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## Determinants factors of agriculture in the Danube Delta area

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# DETERMINANTS FACTORS OF AGRICULTURE IN THE DANUBE DELTA AREA

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**Abstract:** *An efficient agriculture is a basic branch of a strong economic system, regardless of the country referred to. All the more we can say this in the case of Romania, taking into account the fact that our country enjoys favorable climatic and pedological conditions for the practice of agriculture, at a high level of productivity. Agriculture is a widely debated topic both in specialized papers, published internationally and domestically, and in various national or European research projects. This is also the case of the project included in the Horizon 2020 program, COASTAL-Collaborative Land-Sea Integration Platform, financed by financing contract number 773782, in which agriculture is treated as a reference economic activity of the Danube Delta coastal area, along with rural tourism. In this paper are analyzed factors that have been delimited by specialists and operators in the field as determinants for specific agriculture in the Danube Delta area.*

**Key words:** *COASTAL project, Tulcea county, agriculture, rural development*

**Jel classification:** *Q15, Q57*

## INTRODUCTION

Within the COASTAL project, funded by the Horizon 2020 program, a series of workshops were held, with different themes that reflect the economic activities of interest in the area, such as agriculture, rural tourism and rural development. All these activities are connected with activities related to the marine area, such as aquaculture or fishing. Thus, the workshop on agriculture was synthesized the opinions and perceptions of stakeholders in the field, such as farmers, representatives of local authorities, representatives of MADR, representatives of NGOs, representatives of SMEs or associations. The workshops included free discussions on the topics mentioned above, starting from five key words: water, lifestyle, climate, environmental challenges, population, policies and infrastructure. Starting from these, different variables have emerged that contribute to a greater or lesser extent to the development of agriculture in the Danube Delta area, as well as the main problems faced by locals, referring in particular to the complex bureaucracy, poorly developed infrastructure, especially water infrastructure, insufficient labor force, poorly developed logistics of farms, farmers' attitude towards the concept of association. Also, as opportunities were identified competitive advantages regarding prices, the presence of profile consultants, the possibility to access European funds or start-up programs.

Starting from all this, in this paper we will analyze various variables of interest, such as: farmers' cooperation, legislation, integrated production, irrigation, animal husbandry, labor, population and others, referring to Tulcea County.

## MATERIALS AND METHODS

The following main working methods will be used to perform this paper:

- dissemination of existing information in the specialized, domestic and international literature of interest;
- quantitative and comparative analysis of statistical data provided by the National Institute of Statistics on both the agricultural sector in Tulcea County (average yields recorded in main crops, average fruit production, livestock, agri-environment indicators), as well as data on social components affecting the agricultural sector in the ibteres area for the project.

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## RESULTS AND DISCUSSION

Following the analysis of the existing data on the website of the National Institute of Statistics, we can draw an overview of the agricultural sector of Tulcea County, relating it to the South East region of the country.

Regarding the average productions registered for the main crops cultivated in our country, on the territory of Tulcea county, we centralize the data obtained in table 1, between 2015 and 2019.

Table 1 – Average production registered at the main crops, at the level of Tulcea county and at the level of the South-East Region (kg / hectare)

