

THE INFLUENCE OF SOIL RESOURCES ON AGRICULTURAL PRODUCTION IN PRAHOVA COUNTY

***PRISECARU (URZICĂ) Mariana Mihaela,
PETCU Valentina Mihaela,
MIHALACHE Mircea,
University of Agronomic Sciences and Veterinary Medicine
of Bucharest***

Keywords: soil, degradation, lands evaluation, management, crop production

ABSTRACT

The research aimed to identify the soil resources of Prahova County and the limiting factors of the soil, such as: soil acidity and alkalinity, phosphorus supply, humus reserve, surface erosion and deep erosion, landslides and soil pollution with oil residues or dumps and quarries. The main agricultural crops, the cultivated areas and the obtained productions were analyzed for the 2016-2020 period. The quality of the soils and the lands affected by various limiting factors in Prahova County directly influences the annual productions and their continuous monitoring helps to propose measures regarding their control and soil improvement.

INTRODUCTION

The concept of soil quality includes assessment of soil properties and processes as they relate to the ability of soil to function effectively as a component of a healthy ecosystem (Schoenholtz, S.H. and al., 2000).

Located in the southern part of the Carpathian Mountain chain, Prahova County has an area of 4.716 km², with which it occupies approximately 1.98% of the country's surface (Brânzea, L.V. and al., 2009).

Prahova County is characterized by a wide variety in terms of soil resources, due to diversified climatic and relief conditions.

The plain area is characterized in the south by cernisols and luvisols, which are favorable to cereals.

In the area of the sub-Carpathian hills there is a mosaic of soils in which there are soils from the luvisols class, soils of the cambisols class and spodosols that are favorable to fodder crops, natural meadows and orchards of fruit trees.

The mountainous area is characterized by the spodosols class of soils on which grow, in good conditions, alpine meadow vegetation, coniferous forests and forests mixed with beech.

MATERIAL AND METHOD

In order to identify the lands in Prahova County, the areas with degraded lands and their different uses was analyzed.

The data for the last 5 years was processed in order to follow up on their evolution, through analyzing the land areas on different categories of use, while also taking into account the affected agricultural land, the irrigated agricultural land, the planting and deforestation of trees, the removal of lands from the agricultural circuit (temporary and permanent) and also the productions for the main agricultural crops (autumn wheat, barley, maize grain, sunflower, rapeseed and soybean).

RESULTS AND DISCUSSIONS

Grouping the lands by their suitability for use was done by taking into account the main characteristics and deficiencies of the soils and their drainage capacity, depending on the intensity of manifestation and the nature of the degradation processes.

Currently, the situation, in regards to the classification of lands in quality classes (*Table. 1*) and according to the bonitation grade from 2020, it is shown that the Prahova County, from the total of 269,119 hectares of agricultural land, only 12,272.59 hectares are included in the I quality/class, meaning that only 4.56% of the total agricultural lands are of the best quality and all of them are located in the plain area, in the south and south-eastern part of the County.

Class II of suitability consists of lands with good suitability, with low limitations, where the danger of soil degradation or existing deficiencies can be removed by current technologies or improvement measures available to the farmer (Ilie, L. and Mihalache, M., 2019), and those lands represent 21.81% from the agricultural area of the County.

Class III - lands with medium suitability, with moderate limitations occupy 29.78%, respectively 8,0154.80 hectares of the total agricultural area.

Class IV- lands with poor suitability, with severe limitations in case of use as arable land, occupy 27.46% of the total agricultural area.

What can be more concerning is that 16.39% of the total agricultural land in Prahova County, respectively 44,115 hectares, is almost completely unproductive, being affected by various limiting factors and, therefore, included in the last quality class - the fifth.

