower costs and become competitive in the market.

Although Romania has a high agricultural potential, it cannot be exploited to its true value, due to land fragmentation, the existence of a low-level technology in the agricultural sector, in terms of agricultural machinery and irrigation systems, as well as a low degree percentage attraction of investment funds (Radu 2018). Although the agricultural production sector in Romania can generate quality products in significant quantities that can cover an important segment of the domestic demand for agri-food products, it is found that more raw materials are exported and finished products are imported.

In their work, Tudor, Popa, Gimbășanu (2017), found that the area cultivated with corn in the EU s of Romania, begins to decrease significantly, being gradually replaced by sunflower or rapeseed, much more profitable crops. The study was carried out with the aim of identifying the critical periods of corn cultivation in Romania, but also to identify potential trends, taking into account the specific situation at the European level.

The objective of the study carried out by Popescu et al. (2017) was to evaluate the competitiveness of Romanian agri-food products on the world market, starting from the question of whether the land is cultivated with crops that are competitive. To evaluate the competitiveness, the Balassa index was calculated, resulting in a relative performance for barley, corn, triticale and wheat, although the areas cultivated with barley and wheat decreased during the analyzed period, these products have the highest relative export performance.

The study by Popescu (2021) analyzed the evolution of Romania's agricultural production in the period 2010-2019, using the fixed index, trend equations and the coefficient of determination. The main indicators studied were GDP in agriculture, value of agricultural production, cultivated area and productions for the main crops, production for the main farm species, as well as production per inhabitant. It was found that agriculture is dominated by cereals such as corn and wheat with a share of 63.7% in cultivated area and 82.15% in cereal production. Oilseeds cover 20.6% of the cultivated area and sunflower makes up 69% of oilseed production.

3. Research Methodology

The statistical analysis of production from the period 2009-2021 was carried out by calculating the following indicators: arithmetic mean, dispersion, standard deviation and coefficient of variation. The analysis of average agricultural productions per hectare was done by comparing the results obtained between 2009-2021 at S.D.C.A Simnic, Dolj county and Romania as a whole. To check whether the statistical series follow a normal distribution or not, the Jarque-Bera test was used. To verify the significance of the difference between the variances, the F-test was used, and to determine whether or not the means differ statistically significantly at a chosen significance level of 5%, the t-Student test was used (see for instance Wooldridge (1999), Maddala (2001), Brooks, (2008)).

The Jarque-Bera test is a statistical test for verifying the assumption of normality of a distribution. It is based on measuring skewness *S* and kurtosis K of a distribution. The tested variable is

$$JB = \frac{n}{6}\left(S^2 + \frac{(K-3)^2}{4}\right)$$

which follows a χ-square distribution law, where *n* is the number of observations or degrees of freedom. The null hypothesis of the Jarque-Bera test is H_0: the data are normally distributed and is evaluated against the alternative hypothesis H_1: the data follow another distribution from the family of Pearson distributions.

If $JB < \chi_2^2(\alpha)$, χ-square distribution with two degrees of freedom, then, at the significance level α, H_0 is accepted, according to which the data are normally distributed, this being equivalent to the fact that the probability attached to the Jarque-Bera test is greater than the chosen significance level $\alpha = 0.05$.

To check the equality or difference between the variances for two volume samples n_1 and n_2 from different samples with the estimated variances s_1^2 and s_2^2, the

variable $F_c = \frac{s_1^2}{s_2^2}$, is calculated, which follows a Fisher distribution with n_1-1, respectively n_2-1 degrees of freedom

For a chosen significance level $\alpha = 0.05$, the null hypothesis H_0: $s_1^2 = s_2^2$, is verified, against the alternative hypothesis H_1: $s_1^2 \neq s_2^2$. If *Fc<Fcritical* (equivalent to the fact that the probability attached to the F-test is higher than the significance level $\alpha = 0.05$) then the null hypothesis is accepted, otherwise it is rejected.

The verification of the hypothesis of the equality of the means of two samples from two different communities, denoted H_0: $m_1=m_2$, contrary to the hypothesis H_1: $m_1 \neq m_2$ is done by applying the Student t-test, but differently depending on the equality or the significant difference of the variances.

If the variances do not differ significantly, we can assume that $s_1^2 = s_2^2$,, and then calculate

$$s^2 = \frac{s_1^2(n_1 - 1) + s_2^2(n_2 - 1)}{n_1 + n_2 - 2}$$

and variable

$$t_c = \frac{m_1 - m_2}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

which follows a t-Student distribution with n_1+n_2-2 degrees of freedom. If *|tc|<tcritical* (equivalent to the fact that the probability attached to the t test is higher than the chosen significance threshold $\alpha = 0.05$) then the null hypothesis H_0 is accepted, and otherwise it is rejected.

If the variances differ significantly, $s_1^2 \neq s_2^2$, then the variable t_c is calculated

$$t_c = \frac{m_1 - m_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

which follows a t-Student distribution with *f* degrees of freedom, where

$$f = \left[\frac{1}{\frac{c}{n_1 - 1} + \frac{(1-c)^2}{n_2 - 1}}\right], \quad c = \frac{\frac{s_1^2}{n_1}}{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

and [,] represents the whole part of the respective number.

If *|tc|<tcritical* (equivalent to the fact that the probability attached to the t test is higher than the chosen significance threshold $\alpha = 0.05$)then the null hypothesis H_0 is accepted, and otherwise it is rejected.

4. Results and discussion

After applying the Jarque-Bera test, it was found (see Tables 4-6) that the only series of data that does not follow a normal distribution is represented by the average quantities per hectare of silage corn obtained in Dolj county in the period 2009-2021 (JB=25.49417, p=0.000003<0.05). Consequently, we cannot apply the Student's t-test to verify the difference between the means for this data series. All other data series follow a normal distribution.

The next stage consisted in checking the difference of variances, using the F-test, between the data series from S.C.D.A Simnic, Dolj county and total Romania. The obtained results were grouped in the Tables 7-9 and it is found that, in general, there are no significant differences between them from a statistical point of view at a significance threshold of 5%, with a few exceptions. Thus, it turns out that we have a significant difference between the variances obtained for the average productions per hectare for the crops of oats (Fc=8.32, p=0.0004) and peas (Fc=3.12, p=0.029) from S.C.D.A Simnic, respectively at the level of Dolj county. Regarding the significant differences between the variances for the average productions obtained at the S.C.D.A Simnic level in comparison with those obtained at the national level, they are recorded for the crops of silage corn (Fc=3.21, p=0.026), oats (Fc=13.45, p =3.73328E-05) and peas (Fc=4.72, p=0.005). Between the cultures analyzed at the level of Dolj County and those at the national level, we have no significant differences between variances from a statistical point of view at a significance threshold of 5%.