<i>Region/County</i>	<i>2015</i>	<i>2016</i>	<i>2017</i>	<i>2018</i>	<i>2019</i>	<i>Average value</i>
<b>Grain cereals</b>						
<i>South East Region</i>	3462	4024	5206	6162	5117	<b>4794,2</b>
<i>Tulcea County</i>	3428	3715	5019	5728	3580	<b>4294</b>
<i>Percentage Tulcea County(%)</i>	<b>99,02</b>	<b>92,32</b>	<b>96,41</b>	<b>92,96</b>	<b>69,96</b>	<b>89,57</b>
<b>Wheat and rye</b>						
<i>South East Region</i>	3701	4201	5057	5093	4568	<b>4524</b>
<i>Tulcea County</i>	3618	4063	4704	4587	3710	<b>4156,4</b>
<i>Percentage Tulcea County(%)</i>	<b>97,76</b>	<b>96,72</b>	<b>93,02</b>	<b>90,06</b>	<b>81,22</b>	<b>91,43</b>
<b>Barley</b>						
<i>South East Region</i>	3335	4015	4230	4473	4213	<b>4053,2</b>
<i>Tulcea County</i>	3328	3617	4231	3975	3409	<b>3722</b>
<i>Percentage Tulcea County(%)</i>	<b>99,79</b>	<b>90,09</b>	<b>100,02</b>	<b>88,87</b>	<b>80,92</b>	<b>91,58</b>
<b>Oat</b>						
<i>South East Region</i>	1944	2085	2335	2366	2378	<b>2221,6</b>
<i>Tulcea County</i>	1666	2001	2130	2163	2074	<b>2006,8</b>
<i>Percentage Tulcea County(%)</i>	<b>85,70</b>	<b>95,97</b>	<b>91,22</b>	<b>91,42</b>	<b>87,22</b>	<b>90,33</b>
<b>Corn grain</b>						
<i>South East Region</i>	3313	3939	5859	7991	6012	<b>5422,8</b>
<i>Tulcea County</i>	3067	3232	6345	8820	3573	<b>5007,4</b>
<i>Percentage Tulcea County(%)</i>	<b>92,57</b>	<b>82,05</b>	<b>108,29</b>	<b>110,37</b>	<b>59,43</b>	<b>92,34</b>
<b>Beans</b>						
<i>South East Region</i>	1098	1064	1384	1387	1186	<b>1223,8</b>
<i>Tulcea County</i>	1019	714	1071	1072	961	<b>967,4</b>
<i>Percentage Tulcea County(%)</i>	<b>92,81</b>	<b>67,11</b>	<b>77,38</b>	<b>77,29</b>	<b>81,03</b>	<b>79,05</b>
<b>Sun flower</b>						
<i>South East Region</i>	1641	1908	2999	3166	2622	<b>2467,2</b>
<i>Tulcea County</i>	1541	1809	2772	3451	2156	<b>2345,8</b>
<i>Percentage Tulcea County(%)</i>	<b>93,91</b>	<b>94,81</b>	<b>92,43</b>	<b>109,00</b>	<b>82,23</b>	<b>95,08</b>
<b>Rape</b>						
<i>South East Region</i>	2469	2634	2554	2360	1980	<b>2399,4</b>
<i>Tulcea County</i>	2423	2790	2461	2232	1468	<b>2274,8</b>
<i>Percentage Tulcea County(%)</i>	<b>98,14</b>	<b>105,92</b>	<b>96,36</b>	<b>94,58</b>	<b>74,14</b>	<b>94,81</b>
<b>Linen for oil</b>						
<i>South East Region</i>	1641	1650	1610	1719	1300	<b>1584</b>
<i>Tulcea County</i>	1573	1501	1589	1602	1129	<b>1578,8</b>
<i>Percentage Tulcea County(%)</i>	<b>95,86</b>	<b>90,97</b>	<b>98,70</b>	<b>93,19</b>	<b>86,85</b>	<b>93,36</b>

