Market trends of oilseeds production in Ukraine

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Abstract
This article analyses the recent research on the production and development of the oilseeds, set production dynamics and structure of sown areas of oil relative to the area of industrial crops. Defined synchronicity yield fluctuations sunflower, soybeans and rape seed. Established correlation between the yield of certain types of oilseeds and proposed strategic priorities for future development of oilseeds market. Production of oilseeds for agricultural enterprises is one of the main sources of profitability that allows for their efficient operation. Production of oilseeds plays an important role in providing valuable food, livestock industry - nutritious food, processing industry - with raw materials. In a market economy to the economic oilseeds are the reliable source of cash income, their seeds and processed competitive and demand in the domestic and global markets. Ukraine - the world leader in the processing and production of sunflower oil, domestic oil and fat industry shows positive dynamics of production and development even during the crisis.

Keywords: oil and fat industry, oilseeds, production dynamics, correlation coefficient pair

JEL classification: Q10, Q13, Q17

1. Introduction
Domestic oil and fat industry is one of the most advanced and promising segments of the food sector of Ukrainian economy. In recent years there has been steady increase in production of major oil and fat products. The main factor of the increase in output is the growth in world consumption of oil and fat products and the associated significant increase in its exports by domestic producers. In its turn, the main reasons for increase in demand are: reorientation in the structure of nutrition for preferential use of vegetable oils and fats because of their physiological superiority and more affordable prices compared to animal fats and increased use of vegetable oils in technical purposes, production of detergents, lubricants and especially biodiesel.

These issues are important and require in-depth research and scientific support

2. Data and Methods
The purpose of the article is to evaluate variations of dynamics of productivity of oilseeds and identify the main trends of development of the market of oilseeds in Ukraine.

The basis of the study is formed by the scientific works of local scientists on the problems of the market of oilseeds in Ukraine and abroad, materials of the Ministry of Agrarian Policy, the Cabinet of Ministers of Ukraine, the State Statistics Service, US Department of Agriculture (USDA) with using monographic (the study of the causes of low productivity of oilseeds ), statistical and economic (to analyze key indicators of production and sales of oilseeds), abstract and logical (for theoretical generalization of research results and formulation of
conclusion) and balance (for the calculation of the balance sheet) combination of quantitative and qualitative analysis, and also tabular method of displaying information.

3. Results and Discussion

Production of oilseeds in Ukraine for many years has focused primarily on sunflower as the main raw material for industrial production. Rape is an attractive crop for the market, the demand for which is constantly growing. This crop is the source of green fodder and restoration of soil fertility, excellent raw material for biofuel production. Ukraine the industry of rape-growing and industrial processing has great potential to be implemented through market mechanisms. Soybean is a valuable plant in terms of agronomy because it enriches the soil with nitrogen, improves its structure. It is in demand among producers of agricultural products as a profitable crop.

Main oil crops in the national agricultural market is the sunflower, whose share in the total production of oilseeds on average over the last three years is 6%. Sunflower is the most profitable among other oilseeds. At the same time, in recent years, the level of profitability of cultivation reduced (from 45.5% in 2012 to 36.5% in 2014) as a result of increased production costs due to the use of expensive seeds and improving the culture of farming [2].

Production of major oilseeds in 2012-2014 increased by 4,214 thousand tons, or 30.1%, due to the increased production of rapeseed to 993.6 thousand tons or 82.5%, of soybean - to 1471.7 thousand tons or 61.1%. The main place in the structure of sown areas of oilseeds is occupied by sunflower - up to 65%. The increase in oilseed sowing on 722 thousand hectares (7.7%) in the last three years was due to the increase in rape crops up to 1,240 thousand hectares (219%) and soybeans up to 63 thousand hectares (1.2%). There should be noted the positive dynamics of yield of oilseeds. Thus, the average sunflower yield increased by 2.9 centner/ha, of rape - by 3.4 centner/ha, of soybean - by 4.5 centner/ha [3,4]. But we can consider as a real achievement the results of the production of soybean, as a significant increase in productivity occurred at the background of a decline of sown areas which indicates the growth of processes of intensification of production of rapeseed in Ukraine (table 1).