The results, regarding the significant differences between means, can be found grouped in tables 10-12. Thus, there is a significant difference between the average production per hectare of oats (tc =3.35, p=0.004) between S.C.D.A Simnic and Dolj county in the period 2009-2021. Regarding the average differences between the productions obtained at S.C.D.A Simnic, compared with those at the national level, they were recorded for corn silage (tc=7.33, p=5.89754E-07), oats (tc=3.33, p= 0.004) and colza (|tc|=3.14, p=0.004). Between the production averages per hectare for the crops analyzed in the period 2009-2021 at the level of Dolj county and Romania as a whole, it is found that there are no significant differences from a statistical point of view, at a significance threshold of 5%. Next, we will do a more detailed analysis on the types of cultures, see also the Tables 1-3.

Wheat

In Romania, wheat was and still is one of the most important agricultural crops, with an average annual production kg/ha that varied between 2400-4800 kg/ha in the period 2009-2021. Wheat is used both for food, through the manufacture of numerous products, but also as animal feed.

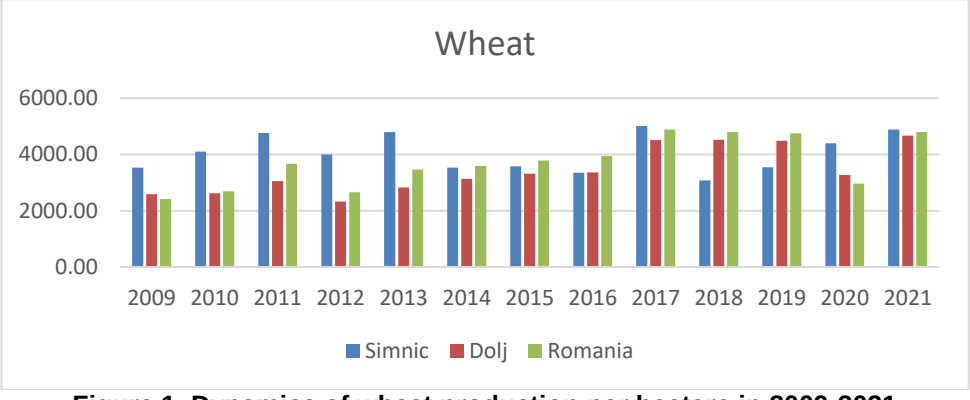

Figure 1. Dynamics of wheat production per hectare in 2009-2021

Source: Own design based on data provided by S.C.D.A Simnic and the National Institute of Statistics, Tempo-online database, 2022

For wheat production at S.C.D.A Simnic, an average of 4042 kg/ha was calculated in the analyzed period. The maximum production of 5007 kg/ha was achieved in 2017, and the minimum of 3079 kg/ha was recorded a year later in 2018. It is found that wheat production at S.C.D.A Simnic during the analyzed period tends towards a normal distribution according to the Jarque test Beer with the value of 1.192199 and attached probability p=0.550956 (Skewness=0.185389; Kurtosis=1.563509). The coefficient of variation, calculated as the ratio between the standard deviation and the average, has the value of 16.37%, which is below the value of 35%, which leads to the conclusion of a homogeneous production of wheat per hectare at S.C.D.A Simnic, the average being significant. Regarding the dynamics of wheat production, it is noted that in the period 2010-2013 values of over 4000 kg/ha were recorded with a somewhat increasing trend, between 2014-2016 the production decreased to around 3500 kg/ha, and from 2018 to 2021 there was an upward trend from 3079 kg/ha to 4889 kg/ha.

Regarding wheat production in Dolj county, it had an average of 3437 kg/ha in the period 2009-2021, obtaining a maximum value of 4673 kg/ha in 2021, but also a minimum production of 2326 kg /ha in 2012. The average production of wheat in Dolj tends towards a normal distribution according to the Jarque-Bera test with the value of 1.274406 and the attached probability p=0.528769 (Skewness=0.412092; Kurtosis=1.706373). The coefficient of variation has the value of 24.11%, which is below the value of 35%, which means that wheat production is homogeneous in Dolj county and the average is representative. Starting with 2009, an increasing trend was recorded from 2586 kg/ha to 4521 kg/ha in 2018, with an exception regarding 2012. After 2018, production remained around 4500 kg/ha, with one exception in 2020, when 3270 kg/ha were recorded.

The wheat crop in Romania had an average of 3723 kg/ha during the period under study, the maximum value of 4888 kg/ha was achieved in 2017, and the minimum of 2421 kg/ha was recorded in 2009. Average production of wheat in Romania tends towards a normal distribution, a fact confirmed by the Jarque-Bera test with the value of 0.943048 and the attached probability p=0.624051 (Skewness=0.017547; Kurtosis=1.680993). Regarding the coefficient of variation, it has a value of 23.68%, leading to a homogeneous production and a significant average in Romania. Starting with 2009, an increasing trend was recorded until 2017, with the exception of 2012 with 2652 kg/ha. After 2018, production remained around 4700 kg/ha, with an exception in 2020, when 2966 kg/ha were recorded.

Comparing the agricultural production of wheat per hectare in the period 2009-2021 obtained at S.C.D.A Simnic, Dolj county and Romania as a whole by applying the t-student test, it is found that there are no significant differences between means, from a statistical point of view, at a significance level of 5%.

Silage corn

Silage corn, also called the "winter pasture" of animals, is an excellent fodder, which can be preserved relatively easily by ensiling. Average annual production generally varied between 18,000-30,000 kg/ha in the period 2009-2021 at the national level.

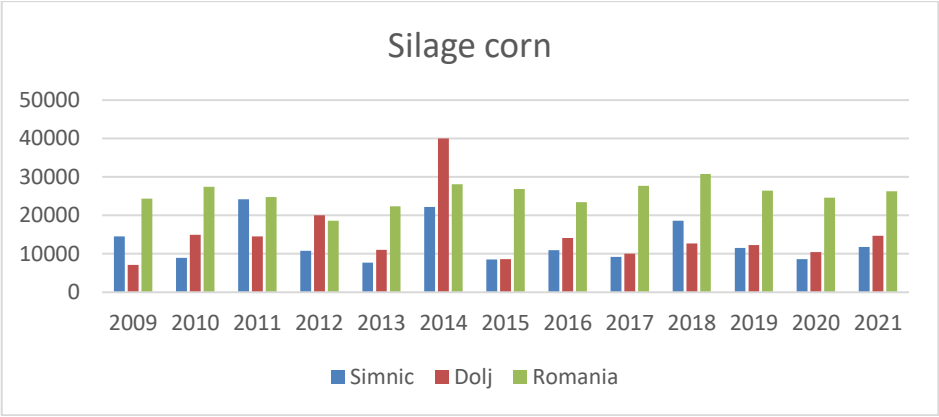

Figure 2. Dynamics of silage corn production per hectare in 2009-2021
Source: Own design based on data provided by S.C.D.A Simnic and the National Institute of Statistics, Tempo-online database, 2022

Silage corn production at S.C.D.A Simnic had an average of 12888.47 kg/ha in the period 2009-2021. The maximum production of 24174 kg/ha was achieved in 2011, and the minimum of 7728 kg/ha was recorded in 2013. It is found that the production of silage corn at S.C.D.A Simnic during the analyzed period tends towards a normal distribution according to the Jarque-Bera test with the value of 2.599960 and attached probability p=0.272537 (Skewness=1.089843; Kurtosis=2.778874). The coefficient of variation has the value of 42.09%, which, although it is above the value of 35%, leads to the conclusion of a somewhat homogeneous production of corn silage per hectare at S.C.D.A Simnic, the average being still considered significant. Regarding the dynamics of silage corn production, it is found that it had fluctuations of successive decreases and increases at intervals of 3 or 4 years, unable to establish a certain trend.

