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WHITE CABBAGE CULTURE IN ROMANIA - STATUS, CHALLENGES, TRENDS AND OPPORTUNITIES

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Abstract

White cabbage (Brassica oleracea var. capitata) is a significant crop among the Brassicaceae family cultivated in Romania, with implications for local livelihoods and the regional economy. The study aims to comprehensively analyse the situation of this crop in Romania through important statistical indicators, such as cultivated areas, total production, and average price over a 10-year period (2015-2024). Analysing these indicators, it can be appreciated that the areas cultivated with white cabbage in Romania were larger in the first part of the interval, with a constant downward trend, from 48.718 ha in 2015 to 36.662 ha in 2024, decreasing by 24.6% over this period. Total production exhibits the same downward trend, reflected by values starting from 1.077.978 t in 2015, reaching 565.532 t in 2024 (47.5% decrease). Regarding the average price of early white cabbage and autumn in Romania, it had an increasing trend: in 2015 recorded a value of 1.33 lei/kg, reflecting an increase of 129% and reached 3.05 lei/kg in 2024 and respectively, from 1.83 lei/kg to 3.42 lei/kg, meaning an increase of 86.88%. To increase production, it is necessary to improve cultivation technology and promote the development of the sector.

Key words*: Brassica oleracea, cultivated area, production, growth rate.*

INTRODUCTION

Cabbage (*Brassica oleracea* var. *capitata*) is a species of the *Brassicaceae* family and is an important crop worldwide, valued for its nutritional and economic value. It is a biennial, herbaceous, dicotyledonous species that forms short stems with a rich mass of leaves around a central bud with closed growth in the first year, and forms seed heads in the second year. This species is a rich source of vitamins and essential minerals, such as iron, calcium, magnesium, potassium, sodium, and phosphorus, vitamin C, fiber, and antioxidants (Šamec et al., 2017; Soare et al., 2017; Nawaz et al., 2018; Băbeanu et al., 2020; Bytyçi et al., 2025). Consuming nutritious foods rich in antioxidants increases the body's resistance to free radicals and, therefore, helps protect against chronic diseases (Babeanu et al., 2017; Ștefan and Ona, 2020), the potential health benefits depend on several factors, including the technology applied, including genotype (Soare et al., 2016).

The main cabbage producing countries worldwide are China, with an area of 998,448 ha, followed by India, with 433,000 ha, resulting in a global production of cabbage and brassicas in China of approximately 36 million tons and 10 million tons in India in 2023. In the European Union, the main white cabbage producing countries are Poland and Germany, Romania and the Netherlands (Soare, 2025). Poland reported a production of 666.2 thousand tons in 2023, and Germany 660.6 thousand tons (Faostat, 2025). At the global level, China and India represent some of the largest consumer markets (Statista, 2025).

Maintaining stable crop yields is crucial for sustainable agriculture (Hou and Chang, 2025). Cabbage production faces significant challenges due to climate change, disease and pest attacks, or soil salinity (Prajapati et al., 2024). The success of the crop depends on a series of correctly applied cultural practices. The hybrids used in the crop have different requirements for climatic conditions. Obtaining cabbage hybrids with tolerance to biotic and abiotic stress is crucial to increase the productive capacity of this crop.

White cabbage cultivation is practiced seasonally, in three periods: early crop, summer crop, and autumn crop. For this, cultivating the same hybrid regardless of the season, throughout the year, should be avoided.

Cultivation objectives should take into account the destination of production: for fresh consumption, pickling, storage, or processing (Cervenski et al., 2022).

Crop improvement relies on new breeding techniques such as tissue culture, somatic hybridization, molecular-assisted breeding, genetic engineering, RNAi, genome editing, methods that have the potential to address the challenges of improving crop production and abiotic stress tolerance (Jabeen et al., 2024). In addition, optimal agroecological conditions, access to inputs, strong market demand, and the presence of multifunctional agricultural cooperatives can be favorable environments for increasing production and commercialization of head cabbage (Ayalew et al., 2025).

In Romania, as in many other countries, white cabbage is one of the most important vegetable crop species (Stoleru et al., 2012). It is cultivated in the field (early, summer, and autumn crops) and in protected areas. By cultivating this species in protected areas, production is obtained three weeks earlier than in the early crop practiced in the field, when the production is marketed at advantageous prices. Environmental conditions, such as temperature, have a significant influence on production. Along with water, nutrients are an essential factor in obtaining high production, since cabbage is considered a species with high specific consumption. The use of microbial sources in nutrition is an alternative to conventional agricultural methods; by incorporating them, resistance to biotic stress increases, and plant production and quality improve (Al-Khayri and Khan, 2024; Iancu et al., 2024).