<b>Potatoes - total</b>						
South East Region	10996	10294	16479	15688	14224	<b>13536,2</b>
Tulcea County	8681	5845	18596	16352	14920	<b>12878,8</b>
Percentage Tulcea County(%)	<b>78,95</b>	<b>56,78</b>	<b>112,85</b>	<b>104,23</b>	<b>104,89</b>	<b>95,14</b>
<b>Tomatoes</b>						
South East Region	20193	22168	21340	22924	21752	<b>21675,4</b>
Tulcea County	11838	8841	9540	10323	10070	<b>10122,4</b>
Percentage Tulcea County(%)	<b>58,62</b>	<b>39,88</b>	<b>44,70</b>	<b>45,03</b>	<b>46,29</b>	<b>46,70</b>
<b>Onion</b>						
South East Region	12842	12384	12624	11516	11763	<b>12225,8</b>
Tulcea County	11591	10255	11001	9749	9443	<b>10407,8</b>
Percentage Tulcea County(%)	<b>90,26</b>	<b>82,81</b>	<b>87,14</b>	<b>84,66</b>	<b>80,28</b>	<b>85,13</b>
<b>Dried garlic</b>						
South East Region	5490	4941	5371	5687	5434	<b>5384,6</b>
Tulcea County	4131	3218	3765	4908	4811	<b>4166,6</b>
Percentage Tulcea County(%)	<b>75,25</b>	<b>65,13</b>	<b>70,10</b>	<b>86,30</b>	<b>88,54</b>	<b>77,38</b>
<b>Cabbage</b>						
South East Region	21851	19480	20996	23156	21802	<b>21457</b>
Tulcea County	18563	13840	14851	18506	17561	<b>16664,2</b>
Percentage Tulcea County(%)	<b>84,95</b>	<b>71,05</b>	<b>70,73</b>	<b>79,92</b>	<b>80,55</b>	<b>77,66</b>
<b>Pepper</b>						
South East Region	12212	12104	13572	14378	13083	<b>13069,8</b>
Tulcea County	8560	6660	9424	10642	10150	<b>9087,2</b>
Percentage Tulcea County(%)	<b>70,09</b>	<b>55,02</b>	<b>69,44</b>	<b>74,02</b>	<b>77,58</b>	<b>69,53</b>

Source: database data processing INSSE, <http://statistici.insse.ro:8077/tempo-online/>

Thus, we note that, in the analyzed period 2015-2019, the average production per hectare, in most of the analyzed crops was characterized by a generally increasing trend, with slight decreases recorded in 2019. We also note that in terms of agricultural, Tulcea county is an important county for the South-East of the country, taking as a reference the average production per hectare, which in most cases reaches the yields achieved in the entire region. Lower average yields compared to those recorded in the region are found in tomatoes, potatoes and peppers, and higher in all types of cereals, rape and sunflower.

In table 2, we present similarly to table 1, the average production recorded for fruits, taking as interval the period 2015-2019.

Table 2 – Average production registered at the main fruits, at the level of Tulcea county and at the level of the South-East Region (kg /tree)

<b>Region/County</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>Average value</b>
<b>Total fruits</b>						
South East Region	16	15	13	22	19	<b>17,00</b>
Tulcea County	10	16	17	19	24	<b>17,20</b>
Percentage Tulcea County(%)	<b>62,50</b>	<b>106,67</b>	<b>130,77</b>	<b>86,36</b>	<b>126,32</b>	<b>102,52</b>
<b>Plums</b>						
South East Region	16	14	12	25	22	<b>17,80</b>
Tulcea County	10	14	16	28	33	<b>20,20</b>
Percentage Tulcea County(%)	<b>62,50</b>	<b>100</b>	<b>133,33</b>	<b>112</b>	<b>150</b>	<b>113,48</b>
<b>Apples</b>						