Table 1: The structure of sown areas of oilseeds in Ukraine

<table>
<thead>
<tr>
<th>Crop</th>
<th>Sown area, thousand/ha</th>
<th>Yield, centner/ha</th>
<th>Gross harvest, thousand tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunflower</td>
<td>5194</td>
<td>5051</td>
<td>5257</td>
</tr>
<tr>
<td>Rape</td>
<td>566</td>
<td>1017</td>
<td>1806</td>
</tr>
<tr>
<td>Soybean</td>
<td>1476</td>
<td>1370</td>
<td>882</td>
</tr>
<tr>
<td>Total</td>
<td>9248</td>
<td>9451</td>
<td>9959</td>
</tr>
</tbody>
</table>

Source: calculated according to the data of ukrstat.gov.ua (*excluding the temporarily occupied territory of the Autonomous Republic of Crimea and the city of Sevastopol and excluding the zone of the antiterrorist operation)

The results of analysis of the dynamics of certain oilseeds yield indicate that the most stable oilseed is sunflower (table 2). At the same, during the years of 2000-2014 there can be observed discrepancies of periods of decline and increase of productivity of some crops. In particular, in 2001 compared with 2000 the increase of rapeseed yield was 47.62%, while the yield of sunflower seeds and soybeans fell by 22.95% and 4.72% respectively. In 2004 compared with 2003 the yield of sunflower seeds declined by 20.54%, and the yield of soybeans and rapeseed tended to increase – 16.39% and 47.87% respectively. In 2014
compared with 2013 the yield of sunflower seeds decreased by 10.6% and the yield of rapeseed and soybeans tended to increase – 8.09% and 5.37% respectively.

**Table 2: Dynamics of yield of oilseeds in Ukraine for the years 2000-2014**

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Sunflower seeds</td>
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<td></td>
</tr>
<tr>
<td>Yield, centner/ha</td>
<td>12.2</td>
<td>9.4</td>
<td>12.0</td>
<td>11.2</td>
<td>8.9</td>
<td>12.8</td>
<td>13.6</td>
<td>12.2</td>
<td>15.3</td>
<td>15.2</td>
<td>15.0</td>
<td>18.4</td>
<td>16.5</td>
<td>21.7</td>
<td>19.4</td>
<td>14.3</td>
</tr>
<tr>
<td>Absolute growth (chain), centner/ha</td>
<td>-2.8</td>
<td>2.6</td>
<td>-0.8</td>
<td>-2.3</td>
<td>3.9</td>
<td>0.8</td>
<td>-1.4</td>
<td>3.1</td>
<td>-0.1</td>
<td>-0.2</td>
<td>3.4</td>
<td>-1.9</td>
<td>5.2</td>
<td>-2.3</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td>Growth rate (chain), %</td>
<td>-23.0</td>
<td>27.7</td>
<td>-6.7</td>
<td>-20.5</td>
<td>43.8</td>
<td>6.2</td>
<td>-10.3</td>
<td>25.4</td>
<td>-0.7</td>
<td>-1.3</td>
<td>22.7</td>
<td>-10.3</td>
<td>31.5</td>
<td>-10.6</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Rape seeds</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Yield, centner/ha</td>
<td>8.4</td>
<td>12.4</td>
<td>8.7</td>
<td>9.4</td>
<td>13.9</td>
<td>14.6</td>
<td>15.7</td>
<td>13.1</td>
<td>20.8</td>
<td>18.5</td>
<td>17.0</td>
<td>17.3</td>
<td>22.0</td>
<td>23.5</td>
<td>25.4</td>
<td>16.0</td>
</tr>
<tr>
<td>Absolute growth (chain), centner/ha</td>
<td>-4.0</td>
<td>-3.7</td>
<td>0.7</td>
<td>4.5</td>
<td>0.7</td>
<td>1.1</td>
<td>-2.6</td>
<td>7.7</td>
<td>-2.3</td>
<td>-1.5</td>
<td>0.3</td>
<td>4.7</td>
<td>1.5</td>
<td>1.9</td>
<td>17.0</td>
<td></td>
</tr>
<tr>
<td>Growth rate (chain), %</td>
<td>-47.6</td>
<td>-29.8</td>
<td>8.0</td>
<td>47.9</td>
<td>5.0</td>
<td>7.5</td>
<td>-16.6</td>
<td>58.8</td>
<td>-11.1</td>
<td>-8.1</td>
<td>1.8</td>
<td>27.2</td>
<td>6.8</td>
<td>8.1</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Soybeans</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Yield, centner/ha</td>
<td>10.6</td>
<td>10.1</td>
<td>12.7</td>
<td>12.2</td>
<td>14.2</td>
<td>14.5</td>
<td>12.4</td>
<td>12.4</td>
<td>15.1</td>
<td>16.8</td>
<td>16.2</td>
<td>20.4</td>
<td>17.1</td>
<td>20.5</td>
<td>21.6</td>
<td>15.1</td>
</tr>
<tr>
<td>Absolute growth (chain), centner/ha</td>
<td>-0.5</td>
<td>2.6</td>
<td>-0.5</td>
<td>2.0</td>
<td>0.3</td>
<td>-2.1</td>
<td>0.0</td>
<td>2.7</td>
<td>1.7</td>
<td>-0.6</td>
<td>4.2</td>
<td>-3.3</td>
<td>3.4</td>
<td>1.1</td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td>Growth rate (chain), %</td>
<td>-4.7</td>
<td>25.7</td>
<td>-3.9</td>
<td>16.4</td>
<td>2.1</td>
<td>-14.5</td>
<td>0.0</td>
<td>21.8</td>
<td>11.3</td>
<td>-3.6</td>
<td>25.9</td>
<td>-16.2</td>
<td>19.9</td>
<td>5.4</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Source: calculated according to the data of State Statistics Service of Ukraine [1]