The economic importance of this species is linked to the high profitability of the crop due to the large volume of production and consumption. This study followed the evolution of the white cabbage crop in Romania, in terms of cultivated areas, total production, and average price, during the period 2015-2024.

MATERIALS AND METHODS

To carry out the research, data were collected from the National Institute of Statistics for the period 2015-2024, regarding the following indicators: cultivated areas, total production, average monthly consumption of cabbage and cauliflower/person, quantity purchased by a household (cabbage and cauliflower) and the average selling price of white cabbage grown in Romania. The data were processed in Excel, calculating descriptive statistics, such as mean, standard deviation, coefficient of variation, and annual growth rate.

The standard deviation indicates how much the values are dispersed from the mean. The coded indicators used in the presentation of the descriptive statistics are: ∂ = standard deviation; x = values of the data series over a number of years; n = number of years considered.

Coefficient of variation: $C = \partial / \bar{X} * 100$, with the following interpretation: between 0-10% indicates a higher degree of homogeneity of the series; between 10-20% is medium variation; over 20% - high variation.

Annual growth rate indicates the annual increase of the analysed indicator: R (%) = (Ending Value ÷ Beginning Value) ^ (1 ÷ Number of Periods) – 1.

RESULTS AND DISCUSSIONS

White cabbage is a species that presents high ecological plasticity, being adapted to environmental conditions with a temperate climate and cultivated in Romania throughout the country. Table 1 presents statistical data on the cultivated areas and production of white cabbage in Romania during the period 2015-2024. Thus, the cultivated area during this period ranged between 36,557 ha in 2022 and 48,718 ha in 2015. Larger areas cultivated with white cabbage were recorded in the first part of the studied interval, but in the last years of the analysed series the indicator had a downward trend. The same trend was followed by total production, with the recorded values being higher in the first part of the interval, starting from 1,077,978 t in 2015 and reaching 565,532 t in 2024, showing a significant decrease in production compared to 2015. Regarding the productivity of white cabbage in our country during the period 2015-2024, it is observed that it was oscillating, with a downward trend in the latter part of the interval, starting from 22,126 kg/ha in 2015, reaching 24,324 kg/ha in 2020 and decreasing to 15,425 kg/ha in 2024.

Table 1. Cultivated areas, total production, and yield per unit area of cabbage crops in Romania

Indicators	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Area (ha)	48,718	46,248	46,200	47,330	47,153	37,626	37,966	36,557	36,720	36,662
Production (tons)	1,077,978	992,398	1,026,575	1,065,537	985,842	915,246	919,961	689,704	643,316	565,532
Yield (kg/ha)	22,126	21,458	22,220	22,512	20,907	24,324	24,231	18,866	17,519	15,425

Source: INS Tempo, accessed 29.11.2025

Table 2 presents the descriptive analysis of the areas and production of cabbage in the period 2015-2024. Thus, the average cultivated area was 42,118 ha, and the standard deviation was 5,344.20. The coefficient of variation (%) recorded a value of 12.6%, indicating an average variability from one year to another. The average total production was 1,077,978 kg/ha, and the standard deviation was 186,257.48 and the coefficient of variation was 20.9%, indicating average variability. Compared with 2015, cultivated areas and total production decreased by 24.7%, respectively 47.5%, in 2024. Annual growth rate (%) was -2.8% in terms of areas cultivated with white cabbage and -6.24% in terms of total production obtained.

It can be appreciated that the negative trend in the case of the indicator regarding production in the period 2015-2024, in Romania was conditioned first of all by the level of cultivated areas, which is decreasing. Also, the impact of climate change has influenced cabbage production in recent years, as precipitation and atmospheric humidity have been low, factors to which white cabbage has high requirements.

Another important factor in the stability of production and prices is the organization of agricultural production through producer organizations, cooperatives, or through interprofessional organizations (Alboiu et al., 2022), but many private producers in Romania hesitate to join such organizations for various reasons. Also, growing conditions and genotype are the predominant factors in obtaining high yields (Dinu et al., 2024).

The lower levels of area and production of white cabbage cultivated in Romania have led the Ministry of Agriculture and Rural Development (MADR) to introduce financial support for producers to support the production of vegetables cultivated in protected areas, including white cabbage, in the period 2025-2027 (madr.ro, 2025). The financial support for de minimis aid is 1.5 euros/sqm, equivalent to 1,500 euros/1,000 sq m, for a cumulative area of at least 1,000 sq m. In Romania, vegetable production should increase to better cover the needs of the domestic market and support exports to the EU market (Popescu, 2013).