<i>South East Region</i>	19	16	12	21	19	17,80
<i>Tulcea County</i>	19	18	17	31	24	20,20
<i>Percentage Tulcea County(%)</i>	100	112,5	141,66	147,61	126,31	125,28
<b>Pears</b>						
<i>South East Region</i>	17	18	14	18	16	16,60
<i>Tulcea County</i>	15	17	27	28	23	22
<i>Percentage Tulcea County(%)</i>	88,24	94,44	192,86	155,56	143,75	132,53
<b>Peaches</b>						
<i>South East Region</i>	14	14	14	16	10	13,60
<i>Tulcea County</i>	21	21	19	7	21	17,80
<i>Percentage Tulcea County(%)</i>	150	150	135,71	43,75	210	130,88
<b>Nectarines</b>						
<i>South East Region</i>	10	24	39	14	14	20,20
<i>Tulcea County</i>	21	22	21	21	21	21,20
<i>Percentage Tulcea County(%)</i>	210	82,05	108,29	110,37	59,43	114,03
<b>Cherry and sour cherries</b>						
<i>South East Region</i>	15	15	12	17	14	14,60
<i>Tulcea County</i>	5	14	10	6	19	10,80
<i>Percentage Tulcea County(%)</i>	33,33	93,33	83,33	35,29	135,71	73,97
<b>Apricots</b>						
<i>South East Region</i>	11	15	16	16	13	14,20
<i>Tulcea County</i>	1	14	14	3	18	10
<i>Percentage Tulcea County (%)</i>	9,09	93,33	87,50	18,75	138,46	70,42
<b>Nuts</b>						
<i>South East Region</i>	19	20	23	29	25	23,20
<i>Tulcea County</i>	21	27	32	27	12	23,80
<i>Percentage Tulcea County(%)</i>	110,53	135,00	139,13	93,10	48,00	102,59

Source: database data processing INSSE, <http://statistici.insse.ro:8077/tempo-online/>

The yield trend obtained for fruit production between 2015 and 2019 is increasing in the case of plums and walnuts, and decreasing in the case of peaches and nectarines. At the total level of yields recorded in fruit production, we notice that at the regional level the yields improved slightly, while at the county level, the positive changes are much more significant, in the sense that in 2015 the yield was around 10 kg of fruit / tree, and in 2019, it registers the value of 24 kg of fruit / tree. In most of the cases, the yields registered on the territory of the county are higher than those registered at the level of the region, except for apricots, cherries and sour cherries.

Regarding the livestock sector in the South-East region of the country and Tulcea County, following the analysis of statistical data, table 3 is presented.

Table 3 – Livestock numbers per 100 hectares, in Tulcea County and in the South-East Region (number/100 hectare)

<b>Region/County</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>Average value</b>
<b>Cattles</b>						
<i>South East Region</i>	11,1	10,7	11,1	11,1	10,5	10,9
<i>Tulcea County</i>	10,7	9,8	10,8	11,4	10,9	10,72
<i>Percentage Tulcea County (%)</i>	96,40	91,59	97,30	102,70	103,81	98,35
<b>Cows, buffaloes and heifers</b>						
<i>South East Region</i>	6,2	6,5	6,7	6,8	6,2	6,48
<i>Tulcea County</i>	4,8	5,2	5,2	5,5	4,9	5,12

<i>Percentage Tulcea County (%)</i>	77,42	80,00	77,61	80,88	79,03	79,01
<b>Swine</b>						
<i>South East Region</i>	42	40,7	41,3	26,2	27,5	35,54
<i>Tulcea County</i>	39	35,7	36,7	6,9	5	24,66
<i>Percentage Tulcea County (%)</i>	92,86	87,71	88,86	26,34	18,18	69,39
<b>Sows</b>						
<i>South East Region</i>	3,5	3,8	3,6	2,2	2	3,02
<i>Tulcea County</i>	4,4	4	3,8	0,5	0,5	2,64
<i>Percentage Tulcea County (%)</i>	125,71	105,26	105,56	22,73	25,00	87,42
<b>Sheep and goats</b>						
<i>South East Region</i>	134,4	140,2	148,7	161,7	157,6	148,52
<i>Tulcea County</i>	70,6	71,9	74,3	75,6	75,7	73,62
<i>Percentage Tulcea County (%)</i>	52,53	51,28	49,97	46,75	48,03	49,57
<b>Sheep and goats</b>						
<i>South East Region</i>	68,1	70,6	72,8	74,7	79,5	73,14
<i>Tulcea County</i>	104,1	118,7	122,3	132,5	124	120,32
<i>Percentage Tulcea County (%)</i>	152,86	118,70	122,30	132,50	124,00	130,07