The category of land use in Prahova County Table 1

Category of use	Quality Class	I		II		III		IV		V	
	Total ha	Ha	%	Ha	%	Ha	%	Ha	%	Ha	%
ARABLE	143126	10491.14	7.33	53228.56	37.19	52670.37	36.80	25490.74	17.81	1245.20	0.87
PASTURES+ MEADOWS	108661	1695.10	1.56	2933.85	2.70	21047.64	19.37	40334.96	37.12	42649.44	39.25
VINEYARDS	7850	86.35	1.10	1830.62	23.32	3154.13	40.18	2719.24	34.64	59.66	0.76
ORCHARDS	9482	0.00	0.00	689.34	7.27	3282.67	34.62	5348.80	56.41	161.19	1.70
TOTAL	269119	12272.59	4.56	58682.37	21.81	80154.80	29.78	73893.74	27.46	44115.49	16.39

Soil degradation processes have a direct impact on water and air quality, biodiversity and climate change. The degradation of soil resources affects the health and safety of agricultural land and food products (Dumitru, M. and al., 2000).

Soil degradation processes are driven or exacerbated by human activity. Climate change, together with individual extreme weather events, which are becoming more frequent, will also have negative effects on soil. Soil degradation processes occurring in the European Union include erosion, organic matter decline, compaction, salinization, landslides, contamination, sealing and biodiversity decline (Mihalache, M. and al., 2015).

The acidifying tendency of the soil is continuous and is caused unfortunately, mainly due to the irrational use of chemical fertilizers by farmers. Thus, the total area of acidic agricultural lands in Prahova County is of 28.5% - 76,698 hectares and the total area of alkaline lands is 19% - 51,132 hectares (Table. 2).

Limiting factors of soils in Prahova County Table 2

Area	Hectares	%
Acidic (totally)	76698.92	28.5
Alkaline (totally)	51132.61	19
Weak and very poor phosphorus supply	56514.99	21
Weak and very weak humus supply	123794.74	46
With strong and very strong surface erosion	44404.64	16.5
In-depth erosion	3498.55	1.3
Active landslides	5382.38	2
Polluted with petrol /oil residues	1076.48	0.4
Polluted with landfills and quarries	6189.74	2.3

There are 56,515 hectares, respectively 21% of the lands that are weakly and very poorly supplied with phosphorus and 123,794 hectares, respectively 46% of the areas that are weakly and very poorly supplied with humus.

Humus is the soil's constituent with important influences on the physical, chemical and biological properties of soils, with direct implications on the state of production potential (Mihalache. M., 2014).

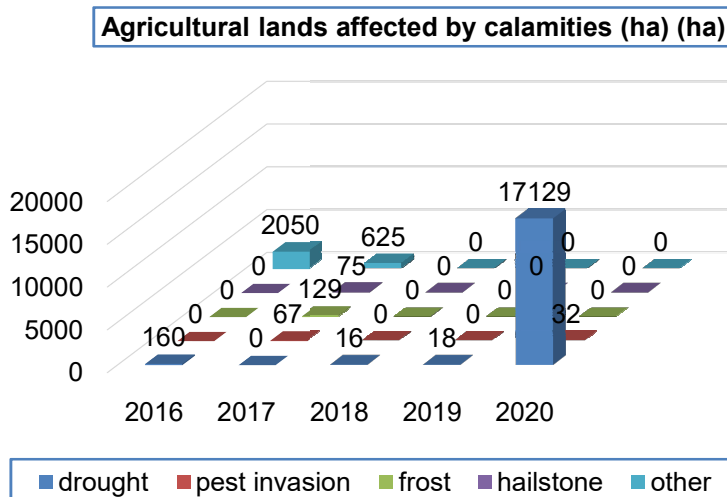
Lands affected by surface erosion are at around 16.5%, with 44,404 hectares, and those affected by deep erosion are of about 3,500 hectares.

Approximately 1,000 hectares of land in Prahova County are polluted with petrol /oil residues and another 6,189 hectares are polluted with landfills and quarries.

Amongst the restrictive factors of the soils, which led to the classification of some lands in the quality Class V, the presence of active landslides is noted, as they affect 2% of the area, respectively 5,382 hectares in the Prahova County.