Table 2. Descriptive statistics regarding the area and total production of cabbages in Romania in the period 2015-2024

Indicator	2024/2015 (%)	MIN.	MAX	Average	Standard deviation	Coefficient of variation (%)	Annual growth rate (%)
Area (ha)	-24.7	36557	48718	42118	5344.20	12.6	-2.8
Production(tons)	-47.5	565532	1077978	888208.9	186257.48	20.9	- 6.24

Source: INS Tempo, accessed 29.11.2025

Table 3 presents the average monthly consumption of cabbage and cauliflower/person and the quantity purchased by a household in Romania over the last 10 years. Both the average monthly consumption of cabbage and cauliflower/person and the quantity purchased by a household (cabbage and cauliflower) have recorded continuous fluctuations during this period, pointing to a similar pattern. Thus, the average monthly consumption of cabbage and cauliflower/person was between 0.781 kg in 2015 and 0.924 kg in 2023, indicating an oscillating trend, with a slight increase starting in 2021 and then a slight decrease in 2024 (Table 3). This aspect may be influenced by the volatility of market prices, which were higher during this period. Regarding the quantity purchased by a household (cabbage and cauliflower), the values ranged between 0.91 kg in 2015 and 1.043 kg in 2023, the values fluctuating from one year to another (Table 3).

Table 3. Average monthly consumption of cabbage and cauliflower/person and quantity purchased by a household

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Average monthly consumption/person (cabbage and cauliflower) - kg	0.781	0.807	0.857	0.823	0.806	0.836	0.855	0.874	0.924	0.9
Quantity purchased by a household (cabbage and cauliflower) - kg	0.91	0.94	1.042	0.945	0.928	1.027	1.017	0.978	1.043	0.981

Source: INS tempo, accessed 29.11.2025

The descriptive analysis of these indicators regarding the consumption and quantity of cabbage purchased is presented in Table 4. Thus, the mean of the indicator regarding average monthly consumption/person (cabbage and cauliflower) was 0.8463 kg, with 0.044 standard deviation, while the coefficient of variation was 5.2%, indicating low variability from one year to another, which presents a relatively stable behaviour in the food preferences of the population regarding cabbage consumption. Regarding the quantity purchased by a household (cabbage and cauliflower), the average value recorded the value of 0.9811 kg with 0.049 standard deviation, and the coefficient of variation was 5.01%, which indicates low variability from one year to another.

However, compared with 2015, the average monthly consumption of cabbage and cauliflower/person and the quantity purchased by a household increased by 15.23% and 7.8%, respectively, in 2024. The annual growth rate was 1.42% and 0.75%, respectively.

Table 4. Descriptive statistics regarding consumption of cabbages in Romania the period 2015-2024

Indicator	2024/2015 (%)	Min.	Max.	Average	Standard deviation	Coefficient of variation (%)	Annual growth rate (%)
Average monthly consumption/person (cabbage and cauliflower) - kg	15.23	0.781	0.924	0.8463	0.044	5.2	1.42
Quantity purchased by a household (cabbage and cauliflower) - kg	7.8	0.91	1.043	0.9811	0.049	5.01	0.75

The average price/year for early white cabbage registered an oscillating trend, with the minimum value in 2016, at 1.24 lei/kg, and the maximum value in 2024, at 3.05 lei/kg (Table 5). The average price per year for autumn white cabbage also registered an oscillating trend, with a variation amplitude from 1.35 lei/kg in 2017 to 3.42 lei/kg in 2024. This price instability prevents farmers from obtaining a stable income; therefore, and for this it is necessary to forecast the price for the harvest season so that they can make timely adjustments regarding the cultivated areas.

The selling price, in general, is influenced by supply and demand, as well as by the sales period.

Table 5. Selling price of white cabbage in Romania, 2015-2024

Indicator	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Average price/year early white cabbage (lei/kg)	1.33	1.24	1.47	2.69	2	1.93	2.6	2.91	2.88	3.05
Average price/year autumn white cabbage (lei/kg)	1.83	1.41	1.35	1.84	1.75	1.66	2.22	2.31	2.47	3.42

Source: INS Tempo, accessed 29.11.2025

Table 6 presents the descriptive statistics analysis regarding prices for cabbages in Romania in the period 2015-2024. The average price/year for early white cabbage (lei/kg) was 2.21 lei/kg, with 0.70 standard deviation, while the coefficient of variation was 31.16%, indicating very high variability from one year to another. The average price/year for autumn white cabbage was 2.02 lei/kg, with 0.61 standard deviation, and the coefficient of variation was 30.1%, indicating very high variability from one year to another. Compared to 2015, in 2024, the average price/year for early white cabbage and the average price/year for autumn white cabbage increased by 129% and 86.88%, respectively.