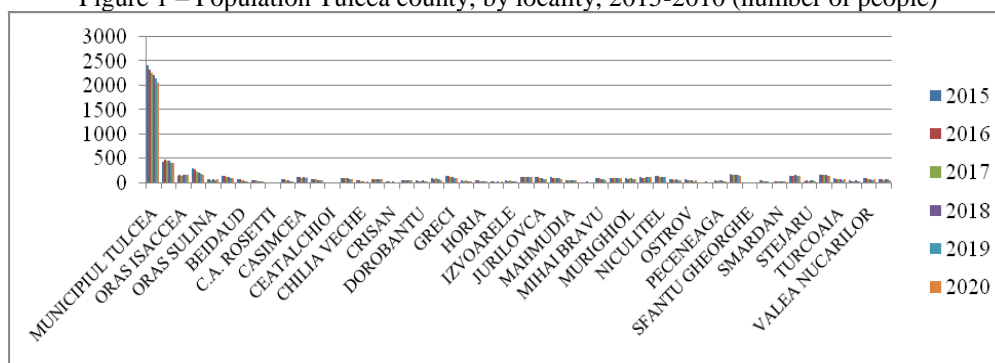
Source: database data processing INSSE, <http://statistici.insse.ro:8077/tempo-online/>

Referring to the number of livestock per 100 hectares, we note that, in the case of breeding sows, sheep and goats, yields are higher than those recorded in the entire region. There were no significant changes in the analyzed time interval, although there is a slight downward trend in the number of animals per 100 hectares.

Regarding the influencing factors of agriculture, in this paper they are grouped into demographic, economic and social factors (population, active population, number of unemployed), technical and technological (fleet of tractors and agricultural machinery, land area), health or education infrastructure.

In figure 1, the population residing in Tulcea County is presented, depending on the locality, in the reference time interval 2015 - 2020.

Figure 1 – Population Tulcea county, by locality, 2015-2010 (number of people)