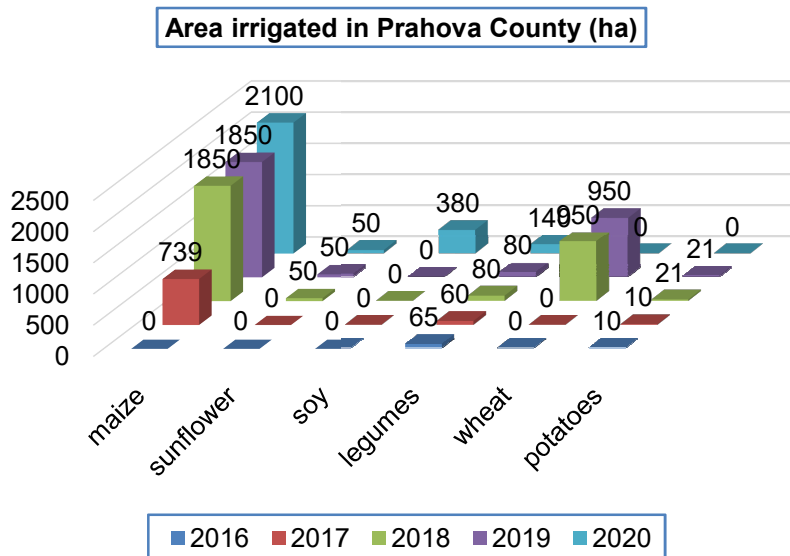
When we talk about limiting factors, we refer to the factors and soil properties that influence the productivity and yield potential of either the soil or the crops. That is, they are those properties and environmental or geographical characteristics that affect negatively the crop development in a given time (Hernández, A. and al, 2006).

Figure 1



Regarding the agricultural areas affected by calamities in Prahova County, we can see that, for the last 5 years, the largest area affected by the pedological drought was of 17,129 ha in 2020. As we can see in *Figure 1*, in 2018 and 2019 the fewest land areas recorded disasters in the County, with the year of 2020 being at the opposite pole and registering the most areas affected by various disasters.

Figure 2

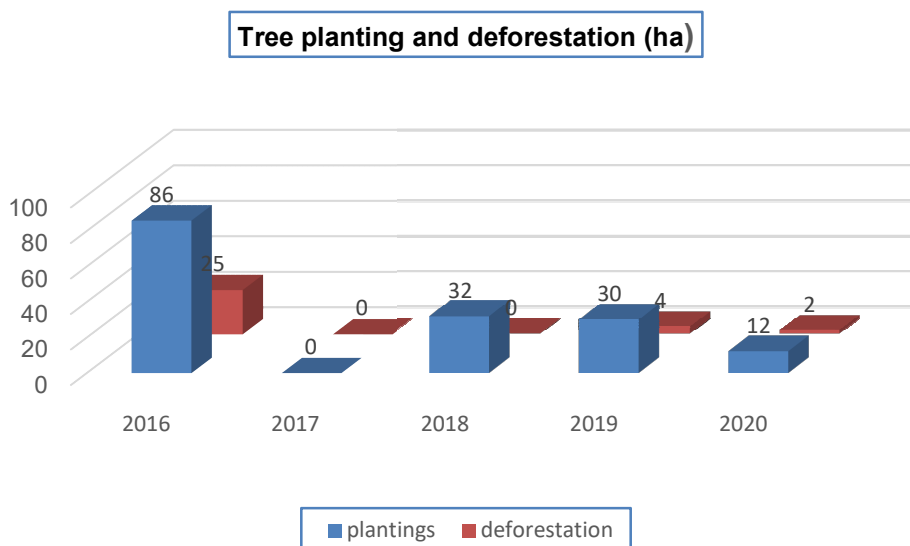


In Prahova County, the largest irrigated areas are those cultivated with maize. In 2016 there were no irrigated lands from those cultivated with maize, while in 2017, there were recorded 739 ha irrigated, in 2018 and 2019 the irrigated area increased to 1,850 ha in each year and up to 2,100 ha in 2020.

For the lands cultivated with sunflower, there were no areas actually irrigated in 2016 and 2017, and in the next 3 years only 50 ha were irrigated in each year. There were areas actually irrigated for land cultivated with soybean only in 2020, with an irrigated area of 380 ha. For the lands cultivated with legumes the irrigated areas in 2016 and 2017 were of 60 ha in each year. In 2018 and 2019 there were 80 ha irrigated each year and in 2020 there was an increase in irrigated area that reached up to 140 ha.