Regarding silage corn production in Dolj county, it had an average of 14654.61 kg/ha in the analyzed period, obtaining a maximum value of 40000 kg/ha in 2014, according to INS, which is much higher than in all other years, but also a minimum production of 7135 kg/ha in 2009. The average silage corn production in Dolj does not tend towards a normal distribution according to the Jarque-Bera test with the value of 25.49417 and the attached probability p=0.000003. The coefficient of variation has a value of 56.62%, which is much higher than the value of 35%, which means that silage corn production is heterogeneous in Dolj county and the average is somewhat unrepresentative.

Analyzing the production of silage corn in Romania, an average of 25528.23 kg/ha is found during the study period, with a maximum value of 30782 kg/ha achieved in 2018, and the minimum of 18651 kg/ha recorded in 2012. Average corn silage in Romania tends towards a normal distribution, a fact confirmed by the Jarque-Bera test with the value of 0.845015 and the attached probability p=0.655401 (Skewness=-0.581433; Kurtosis=3.455819). Regarding the coefficient of variation, it has the value of 11.84%, leading to a homogeneous production and a significant average in Romania. Regarding the dynamics of silage corn production, it is found that it had fluctuations of successive decreases and increases at intervals of 3 or 4 years, unable to establish a certain trend.

Comparing the agricultural production of corn silage per hectare in the period 2009-2021 obtained at S.C.D.A Simnic and in Romania, it is found that there are significant differences between environments from a statistical point of view, according to the t-student test, at a significance level of 5%. The average at the S.C.D.A Simnic level is significantly lower than at the national level, this is due to the cultivation of this crop on sandy land, without the possibility of irrigation.

Sunflower

Sunflower seeds are rich in oil, they contain, without the skin of the fruit, about 55% edible and industrial oil. Sunflower is one of the main sources of vegetable oil in Romania. Also, the residues left over from oil extraction constitute a concentrated feed, rich in proteins, used for animals. The average production in Romania was between 1300 and 3000 kg/ha in the analyzed period.

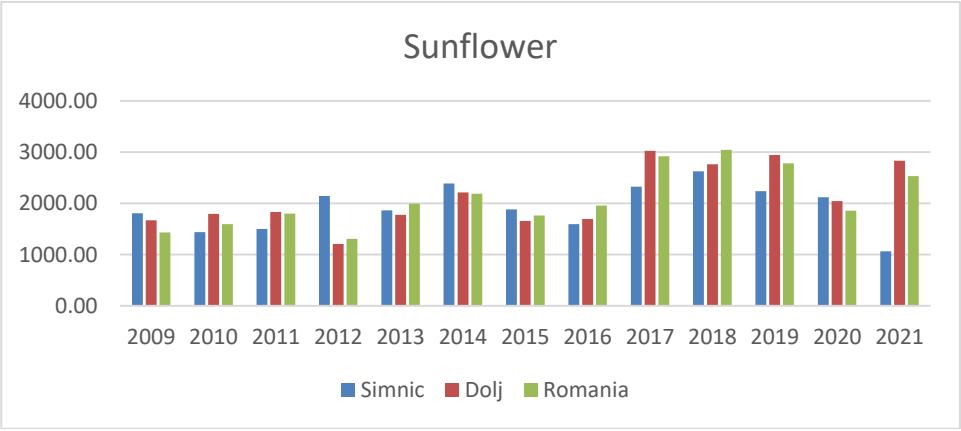

Figure 3. Dynamics of sunflower production per hectare in 2009-2021

Source: Own design based on data provided by S.C.D.A Simnic and the National Institute of Statistics, Tempo-online database, 2022

Analyzing sunflower production per hectare at S.C.D.A Simnic, an average of 1921.99 kg/ha was found in the period 2009-2021. The maximum production was 2625 kg/ha and was reached in 2018, and the minimum value of 1061 kg/ha was recorded in 2021. It is found that the sunflower production at S.C.D.A Simnic during the analyzed period tends towards a normal distribution according to the Jarque test - Beer with the value of 0.440939 and attached probability p=0.802142 (Skewness=-0.299549; Kurtosis=2.325372). The coefficient of variation has the value of 22.97%, which leads to the conclusion of a homogeneous sunflower production per hectare at S.C.D.A Simnic, the average being significant. Regarding the dynamics of sunflower production, it is found that it had fluctuations of successive decreases and increases until the maximum in 2018, and a downward trend in the last three analyzed years.

Regarding the sunflower production on the entire surface of Dolj county, it is found that it had an average of 2112.53 kg/ha in the period 2009-2021, obtaining a maximum value of 3027 kg/ha in 2017, but and a minimum production of 1206 kg/ha in 2012. The average sunflower production in Dolj tends towards a normal distribution according to the Jarque-Bera test with the value of 1.067689 and the attached probability p=0.586346 (Skewness=0.382571; Kurtosis=1.822852). The

coefficient of variation has the value of 27.92%%, which is below the value of 35%, which means that sunflower production is homogeneous in Dolj county and the average is representative. There is generally an increasing trend of production per hectare with a few exceptions in 2012, 2015 and 2020.

Analyzing the sunflower production in Romania during this period, an average of 2089.76 kg/ha is found, with a maximum value of 3041 kg/ha achieved in 2018, and the minimum of 1310 kg/ha recorded in 2012. The average sunflower production in Romania tends towards a normal distribution, a fact confirmed by the Jarque-Bera test with the value of 1.003957 and the attached probability p=0.605332 (Skewness=0.430638; Kurtosis=1.945646). Regarding the coefficient of variation, it has a value of 27.02%, leading to a homogeneous production and a representative average in Romania. Regarding the dynamics of sunflower production, there is generally an increasing trend of production per hectare with a few exceptions in 2012, 2015 and 2020, as in the case of Dolj county.

Comparing the agricultural production per hectare of sunflower in the period 2009-2021, obtained at S.C.D.A Simnic, in Dolj county and the total cultivated area in Romania, it is found that there are no significant differences between means from a statistical point of view, according to the t-student test, at a significance level of 5%.

Oat

Oats are mostly used as animal feed, but they are also used in food or bakery products. In the period 2009-2021, average production in Romania was between 1400-2500 kg/ha.