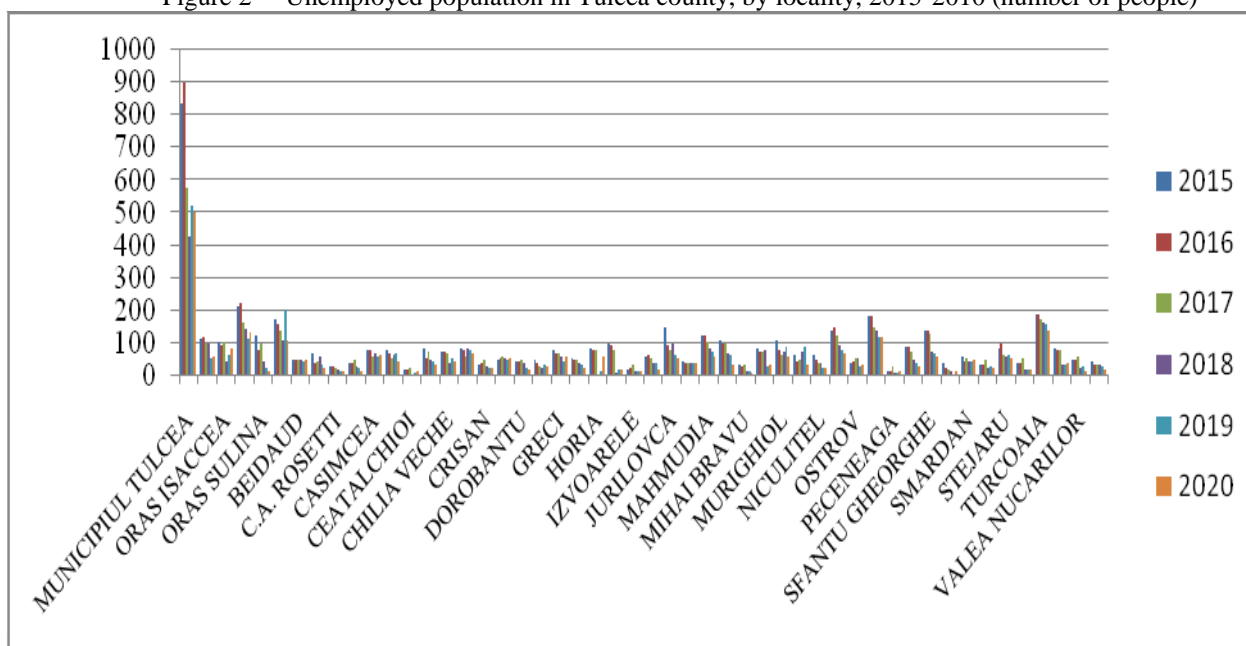


Source: database data processing INSSE, <http://statistici.insse.ro:8077/tempo-online/>

Thus, the localities with the highest population in Tulcea County are Tulcea (Municipality), Babadag, Macin, Issacea. It is observed that, at county level, the population decreased, in 2015 it numbered 2421 people, and in 2020, 2074 people. Changes in the negative direction at the ends of the range are present in most localities, except for localities such as Issacea, Ceatalchioi, Daeni and Stejaru.

Figure 2 presents the number of unemployed registered with domicile in Tulcea County, depending on the locality.

Figure 2 – Unemployed population in Tulcea county, by locality, 2015-2010 (number of people)

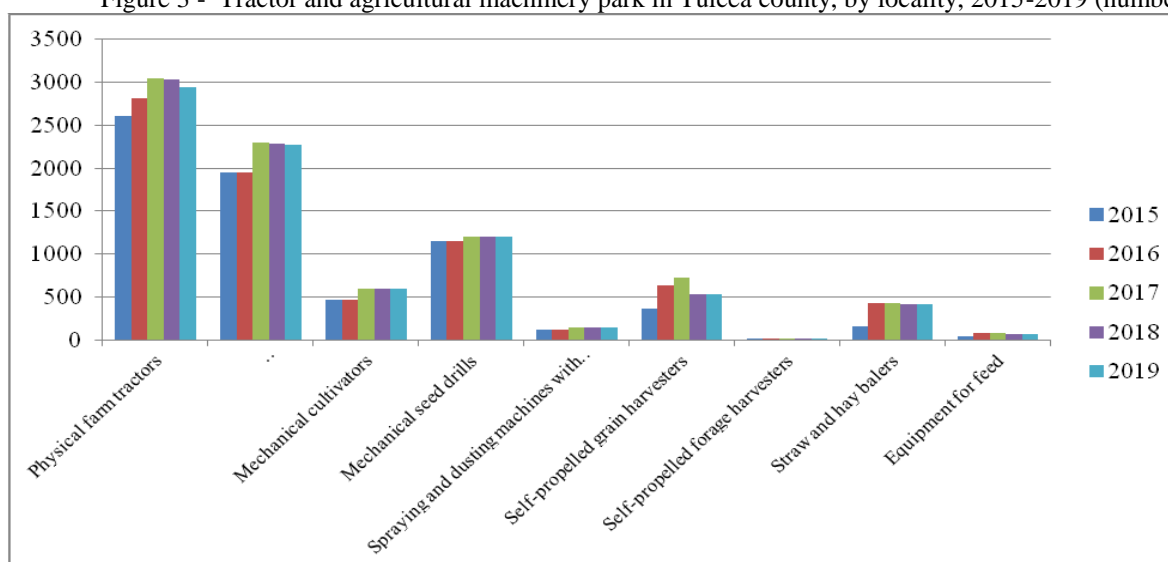


Source: database data processing INSSE, <http://statistici.insse.ro:8077/tempo-online/>

Thus, we encounter a difficult situation of the inhabitants of Tulcea County. According to statistical data, it is observed that in Tulcea County, the share of unemployed is 42.82% in 2020, a percentage decreasing compared to 2015, when the share of the unemployed population reached 67.95%. However, the number of unemployed is very high.