For the areas cultivated with wheat, we registered irrigated areas only in 2018 and 2019, with 950 ha in each year. As for areas cultivated with potatoes, there were 10 ha irrigated in 2016 and 2017 and 21 ha in 2018 and 2019. The actually irrigated areas in Prahova County registered a positive evolution from year to year.

Figure 3



In 2016, tree planting took place on 86 ha and deforestation on an area of 25 ha, while in 2017 there were no deforestations and plantings. In 2018, forestation was recorded for 32 ha, with no deforestations taking place. In 2019 plantings were done on 30 ha and deforestation took place on 4 ha, while in 2020, deforestation

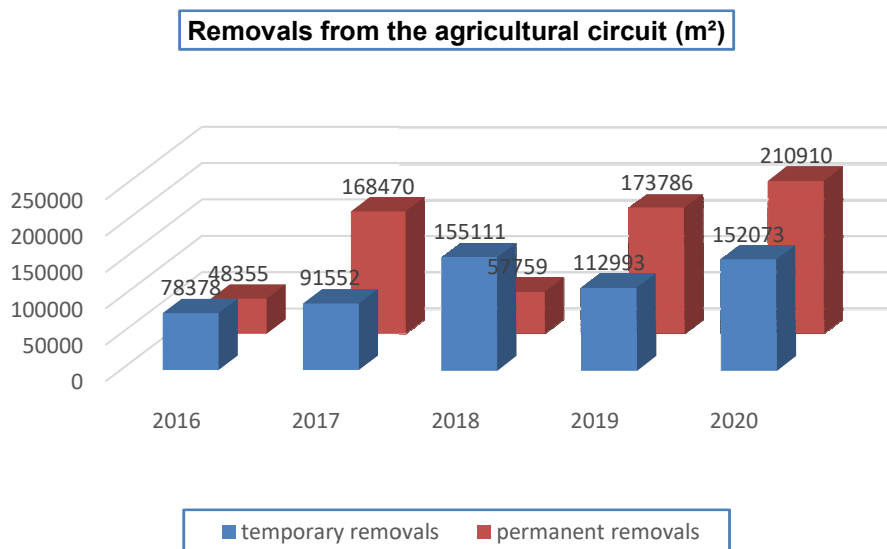
was recorded on 2 ha and tree plantings on 12 ha. Every year, in Prahova County, there were more plantings than deforestation.

When taking into discussion the removal from the agricultural circuit of various areas of land, there are two categories to take into account – temporary removals and permanent removals.

In Prahova County, in 2016, the areas temporary removed from the agricultural circuit were of 78,378 m² and those permanently removed were of 48,355 m². In 2017, 91,552 m² were temporarily removed and 168,470 m² were permanently removed, while in 2018, 155,111 m² were temporary removed and 57,759 m² were permanently removed. As for the last two years, in 2019, from the agricultural circuit were removed 112,993 m² temporary and 1,737,86 m² permanently, with an increase during the year of 2020, when 152,073 m² were temporary removed and 210,910 m² were permanently removed.

We can conclude that, in total, the largest area permanently removed from the agricultural circuit of Prahova County was registered in 2020, and largest area temporary removed was registered in 2018 (Figure 4).

Figure 4



Other than the aspects mentioned before, the production was analyzed for crops such as autumn wheat, barley, maize (grains), sunflower, rapeseed and soybean.

For autumn wheat, in Prahova County, the production was of 153,079 tonnes for 2016, 140,542 tonnes in 2017, and a smaller yield, compared to the two previous years of 121,215 tonnes in 2018. In 2019 a production of 164,173 tonnes was recorded and the following year, in 2020, only a yield of 78,954 tonnes was recorded. In conclusion, 2019 was the year with the highest autumn wheat production and 2020 recorded the lowest production, due to the pedological drought (Figure 5).