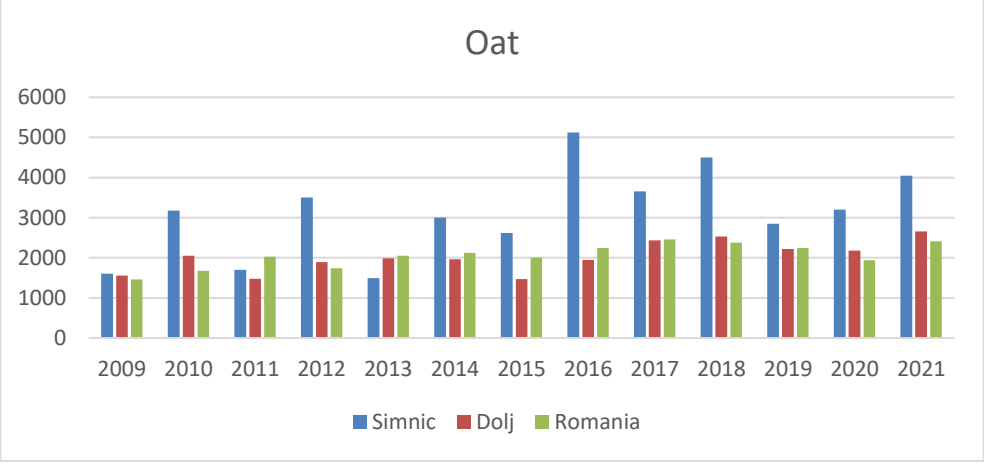

Figure. 4. Dynamics of oat production per hectare in 2009-2021

Source: Own design based on data provided by S.C.D.A Simnic and the National Institute of Statistics, Tempo-online database, 2022

From the analysis of oat production per hectare at S.C.D.A Simnic, an average of 3111.16 kg/ha resulted during the 13 years studied. The maximum production was 5120 kg/ha and was reached in 2016 and the minimum value of 1490 kg/ha was recorded in 2013. It is found that the oat production at S.C.D.A Simnic in the period 2009-2021 tends towards a normal distribution according to the Jarque test - Beer with the value of 0.290952 and attached probability p=0.864611

(Skewness=0.075375; Kurtosis=2.282772). The coefficient of variation has the value of 35.35%, which is at the limit of 35%, that is, we can draw the conclusion of a homogeneous oat production per hectare at S.C.D.A Simnic, the average being representative. Regarding the dynamics of oat production, it is found that it had fluctuations of successive decreases and increases without being able to establish a certain trend.

Regarding the oat production reported at the level of Dolj county, it is found that it had an average of 2026.76 kg/ha in the analyzed period, reaching a maximum value of 2657 kg/ha in 2021, but also a minimum production of 1465 kg/ha in 2015. The average oat production in Dolj tends towards a normal distribution according to the Jarque-Bera test with the value of 0.438408 and the attached probability p=0.803158 (Skewness=-0.004961; Kurtosis=2.100406). The coefficient of variation has the value of 18.81%, which is below the value of 35%, which means that oat production is homogeneous in Dolj county and the average is significant. There is generally an increasing trend of production per hectare starting with 2015 with two exceptions in 2019 and 2020.

Analyzing oat production in Romania during this period, an average of 2058 kg/ha is found, with a maximum value of 2460 kg/ha achieved in 2017, and a minimum value of 1457 kg/ha recorded in 2009. The average oat production in Romania tends towards a normal distribution, a fact confirmed by the Jarque-Bera test with the value of 0.698066 and the attached probability p=0.705370 (Skewness=-0.477337; Kurtosis=2.385724). Regarding the coefficient of variation, it has a value of 14.57%, leading to a homogeneous production and a significant average of oat production in Romania. Regarding the dynamics of oat production, there is generally an increasing trend of production per hectare with a few exceptions in 2012, 2015 and 2020.

Comparing the agricultural production of oats in the period 2009-2021, it is found that there are significant differences between averages, according to the t-student test, between S.C.D.A Simnic on the one hand and the average production obtained in Dolj county and the total cultivated area in Romania, on the other part. Between the average productions in Dolj county and Romania as a whole, there are no significant differences between averages, from a statistical point of view at a significance level of 5%. Thus, the average production in the period 2009-2021 at S.C.D.A Simnic is significantly higher than that at the Dolj county level and at the national level, this fact being due to the cultivation of this crop on fertile land with the possibility of irrigation.

Barley

It is used both as animal feed, but also in food or in the manufacture of beer. During the analyzed period, average production in Romania was between 2200-4500 kg/ha.

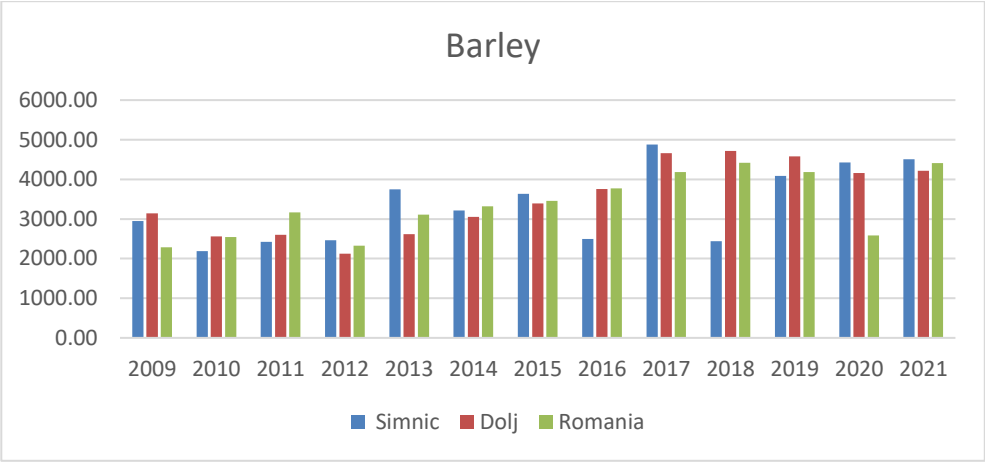

Figure 5. Dynamics of barley production per hectare in 2009-2021
Source: Own design based on data provided by S.C.D.A Simnic and the National Institute of Statistics, Tempo-online database, 2022

Regarding the production of barley per hectare at S.C.D.A Simnic, an average of 3343.23 kg/ha is found in the analyzed period. The maximum production reached 4882 kg/ha and was recorded in 2017 and the minimum value of 2186 kg/ha was recorded in 2010. Barley production at S.C.D.A Simnic in the period 2009-2021 tends towards a normal distribution according to the Jarque-Bera test with the value of 1.184652 and attached probability p=0.553039 (Skewness=0.278653; Kurtosis=1.630161). The coefficient of variation has the value of 27.8%, which is below 35%, that is, we can draw the conclusion of a homogeneous production of barley per hectare at S.C.D.A Simnic, the average being representative. Regarding the dynamics of production, it can be seen that it had fluctuations of successive increases and decreases until 2018, with an increasing trend taking shape in the last 3 years.

Doing a statistical analysis on the production of barley reported at the level of Dolj county, it turns out that it had an average of 3506.23 kg/ha in the analyzed period, with a maximum value of 4714 kg/ha in 2018, but also a minimum production of 2125 kg/ha in 2012. The average production of barley in Dolj tends towards a normal distribution confirmed by the Jarque-Bera test with the value of 1.087265 and the attached probability p=0.580635 (Skewness=0.015240; Kurtosis=1.583551). The coefficient of variation has the value of 25.66%, which means that the production of barley is homogeneous in Dolj county and the average is significant. There is an increasing trend between 2012 and 2018 of production per hectare with a slightly decreasing trend in the last 3 years, but with productions of over 4100 kg/ha.