Technological and technical factors are also factors of major influence for the level of agriculture in our country, implicitly for Tulcea County. In this sense, the number of tractors and agricultural machines that make up the fleet of domestic agricultural machinery will be analyzed. This is how figure 3 appears, which includes the number of machines from 2015-2019.

Figure 3 - Tractor and agricultural machinery park in Tulcea county, by locality, 2015-2019 (number)



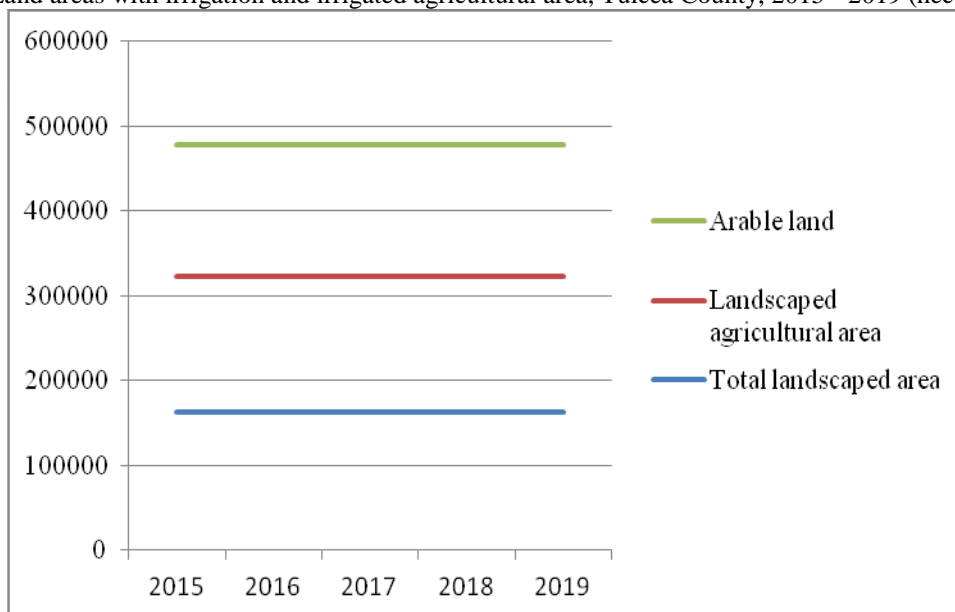
Source: database data processing INSSE, <http://statistici.insse.ro:8077/tempo-online/>

There is an improvement at all categories of machinery and equipment, taking as reference the ends of the range 2015 - 2019, which is reflected in the average yields per hectare, the main crops in our country, but also the average fruit production recorded in the same interval. An explanation and at the same time a solution in this sense can be constituted by accessing the

European funds and the forms of non-reimbursable financial aid granted through the PNDR by the farmers in order to modernize the agricultural exploitations.

Another influencing factor of agriculture in the area of Tulcea County is represented by land improvements, arrangements made for irrigation, presented in Figure 4 of this paper.

Figure 4 - Land areas with irrigation and irrigated agricultural area, Tulcea County, 2015 - 2019 (hectares)



Source: database data processing INSSE, <http://statistici.insse.ro:8077/tempo-online/>

During the analyzed interval, 2015 - 2019, constant values of the surfaces on which improvements were made were registered, through the arrangement of irrigations. Referring to the size of the improved areas found on the territory of Tulcea County, we can say that their share in the total profile areas within the region varies between 13.66% and 14.16%, depending on the specific areas, agricultural or arable. The weights remain constant in the period 2015-2019, due to the constancy of statistical values.

An influencing factor for the level of registered agricultural productions is represented by the quantity of chemical and natural fertilizers used in agriculture. Table 4 summarizes the statistical data on the above mentioned aspect, in the time interval 2015-2019.