As for barley, in 2016 the production was of 17,902 tonnes, in 2017 it was lower than the previous year, with 11,524 tonnes and in 2018 the yield was close to that of the previous year, with 11,546 tonnes produced. In 2019, 20,653 tonnes of barley were harvested in Prahova County while in 2020 there were only 9,902 tonnes. Therefore, the year of 2020 recorded the lowest production and the richest harvest was in 2019 (Figure 6).

Figure 5

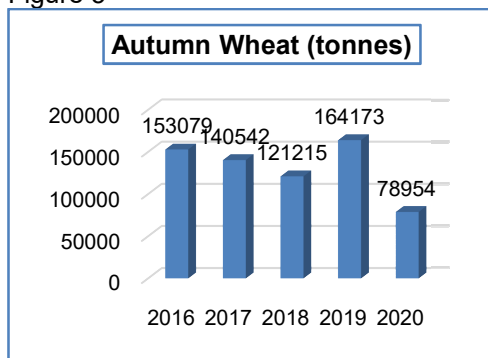
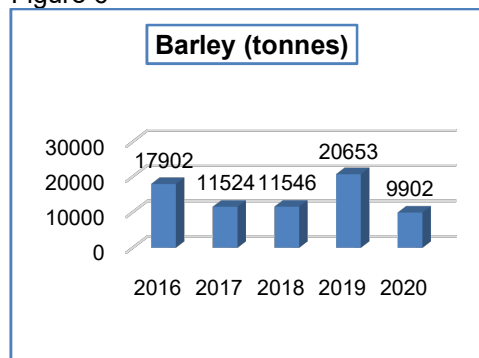


Figure 6



For maize, the production of grains, in Prahova County, was of 198,798 tonnes in 2016, 222,035 tonnes in 2017 and 215,469 tonnes in 2018. In 2019 there were 276,051 tonnes harvested and in 2020 the production was of 173,613 tonnes. In conclusion, 2019 was the most productive year for maize and 2020 was the year with the lowest harvest, as a cause resulting from the occurrence of pedological drought (Figure 7).

Figure 7

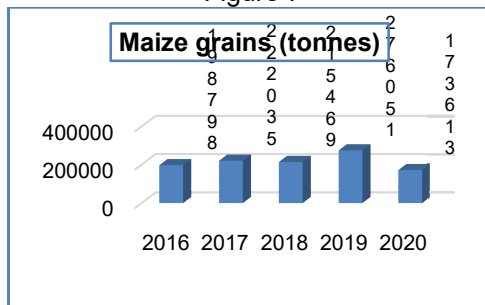
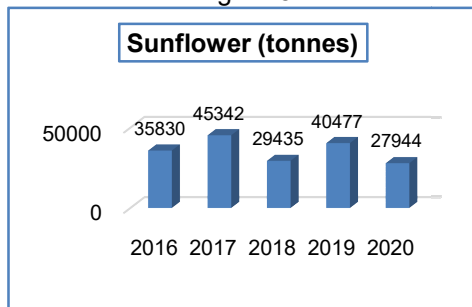


Figure 8



Sunflower production in the Prahova County recorded 35,830 tonnes in 2016, 45,342 tonnes in 2017 and 29,435 tonnes in 2018. In 2019 the production of sunflower was of 40,477 tonnes and in 2020 of 27,944 tonnes. Therefore, 2017 was the year with the highest sunflower production, while 2020 recorded the lowest yield, when compared to previous years (*Figure 8*).

Figure 9

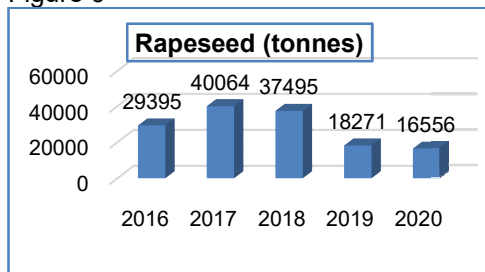
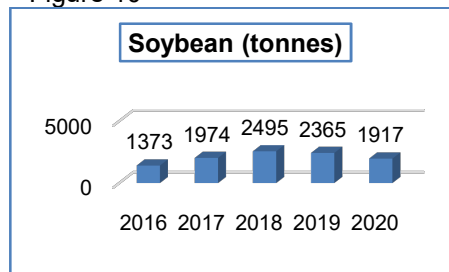


Figure 10



The rapeseed production in Prahova County was of 29,395 tonnes in 2016, 40,064 tonnes in 2017 and 37,495 tonnes in 2018. In 2019, a smaller production of 18,271 tonnes was harvested

and in 2020, an even lower one of 16,556 tonnes. In short, 2017 was the most productive for rapeseed and 2020 was the least productive, due to the pedological drought (*Figure 9*).