Analyzing the production of barley at the level of the whole country during this period, an average of 3366.61 kg/ha is found, with a maximum value of 4417 kg/ha achieved in 2018 and a minimum value of 2284 kg/ha recorded in 2009 The average production of barley in Romania tends towards a normal distribution, a fact confirmed by the Jarque-Bera test with the value of 1.045263 and the attached probability p=0.592958 (Skewness=-0.001201; Kurtosis=1.610860). Regarding the coefficient of variation, it has a value of 23.27%, leading to a homogeneous production and a

significant average of barley production in Romania. Regarding the dynamics of barley production, there is generally an increasing trend of production per hectare with two exceptions in 2012 and 2020.

Comparing the agricultural production of barley in the period 2009-2021, it is found that there are no significant differences from a statistical point of view, between the average production at S.C.D.A Simnic, in Dolj county and the total cultivated area in Romania, according to the t-student test at a level of significance of 5%.

Colza

Colza is used both for food products and for the extraction of oil, which is used in the food and biofuel industry. The average per hectare at the national level was between 1300-3000 kg in the period 2009-2021.

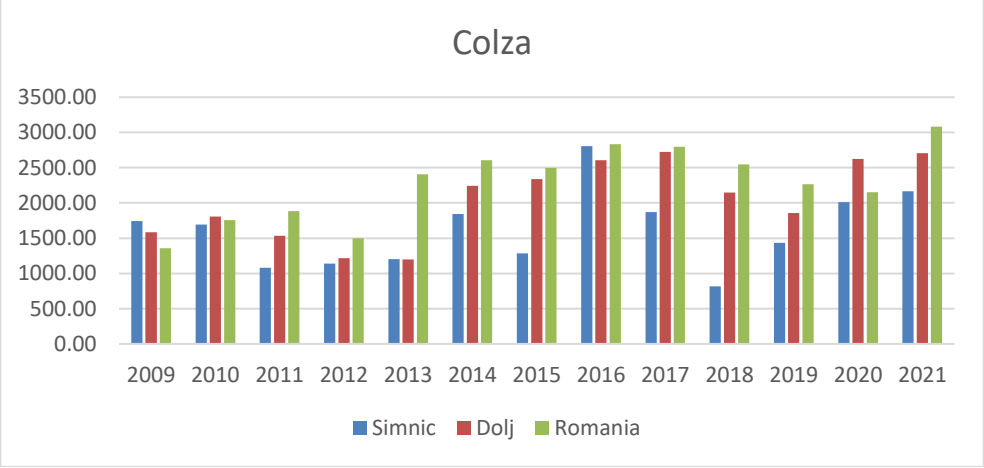

Figure 6. Dynamics of colza production per hectare in 2009-2021

Source: Own design based on data provided by S.C.D.A Simnic and the National Institute of Statistics, Tempo-online database, 2022

Analyzing colza production per hectare at S.C.D.A Simnic, an average of 1622.45 kg/ha is found in the period 2009-2021, with a maximum production of 2808 kg/ha recorded in 2016, and a minimum production of 817 kg/ha in 2018. Colza production at S.C.D.A Simnic during the analyzed period tends towards a normal distribution according to the Jarque-Bera test with a value of 0.672319 with an attached probability p=0.714509 (Skewness=0.554374; Kurtosis=2.890989). The coefficient of variation has the value of 33.21%, which is below 35%, that is, we can draw the conclusion of a homogeneous production of colza per hectare at S.C.D.A Simnic, the average being representative. Regarding the dynamics of production, it can be seen that it had fluctuations of successive increases and decreases until 2018, with an increasing trend taking shape in the last 3 years.

Regarding the colza production reported at the level of Dolj county, it had an average of 2044.61 kg/ha in the analyzed period, with a maximum value of 2724 kg/ha in 2017, but also a minimum production of 1199 kg/ha in 2013. The average colza production in Dolj tends towards a normal distribution confirmed by the Jarque-Bera test with the value of 1.043085 and the attached probability p=0.593604 (Skewness=-0.215868; Kurtosis=1.681175). The coefficient of variation has the value of 26.98%, which means that colza production is homogeneous in Dolj county

and the average is significant. Analyzing the dynamics of production, it is found that it had fluctuations of successive increases and decreases, having a somewhat increasing trend.

For colza production in Romania during this period, there is an average of 2282.92 kg/ha, with the maximum value of 3084 kg/ha achieved in 2021 and a minimum value of 1357 kg/ha recorded in 2009. Averages of colza production in Romania tends towards a normal distribution, a fact confirmed by the Jarque-Bera test with the value of 0.747275 and the attached probability p=0.688226 (Skewness=0.355435; Kurtosis=2.064987). As for the coefficient of variation, it has a value of 23.24%, leading to a homogeneous production and a significant average of colza production in Romania. Regarding the dynamics of colza production, there is generally an increasing trend of production per hectare with two exceptions in 2012 and the period 2017-2019.

Comparing the agricultural production of colza in the period 2009-2021, it is found that there are no significant differences from a statistical point of view, between the production averages at S.C.D.A Simnic and the production in Dolj county, but there is a significant difference between S.C.D.A Simnic and Romania. Also, there are no significant differences from a statistical point of view, between the average production in Dolj and the average production in Romania, according to the t-student test at a significance level of 5%. Thus, the average colza production at S.C.D.A Simnic is significantly lower than the national level, due to the sandy soil and the lack of irrigation system.

Green pea

Peas are used both for food and for oil extraction and fodder production. The average production in Romania during the analyzed period was between 1100 and 2600 kg/ha.

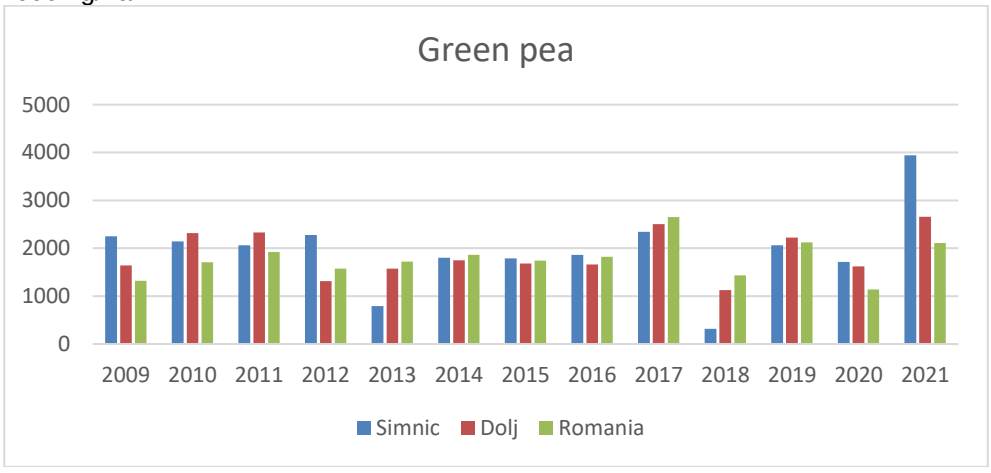

Figure 7. Dynamics of pea production per hectare in 2009-2021

Source: Own design based on data provided by S.C.D.A Simnic and the National Institute of Statistics, Tempo-online database, 2022

Regarding the pea production per hectare at S.C.D.A Simnic, an average of 1950.08 kg/ha was calculated in the period 2009-2021, with a maximum production of 3939 kg/ha recorded in 2021 and a minimum production of only 317 kg/ha in 2018.