Table 4 – Quantity of fertilizers used in agriculture, in Tulcea county, 2015 - 2019 (tons of active substance)

Type	2015	2016	2017	2018	2019
<b>Chemical</b>	5493	6052	6491	4456	4270
<b>Nitrous</b>	3296	3566	3948	2188	2092
<b>Phosphatic</b>	2111	2406	2440	2173	2102
<b>Potash</b>	86	80	103	95	76
<b>Natural</b>			4334	4340	49
<b>TOTAL</b>	10986	12104	17316	13252	8589

Source: database data processing INSSE, <http://statistici.insse.ro:8077/tempo-online/>

The largest amount of fertilizers was applied in 2017, followed by 2018, the trend being after 2017 descending to all categories of applied fertilizers. Greater differences are found in natural fertilizers.

## CONCLUSIONS

The present paper aimed to analyze some factors determining the agricultural yield registered in Tulcea County, factors that influence the level of average agricultural production in the



main crops in our country and the main types of fruits, as well as factors that influence the livestock sector, in this case the number of animals per 100 hectares. These previously mentioned factors have been mentioned over time, both in the local literature and in the various workshops organized together with stakeholders in the field, within the COASTAL project (Horizon 2020 program).

In the first part of the paper were presented the statistical data published by the National Institute of Statistics, regarding the average productions. Analyzing them, we noticed the fact that the agricultural sector of Tulcea County has seen improvements in the last period of time, more precisely the interval 2015 - 2019, 2020. We also notice that whether we refer to cereals, oilseeds, vegetables or fruits, the yields obtained on the territory of Tulcea county it is very close to the yields obtained at the level of the entire region, referring to the South-East Region, in some cases it even exceeding them. This shows the potential and necessity of investing in agricultural development and rural development, in general, of Tulcea County, trying as much as possible to revive it in all areas of interest of economic activity, referring to agriculture, rural tourism, agrotourism and others. . Homologous, the same can be said about the number of animals that amounts to 100 hectares of land, this being representative for the entire region.

In the second part of the paper were analyzed from a statistical point of view economic, demographic, technological and technical factors characteristic of Tulcea County. Thus, we can conclude the following:

- the population of Tulcea county is characterized by a decreasing trend, due to phenomena such as the aging of the population or its migration; the only localities on whose territory no negative changes were registered are Issacea, Ceatalchioii, Daeni and Stejaru;
- regarding the share of the unemployed within Tulcea county, it is high, being on average at the level of 42.82% in 2020, a percentage that decreased, if we take into account the value of the number of unemployed, when the number it reached a percentage of 60% of the total population;
- regarding the share of the unemployed within Tulcea county, it is high, being on average at the level of 42.82% in 2020, a percentage that decreased, if we take into account the value of the number of unemployed, when the number it reached a percentage of 60% of the total population;
- regarding the endowments of agricultural holdings, referring to all categories of machinery and equipment, taking as reference the ends of the period 2015 - 2019, we notice that their number has increased constantly, a possible cause being access to various forms of non-reimbursable financial support. to entrepreneurial farmers or other beneficiaries; the surface of the improved lands, through their irrigation, remained constant during the years 2015-2019, and the amount of fertilizers applied is decreasing.

Thus, after discussions with stakeholders in the field, following the analysis of statistics and literature, we can conclude that one of the biggest threats, problems facing the agricultural sector in Tulcea County is the lack of labor. However, the number of unemployed is declining, still standing at an extremely high rate of 42% of the county's population. Of course, this is also due to education, health infrastructure, job availability, seasonal nature of jobs, low incomes obtained from the provision of services compared to the level in other counties or even other countries, lack of skilled labor It is recommended that entrepreneurs and local authorities implement European programs and not only modernization and development in the community of Tulcea County, in order to develop the most important link, namely the man, the inhabitant of the Danube Delta, in this case.

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