Lastly, when looking at the soybean production recorded in Prahova County, the yield was of 1,373 tonnes in 2016, 1,974 tonnes in 2017 and 2,495 tonnes in 2018. In 2019 soybean crops produced 2,365 tonnes and in 2020 only 1,917 tonnes. To sum it up, 2018 was the most productive year for soybean and 2016 was the year with the lowest production, compared to previous years.

CONCLUSIONS

- The areas actually irrigated in Prahova County registered a positive evolution from year to year. Compared to 2016, the irrigated area for maize crops reached, in 2020 the level of 2,100 ha.
- The fewest agricultural areas affected by calamities in Prahova County were recorded in 2018 and 2019 (16 ha and 18 ha, respectively), while having, at the opposite pole, a total of 17,161 ha affected by calamities in 2020.
- The largest area permanently removed from the agricultural circuit from Prahova County was registered in 2020 (210,910ha), and the area temporarily removed recorded the highest value in 2018 (155,111 ha).
- The highest wheat production was registered in 2019, with a total production at the county level of 164,173 tonnes, as the lowest value was of 78,954 tonnes in 2020, due to the pedological drought.
- The highest yield for barley was also recorded in 2019, with a total per county of 20,653 tonnes, as compared to the lowest record of 9,902 tonnes in 2020.
- The year of 2019 was also the most productive for grain maize, registering a production of 276,051 tonnes, with 2020 being the year with the lowest maize production of 173,613 tonnes.
- Sunflower registered a production of 45,342 tonnes in 2017, compared with the 27,944 tonnes produced in 2020.
- Rapeseed registered the highest production in 2017, with a total of 40,064 tonnes, while the year of 2020 was the least

productive, due to the pedological drought, when a production of 16,556 tonnes was recorded at the county level.

- The year of 2018 was the most productive year for soybean, with a production, at county level, of 2,495 tonnes. By comparison, 2016 had the lowest recorded production of 1,373 tonnes, as compared to previous years.

BIBLIOGRAPHY

1. Brînzea, L.V. and al, 2009 – *Studies on the natural potential of sustainable rural development Prahova County*, Annals, Food Science and Technology, vol. 10, Valahia University Targoviste.
2. Dumitru M. and al., 2000 - *Soil Quality Monitoring in Romania*, Ed. GNP, Bucharest.
3. Hernández, A.; Ascanio, M. O.; Morales, M.; Bojórquez, I.; García, Norma, E. y García, J., 2006 - *Fundamentos sobre la formación del suelo, cambios globales y manejo*, Editorial Universidad de Nayarit., 255 pp. ISBN: 968833072-8.
4. Ilie, L. and Mihalache, M., 2019 – *Bonitatea și stabilirea pretabilității terenurilor agricole*, Editura Ex Terra Aurum, București.
5. Mihalache, M., 2014 – *Pedologie*, Editura Estfalia, București, ISBN 978-606-8284-88-0.
6. Mihalache, M. and al., 2015 - *Romanian soil resources - "Healthy soils for a healthy life"*, AgroLife Scientific Journal - Volume 4, Number 1, ISSN 2285-5718; ISSN CD-ROM 2285-5726; ISSN ONLINE 2286-0126; ISSN-L 2285-5718 .
7. Schoenholtz, S., Miegroet, H.V., Burger, J., 2000, *A review of chemical and physical properties as indicators of forest soil quality: challenges and opportunities*, Forest Ecology and Management, 138(1-3): 335-356.
8. ***Oficiul de Studii Pedologice și Agrichimice Prahova, dadprh.ro/ospa.html.
9. ***Direcția pentru Agricultură Județeană Prahova, dadprh.ro.