Pea production at S.C.D.A Simnic during the analyzed period tends towards a normal distribution according to the Jarque-Bera test with the value of 1.334364 with attached probability p=0.513153 (Skewness=0.303900; Kurtosis=4.447073). The coefficient of variation has the value of 43.1%%, which is above 35%, that is, we can draw the conclusion of a somewhat inhomogeneous pea production per hectare at S.C.D.A Simnic, the average being less representative. Regarding the dynamics of production, it can be seen that it had fluctuations of successive increases and decreases until 2018, with a somewhat increasing trend taking shape in the last 3 years.

Analyzing the pea production reported at the level of Dolj county, it had an average of 1877.07 kg/ha in the analyzed period, with a maximum value of 2503 kg/ha in 2017, but also a minimum production of 1125 kg/ha in 2018 The average pea production in Dolj tends towards a normal distribution confirmed by the Jarque-Bera test with the value of 0.794431 and the attached probability p=0.672189 (Skewness=0.211099; Kurtosis=1.864927). The coefficient of variation has the value of 25.34%, which means that pea production is homogeneous in Dolj county and the average is significant. Analyzing the dynamics of production, it is found that it had fluctuations of successive increases and decreases without being able to establish a certain trend.

Considering the production of pea in Romania during this period, an average of 1779.30 kg/ha is found, with the maximum value of 2649 kg/ha achieved in 2017 and a minimum value of 1143 kg/ha recorded in 2020 The average pea production in Romania tends towards a normal distribution, a fact confirmed by the Jarque-Bera test with the value of 0.595277 and the attached probability p=0.742570 (Skewness=0.500383; Kurtosis=3.312151). Regarding the coefficient of variation, it has the value of 21.73%, leading to a homogeneous production and a significant average of the pea production in Romania. Regarding the dynamics of pea production, it is recorded that it had fluctuations of successive increases and decreases without being able to establish a certain trend.

Comparing the agricultural production of peas in the period 2009-2021, it is found that there are no significant differences from a statistical point of view, between the production averages at S.C.D.A Simnic, the production in Dolj county, respectively Romania, according to the t-student test at a significance level of 5%.

5. Conclusions

In the paper, a comparative statistical analysis was made between the average productions obtained per hectare for several agricultural crops at the S.C.D.A Simnic level, respectively in Dolj county and at the national level. It was thus identified that there are no statistically significant differences between the crops of wheat, sunflower, barley and peas, at a significance threshold of 5%. At the same time, the average production per hectare of silage corn and colza in the period 2009-2021 at the S.C.D.A Simnic level is significantly lower compared to that at the national level, this is due to the less favorable soil for these crops and the lack of irrigation systems at the level of the resort of research. On the other hand, the average agricultural production per hectare of oats at S.C.D.A Simnic is significantly higher than the average production obtained in Dolj County and at the national level, this being due to the cultivation of oats on irrigated surfaces, the soil being rich in phosphorus and potassium. It is thus recommended to increase the irrigated areas at S.C.D.A Simnic,

possible by accessing non-reimbursable European funds, crop rotation, as well as the use of nitrogen-based fertilizers in order to increase the productivity.

As further developments, we propose to do a comparative statistical analysis regarding cattle production, between S.C.D.A Simnic, Dolj county and at the national level.

REFERENCES

Anghelache, C., 2018. Structural analysis of Romanian agriculture. *Revista Română de Statistică - Supliment* nr. 2, pg. 11-18.

Barbu, C. M., 2011. The Romanian agriculture - between myth and reality. Annales Universitatis Apulensis Series Oeconomica, 13(2), pg. 485-496.

Brooks, C., 2008. *Introductory Econometrics for Finance*, 2nd Edition, Cambridge University Press.

Buliga-Ștefanescu, A., 2019. Analysis of the evolution of the vegetable agricultural production in Romania. *Analele Univerrsităţii diin Craiova, seria Agricultură – Montanologie – Cadastru*, Vol.. XLIIX, pg. 251-257.

Grigoras, M. A., 2016. Trends in Romania's agricultural production. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, Vol. 16, Issue 1, pg.183-192.

Maddala, G. S., 2001. *Introduction to Econometrics*, John Wiley & Sons.

Popescu, Gh. H., Istudor, N., Nica, E., Vasile, A. J., Ion, R. A., 2017. The influence of land-use change paradigm on Romania's agro-food trade competitiveness - An overview, Land Use Policy, vol. 61, pg. 293–301.

Popescu, A., 2021. The development of agricultural production in Romania in the period 2010-2019- A statistical approach. *Annals of the Academy of Romanian Scientists Series on Agriculture, Silviculture and Veterinary Medicine Sciences*, vol. 10, nr. 1, pg. 107-123.

Radu, L., 2018. The agricultural crops production of Romania. *"Ovidius" University Annals, Economic Sciences Series*, vol. XVIII, nr. 2, pg.177-181.

Tudor V. C., Popa D., Gimbășanu, G. F., 2017. The analysis of the cultivated areas, the production and the selling price for maize crops during the pre- and post-accession periods of Romania to the European Union and trends of evolution of these indicators, *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, vol. 17, nr. 2, pp. 387-394.

Wooldridge, J., 1999. *Introductory Econometrics: A modern Approach*, South-Western College Pub.

National Institute of Statistics, http://statistici.insse.ro:8077/tempo-online/

Appendix

Table 1. Statistical analysis of the evolution of the average production per hectare in the period 2009-2021 in the main agricultural crops in S.C.D.A. Simnic.