The highest average yield for the period of 2000-2014 is observed in rapeseed - 16 centner/ha. The equations of linear trends of oilseeds yield (Fig. 1) shows that the largest average annual increase of productivity from 1 hectare of harvesting area is observed in rapeseed – 1.0925 centner/ha. At the same time, the average annual increase of productivity of soybeans from 1 hectare of harvesting area is at the level of 0.7411 centner/ha; average annual increase of productivity of sunflower seeds from 1 hectare of harvesting area – 0.7154 centner/ha [5,6].
Fig. 1. Dynamics of productivity of the major oilseeds in Ukraine

Sunflower seeds

\[ y = 0.7154x + 8.5305 \]

\[ R^2 = 0.7774 \]

Rape seeds

\[ y = 1.0925x + 7.3067 \]

\[ R^2 = 0.8461 \]

Soybeans

\[ y = 0.7411x + 9.1914 \]

\[ R^2 = 0.8414 \]

Source: constructed by the authors according to the data of State Statistics Service of Ukraine [1]

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The yield of some oilseeds and the total sowing area should provide the overall stable and necessary harvest of oilseeds. To study the fluctuations of productivity we will calculate the characteristics of variation of oilseeds yield. For this purpose, we will use the mean square deviation indicator that shows how much in the average the yield of certain oilseeds deviate from their average value. On the basis of primary, not grouped data the mean square deviation is calculated by the formula (1):

$$
\delta = \sqrt{\frac{1}{n} \sum_{i=1}^{n} (x_i - \bar{x})^2}, \quad (1)
$$

where \( x_i \) – \( i \)-й sampling unit;

\( \bar{x} \) – the arithmetic mean of the sample \( \bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i \);

\( n \) – the volume (size) of the sample.

To compare the variation of the various features in one set or of a single feature in several sets with different average value the relative indicators of variation are used - variation coefficients, which are calculated as a ratio of absolute values of the variations to the arithmetic mean and are expressed as a percentage. The value of these coefficients depends on how exactly the absolute characteristics of variation is used. Among the variation coefficients the most commonly used indicator, which is calculated by the mean square deviation (Formula 2):

$$
V_r = \frac{\delta}{\bar{x}}, \quad (2)
$$

The variation is considered weak, if \( V_r < 10\% \), if \( V_r \) from 11–25%, but average and significant at \( V_r > 25\% \).

Table 3 shows the general characteristic of variation of oilseeds yield.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Sunflower seeds</th>
<th>Rape seeds</th>
<th>Soybeans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean square deviation, ( \delta )</td>
<td>3,51</td>
<td>5,13</td>
<td>3,49</td>
</tr>
<tr>
<td>Range of variation, ( R )</td>
<td>12,8</td>
<td>17,0</td>
<td>11,5</td>
</tr>
<tr>
<td>Variation coefficient, ( V_r )</td>
<td>0,25</td>
<td>0,32</td>
<td>0,23</td>
</tr>
</tbody>
</table>

Source: calculated according to the data of State Statistics Service of Ukraine [1]

It should be noted that the totality is considered homogeneous when the coefficient of variation does not exceed 33%. Based on the obtained values (25,0%, 32,0%, 23,0%) the studied totalities (yield of sunflower seeds, soybeans, rapeseed) meet the condition of homogeneity.

The calculation results in Table 4 show that the variation in the yield of sunflower seeds and soybeans yield is average. The biggest fluctuations in productivity are observed in growing rape \( (V_r = 0,32 \text{ or } 32\%) \).
To determine the synchronicity of fluctuations of yield of sunflower seeds, rapeseed, soybeans, we calculate the coefficients of pair correlation.

The coefficients of pair correlation називають the ratio of the correlation moment to the derivative of the average square deviations (formula 3):

$$r = \frac{\sum \left( x_i - \overline{x} \right) \left( y_i - \overline{y} \right)}{\sqrt{\sum \left( x_i - \overline{x} \right)^2 \left( y_i - \overline{y} \right)^2}}, \quad (3)$$

where both $x_i$, and $y_i$ – the numerical values of the quantities, between which the correlation is set;

$\overline{x}$, $\overline{y}$ – their average arithmetical values of the quantities.

The coefficient of pair correlation does not depend on the count start and units of measure. The negative value ($r_{yx}$) indicates different directions of yield fluctuations of oilseeds and the positive - on the one-pointedness.