	Mean	Standard Error	Median	Standard Deviation	Coef. of variation	Sample Variance	Minimum	Maximum
Wheat	4042.49	183.55	4000	661.81	16.37%	437995.27	3079	5007
Corn silage	12888.47	1504.61	10920	5424.95	42.09%	29430141.02	7728	24174
Sunflower	1921.99	122.46	1885	441.56	22.97%	194981.66	1061	2625
Oat	3111.16	305.09	3172	1100.02	35.35%	1210057.60	1490	5120
Barley	3343.23	257.83	3218	929.64	27,8%	864244.83	2186	4882
Colza	1622.45	149.44	1691.95	538.83	33.21%	290344.43	817	2808
Green peas	1950.08	233.12	2061	840.55	43.1%	706540.90	317	3939

Source: Developed by author with software Eviews

Table 2. Statistical analysis of the evolution of the average production per hectare in the period 2009-2021 in the main agricultural crops in DOLJ county

	Mean	Standard Error	Median	Standard Deviation	Coefficient of variation	Sample Variance	Minimum	Maximum
Wheat	3437.46	229.94	3270	829.09	24.11%	687394.26	2326	4673
Corn silage	14654.61	2301.41	12699	8297.86	56.62%	68854575.42	7135	40000
Sunflower	2112.53	163.59	1829	589.83	27.92%	347909.76	1206	3027
Oat	2026.76	105.75	1988	381.30	18.81%	145395.52	1465	2657
Barley	3506.23	249.54	3392	899.73	25.66%	809527.85	2125	4714
Colza	2044.61	153.04	2148	551.80	26.98%	304486.75	1199	2724
Green peas	1877.07	131.96	1684	475.80	25.34%	226387.24	1125	2503

Source: Developed by author with software Eviews

Table 3. Statistical analysis of the evolution of the average production per hectare in the period 2009-2021 in the main agricultural crops in Romania

	Mean	Standard Error	Median	Standard Deviation	Coefficient of variation	Sample Variance	Minimum	Maximum
Wheat	3723	244.59	3663	881.91	23.68%	777766.66	2421	4888
Corn silage	25528.23	838.52	26249	3023.33	11.84%	9140552.85	18651	30782
Sunflower	2089.76	156.62	1955	564.72	27.02%	318919.35	1310	3041
Oat	2058	83.17	2051	299.88	14.57%	89931	1459	2460
Barley	3366.61	217.30	3319	783.51	23.27%	613900.42	2284	4417
Colza	2282.92	147.20	2408	530.76	23.24%	281708.41	1357	3084
Green peas	1779.30	107.27	1744	386.78	21.73%	149599.73	1143	2649

Source: Developed by author with software Eviews

Table 4. Jarque-Bera test for S.C.D.A Simnic

	Jarque-Bera test	Probability	Skewness	Kurtosis	Conclusion
Wheat	1.192199	0.550956	0.185389	1.563509	normal distribution
Corn silage	2.599960	0.272537	1.089843	2.778874	normal distribution
Sunflower	0.440939	0.802142	-0.299549	2.325372	normal distribution
Oat	0.290952	0.864611	0.075375	2.282772	normal distribution
Barley	1.184652	0.553039	0.278653	1.630161	normal distribution
Colza	0.672319	0.714509	0.554374	2.890989	normal distribution
Green peas	1.334364	0.513153	0.303900	4.447073	normal distribution

Source: Developed by author with software Eviews

Table 5. Jarque-Bera test for Dolj county

	Jarque-Bera test	Probability	Skewness	Kurtosis	Conclusion
Wheat	1.274406	0.528769	0.412092	1.706373	normal distribution
Corn silage	25.49417	0.000003	2.360115	7.978512	distribution is not normal
Sunflower	1.067689	0.586346	0.382571	1.822852	normal distribution
Oat	0.438408	0.803158	-0.004961	2.100406	normal distribution
Barley	1.087265	0.580635	0.015240	1.583551	normal distribution
Colza	1.043085	0.593604	-0.215868	1.681175	normal distribution
Green peas	0.794431	0.672189	0.211099	1.864927	normal distribution

Source: Developed by author with software Eviews

Table 6. Jarque-Bera test for Romania

	Jarque-Bera test	Probability	Skewness	Kurtosis	Conclusion
Wheat	0.943048	0.624051	0.017547	1.680993	normal distribution
Corn silage	0.845015	0.655401	-0.581433	3.455819	normal distribution
Sunflower	1.003957	0.605332	0.430638	1.945646	normal distribution
Oat	0.698066	0.705370	-0.477337	2.385724	normal distribution
Barley	1.045263	0.592958	-0.001201	1.610860	normal distribution
Colza	0.747275	0.688226	-0.355435	2.064987	normal distribution
Green peas	0.595277	0.742570	0.500383	3.312151	normal distribution

Source: Developed by author with software Eviews

Table 7. Analysis of the comparison of agricultural production per hectare between S.C.D.A Simnic and Dolj county. F-Test Two-Sample for Variances

	Calculated value of F-test / probability associated with the F-test	**The theoretical value of the F-test**	**Conclusions**
Wheat	F_c= 56941025 P=0.22320058	2.686637112	The null hypothesis H_0 is accepted. There is no significant difference between variances.
Sunflower	F_c=1.784322837 P=0.164611306	2.686637112	The null hypothesis H_0 is accepted. There is no significant difference between variances.

Oat	F_c=8.322523016 P=0.000435462	2.686637112	The null hypothesis H_0 is rejected. The alternative hypothesis H_1 is accepted. There is a significant difference between variances.
Barley	F_c=1.06759122 P=0.455831196	2.686637112	The null hypothesis H_0 is accepted. There is no significant difference between variances.
Colza	F_c=1.048708791 P=0.467849974	2.686637112	The null hypothesis H_0 is accepted. There is no significant difference between variances.
Green peas	F_c=3.120939581 P=0.029841083	2.686637112	The null hypothesis H_0 is rejected. The alternative hypothesis H_1 is accepted. There is a significant difference between variances

Source: Developed by author with software Eviews

Table 8. Analysis of the comparison of agricultural production per hectare between S.C.D.A Simnic and Romania. F-Test Two-Sample for Variances

	Calculated value of F-test / probability associated with the F-test	**The theoretical value of the F-test**	**Conclusions**
Wheat	F_c= 1.775742151 P=0.166605923	2.686637112	The null hypothesis H_0 is accepted. There is no significant difference between variances.
Corn silage	F_c=3.219733148 P=0.026669119	2.686637112	The null hypothesis H_0 is rejected. The alternative hypothesis H_1 is accepted. There is a significant difference between variances
Sunflower	F_c=1.635639887 P=0.203096086	2.686637112	The null hypothesis H_0 is accepted. There is no significant difference between variances.
Oat	F_c=13.45540035 P=3.73328E-05	2.686637112	The null hypothesis H_0 is rejected. The alternative hypothesis H_1 is accepted. There is a significant difference between variances
Barley	F_c=1.407793 P=0.281353	2.686637112	The null hypothesis H_0 is accepted. There is no significant difference between variances
Colza	F_c=1.030655882 P=0.479574353	2.686637112	The null hypothesis H_0 is accepted. There is no significant difference between variances
Green peas	F_c=4.72287554 P=0.005881929	2.686637112	The null hypothesis H_0 is rejected. The alternative hypothesis H_1 is accepted. There is a significant difference between variances

Source: Developed by author with software Eviews

Table 9. Analysis of the comparison of agricultural production per hectare between Dolj county and Romania. F-Test Two-Sample for Variances

	Calculated value of F-test / probability associated with the F-test	The theoretical value of the F-test	Conclusions
Wheat	F_c= 1.131470979 p=0.417040947	2.686637112	The null hypothesis H_0 is accepted. There is no significant difference between variances
Sunflower	F_c=1.090902008 p=0.441340827	2.686637112	The null hypothesis H_0 is accepted. There is no significant difference between variances
Oat	F_c=1.616745345 p=0.208630658	2.686637112	The null hypothesis H_0 is accepted. There is no significant difference between variances
Barley	F_c=1.318663139 p=0.319705901	2.686637112	The null hypothesis H_0 is accepted. There is no significant difference between variances
Colza	F_c=1.080857885 p=0.447537268	2.686637112	The null hypothesis H_0 is accepted. There is no significant difference between variances
Green peas	F_c=1.513286437 p=0.241855115	2.686637112	The null hypothesis H_0 is accepted. There is no significant difference between variances

Source: Developed by author with software Eviews

Table 10. t-Test: Two-Sample Assuming Equal/Unequal Variances between S.C.D.A Simnic and Dolj county

	Calculated value of t-test / probability associated with the t-test	The theoretical value of the t-test	Conclusions
Wheat	t_c= -2.056355247 P=0.050778076	2.063898562	The null hypothesis H_0 is accepted. There is no significant difference between means.
Sunflower	t_c= 0.932432531 P=0.360399221	2.063898562	The null hypothesis H_0 is accepted. There is no significant difference between means
Oat	t_c= 3.358291358 P=0.004311382	2.131449546	The null hypothesis H_0 is rejected. The alternative hypothesis H_1 is accepted. There is a significant difference between means.
Barley	t_c=-0.454256955 p=0.653725572	2.063898562	The null hypothesis H_0 is accepted. There is no significant difference between means

Colza	t_c=1.973561843 p=0.06005209	2.063898562	The null hypothesis H_0 is accepted. There is no significant difference between means
Green peas	t_c=0.272540002 p=0.788146764	2.093024054	The null hypothesis H_0 is accepted. There is no significant difference between means

Source: Developed by author with software Eviews

Table 11. t-Test: Two-Sample Assuming Equal/Unequal Variances between S.C.D.A Simnic and Romania

	Calculated value of t-test / probability associated with the t-test	**The theoretical value of the t-test**	**Conclusions**
Wheat	t_c= 1.044741029 p=0.306551919	2.063898562	The null hypothesis H_0 is accepted. There is no significant difference between means
Corn silage	t_c=7.338068165 p=5.89754E-07	2.093024054	The null hypothesis H_0 is rejected. The alternative hypothesis H_1 is accepted. There is a significant difference between means
Sunflower	t_c= 0.843852377 p=0.407084621	2.063898562	The null hypothesis H_0 is accepted. There is no significant difference between means
Oat	t_c= 3.3304237 p=0.004953185	2.144786688	The null hypothesis H_0 is rejected. The alternative hypothesis H_1 is accepted. There is a significant difference between means
Barley	t_c=-0.069338978 p=0.945294305	2.063898562	The null hypothesis H_0 is accepted. There is no significant difference between means
Colza	t_c=-3.148505416 p=0.004349404	2.063898562	The null hypothesis H_0 is rejected. The alternative hypothesis H_1 is accepted. There is a significant difference between means
Green peas	t_c=0.665478936 p=0.514672702	2.109815578	The null hypothesis H_0 is accepted. There is no significant difference between means

Source: Developed by author with software Eviews

Table 12. t-Test: Two-Sample Assuming Equal/Unequal Variances between Dolj county and Romania

	Calculated value of t-test / probability associated with the t-test	The theoretical value of the t-test	Conclusions
Wheat	t_c=0.850538 p=0.403432	2.063898562	The null hypothesis H_0 is accepted. There is no significant difference between means
Sunflower	t_c= 0.100533952 p=0.920755561	2.063898562	The null hypothesis H_0 is accepted. There is no significant difference between means
Oat	t_c= -0.232123396 p=0.818410095	2.063898562	The null hypothesis H_0 is accepted. There is no significant difference between means
Barley	t_c=0.421926845 p=0.676833956	2.063898562	The null hypothesis H_0 is accepted. There is no significant difference between means
Colza	t_c=1.122247433 p=0.27285972	2.063898562	The null hypothesis H_0 is accepted. There is no significant difference between means
Green peas	t_c=0.574893601 p=0.570713801	2.063898562	The null hypothesis H_0 is accepted. There is no significant difference between means

Source: Developed by author with software Eviews

Table 13. Average production kg/ha S.C.D.A. Simnic

	Wheat	Colza	Barley	Oat	Sunflower	Green peas	Corn silage
2009	3530.21	1741.98	2947.37	1600	1805.56	2250	14504
2010	4098	1691.96	2186	3172	1438.85	2140.44	8964.71
2011	4758	1078	2422	1700	1503	2061	24174
2012	4000	1141	2460	3500	2142.857	2274	10800
2013	4797	1205	3745	1490	1863	795	7728
2014	3533	1845	3218	3000	2389	1800	22202
2015	3582	1283	3637	2618	1885	1788	8551
2016	3346	2808	2500	5120	1592	1865	10920
2017	5007	1869	4882	3655	2328	2343	9193
2018	3079	817	2440	4500	2625	317	18584
2019	3540	1434	4090	2848	2235	2063	11516
2020	4393	2012	4427	3198	2118	1716	8624
2021	4889	2166	4508	4044	1061	3939	11789

Source: Data provided by S.C.D.A Simnic

Table 14. Average production kg/ha Dolj county

	Wheat	Colza	Barley	Oat	Sunflower	Green peas	Corn silage
2009	2586	1583	3141	1556	1672	1643	7135
2010	2619	1806	2557	2054	1797	2317	14983
2011	3056	1533	2599	1473	1829	2331	14514
2012	2326	1216	2125	1889	1206	1316	20000
2013	2831	1199	2620	1988	1776	1572	11000
2014	3128	2243	3055	1963	2213	1748	40000
2015	3319	2336	3392	1465	1659	1684	8643
2016	3357	2605	3756	1950	1697	1662	14091
2017	4510	2724	4664	2432	3027	2503	10000
2018	4521	2148	4714	2526	2765	1125	12699
2019	4491	1856	4578	2217	2946	2224	12309
2020	3270	2625	4161	2178	2045	1619	10434
2021	4673	2706	4219	2657	2831	2658	14702

Source: Data provided by National Institute of Statistics, Tempo-online database, 2002

Table 15. Average production kg/ha Romania

	Wheat	Colza	Barley	Oat	Sunflower	Green peas	Corn silage
2009	2421	1357	2284	1459	1433	1323	24363
2010	2688	1755	2542	1679	1597	1708	27407
2011	3663	1882	3170	2028	1798	1922	24805
2012	2652	1496	2325	1743	1310	1572	18651
2013	3468	2408	3111	2051	1993	1719	22395
2014	3590	2604	3319	2124	2187	1864	28091
2015	3780	2499	3461	1999	1765	1744	26862
2016	3944	2835	3773	2239	1955	1823	23461
2017	4888	2798	4186	2460	2917	2649	27699
2018	4793	2546	4417	2376	3041	1435	30782
2019	4749	2264	4188	2243	2783	2121	26475
2020	2966	2150	2582	1941	1858	1143	24627
2021	4797	3084	4408	2412	2530	2108	26249

Source: Data provided by National Institute of Statistics, Tempo-online database, 2022