The coefficient of pair correlation is interpreted as follows:

1) at $0 < |r_{yx}| < 0.3$ weak nature of changes;
2) at $0.3 < |r_{yx}| < 0.7$ average nature of changes;
3) at $0.7 < |r_{yx}| < 1$ tight nature of changes.

On the basis of the results obtained it is found that the coefficient of the pair correlation, which reflects the level and direction of the fluctuation matches of the yield of sunflower seeds and soybeans yield is 0.89, that proves a rather tight nature of changes.

The coefficient of pair correlation between the variation of the yield of sunflower seeds and rape seeds yield was 0.82, that proves close relation between the yield of the studied crops.

The coefficient of pair correlation between the variation of the yield of soybeans and rape seeds yield was 0.84, that proves close relation between the yield of the studied crops.

Thus, the calculated coefficients of pair correlation indicate unidirectionality of fluctuations of yield of investigated oilseeds, confirming the identical response to the climatic conditions of the formation of yield of the studied oilseeds.

With the increased production of major oilseeds, the power of their processing also grows and the infrastructure of the market of oilseeds changes accordingly. An important modern development trend of this market - it is putting into operation the universal processing plants not only for sunflower seeds, but also soybean, rapeseed. The decisive in placing the enterprises of fat and oil complex is a raw material factor, which is associated with high material intensity of a unity of the final product, as cultivation of oilseeds in Ukraine is located unevenly. The main part of cultivated areas is concentrated in eight regions: Dnipropetrovsk, Donetsk, Zaporizhia, Luhansk, Mykolaiv, Odesa, Kharkiv. It is there where major production capacities are located [7].

Research has established that a characteristic feature of modern agricultural market is the integration processes. Large companies, manufacturers of raw materials at the market of
oilseeds of Ukraine, continue increasing own production and processing capacities. Ukrainian oil and fat industry is represented by companies that are affiliated with "Ukroliyaprom" as well as big companies CJSC "Cargill", LLC "Toepfer" SE "Suntrade", PF "KMT", "Bunge", "Kernel". All companies work on the basis of large plants. Currently, the sector consists of 17 large enterprises. Existing capacities of oil and fat enterprises of Ukraine allow during the year to process up to 4.5 million tons of oilseeds (usually sunflower and rape), and you can get 1.5 million tons of sunflower oil, 380 thousand tons of margarine, 105 thousand tons of mayonnaise. Substantial representatives and entities of the agricultural market are agricultural holdings. Their emergence in agriculture of Ukraine is a new phenomenon for our country. In agriculture such structures began to be established later than in other industries, not only in Ukraine but also in other countries. Agricultural holdings now combine in a closed cycle all stages of the production process of sunflower with its subsequent processing into oil.

The growth of production of major oilseeds in recent years is due to the development of processing capacities of oil raw materials (especially of sunflower), and the steady demand from European buyers for rapeseed and soybeans. An important tendency of development of processing capacities in Ukraine is the construction of universal plants that process not only sunflower seeds, but also soybeans and rapeseed.

The structure of sowing areas of major oilseeds is changing: the areas under soybean are reduced in favor of the areas of rapeseed, but leadership is reserved for sunflower. The main advantages of sunflower in the agricultural market are stable high demand for the crop, high prices on the domestic market.

Occupying a leading position in the global production of oilseeds, Ukraine has a competitive advantage in the market of oilseeds. However, the current competitiveness of Ukrainian oilseed is determined only by larger volumes and lower prices compared with other countries. To ensure the competitiveness of oilseeds in the domestic and foreign markets is possible through the growth of yields through the use of highly efficient advanced production technology and increasing volumes of processing of soybeans and rapeseed. Further studies are needed for the questions of the development of a complex of measures to optimize the sown areas through the introduction of crop rotation, improving manufacturability and ecological compatibility of production. Ensuring the increase in the competitiveness of oilseeds in the conditions of Ukraine's associated membership in the European Union.

4. Conclusion

In a market economy for economic entities oilseeds, particularly sunflower seeds, are the reliable source of cash income (in 2014/15 the country's export revenues from corn (3 356 billion dollars) and wheat (2 293 billion dollars) - the leaders of Ukrainian exports in the past - for the first time were lower than revenues from exports of sunflower oil - 4 800 billion dollars).

Revenues from the export of sunflower oil showed the vulnerability of exports of raw materials and economic benefits of processing. In 2014, sunflower oil was the number one export commodity in Ukraine. In order to stay the leading manufacturer of sunflower seeds and oil it is necessary to constantly examine global and national market conjuncture, factors affecting its change, create a favorable investment climate, use and adapt the world experience of regulating the market of sunflower to existing conditions, apply the new technologies of growing.
References


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