Table 6. Descriptive statistics regarding prices for cabbages in Romania in the period 2015-2024

Indicator	2024/2015 (%)	Min.	Max.	Average	Standard deviation	Coefficient of variation (%)	Annual growth rate (%)
Average price/year early white cabbage (lei/kg)	129	1.24	3.05	2.21	0.70	31.6	8.6
Average price/year autumn white cabbage (lei/kg)	86.88	1.35	3.42	2.02	0.61	30.1	6.4

Annual growth rate (%) regarding the average price for both early cabbage and autumn cabbage was 8.6% and 6.4% respectively. This growth rate may be influenced by higher costs of agricultural inputs and rising energy prices. According to Milin et al. (2025), prices are influenced by seasonality, supply reduction, and changes in consumer preferences.

CONCLUSIONS

In Romania, white cabbage is one of the most cultivated vegetable species. Romania is an important producer in the European Union, according to FAO. During the period 2015-2024, the evolution of cabbage cultivation in Romania, in terms of cultivated areas and total production, has shown a downward trend, while the average selling price has shown an upward trend. The reasons for the decrease in areas and production can be both economic, such as fluctuations in selling prices, higher costs of inputs and energy, etc., and technological, namely: climate change, the attack of diseases and pests, or the use of inadequate technology.

To increase production and cultivated areas of white cabbage, it is necessary to choose hybrids with good adaptability to temperature variations, resistant to heat, with easy access to irrigation, farmer training programs on the selection of fertilizers for the development of sustainable and innovative technologies, and the development of strategies to mitigate production risks.

A possible way to mitigate these problems would be to increase the level of information available to farmers regarding supply and demand and market trends, increase the level of association in cooperatives or other organizations to strengthen links with the market, conclude firm contracts, and provide predictability regarding cultivated areas and production costs.

REFERENCES

Al-Khayri, M., J., & Khan, T. (2024). Enhancing plant resistance to biotic stresses through rhizobacteria for sustainable agriculture. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, 52(2), 136.

Alboiu, C. (2022). The evolution of the Romanian vegetable trade in the world context. In: Rodino, Steliana Dragomir, Vili (Ed.): *Agrarian Economy and Rural Development- Trends and Challenges. International Symposium. 13th Edition.* The Research Institute for Agricultural Economy and Rural Development (ICEADR), Bucharest, pp. 81–88

Ayalew, A., & Girma, Y. (2025). Market supply and profitability of head cabbage production in northwest Ethiopia. *Discov Sustain,* 6, 1217.

Babeanu, C., Soare, R., & Dinu, M. (2017). Antioxidant enzyme activities in some cultivars of Brassica oleracea var. capitata F. alba. *17th International Multidisciplinary Scientific GeoConference SGEM Conference Proceedings* (Nano, bio and greentechnologies for a sustaInable future), 17, 93–100.

Băbeanu, C., Soare, R., Dinu, M., & Păniță, O. (2020). Antioxidant activities and phytochemical compounds in leaf cabbage (*Brassica oleracea* L. var. *acephala*) and Chinese cabbage (*Brassica rapa* L. var.

chinensis). *Scientific Papers. Series B. Horticulture*, 64(1), 339–346.

Bytyçi, A., Hyrije, K., Cengiz, Ç., Bujar, Q., Kopali, A., Trajkovska Petkoska, A. (2025). Nutrients and anti-nutrients analysis of green cabbage (*Brassica oleracea* var. *capitata*). *Żywność. Nauka. Technologia. Jakość*, 32, 2(143), 138–152.

Cervenski, J., Vlaji´c, S., Ignjatov, M., Tamindži, G., & Zec, S. (2022). Agroclimatic conditions for cabbage production. *Ratar. Povrt*, 59, 43–50.

Dinu, M., Soare, R., & Soare. B. E. (2024). The morphological and productive characterization of some kale genotypes. *Annals of the University of Craiova -Agriculture, Montanology, Cadastre Series*, 54 (1), 123-130.

Hou, P., & Chang, Y. (2025). Exploring the impact of Different Fertilization Practices and Regional Climate variables on cabbage (Brassica oleracea L. Var. Capitata) yield. *Sustainability*, *17*(13), 6086.

Iancu P., Soare M., & Panita, O. F. 2024, Effect of micronutrients applied to winter wheat. *Scientific Papers. Series A: Agronomy*, LXVII (1), 429-436.

Jabeen, J., I., Mir, G., Malik, S., Yasmeen, S., A., Ganie, R., Rasool, K., R., & Hakeem. (2024). Biotechnological interventions for improvement in cabbage (*Brassica oleracea* var. *capitata* L.). *Sci. Hortic.*, 329. Article 112966.

Milin, I., A., Merce, I., I., Rujescu, C., I., Sicoe -Murg, O., & Sîrbulescu, C. E., (2025). Analysis of Average Prices for Agricultural Products. *Annals of the University of Oradea, Fascicle: Ecotoxicology, Animal Science and Food Science and Technology*, 135–140.

Nawaz, H., Shad, M., A., & Muzaffar, S. (2018). Phytochemical Composition and Antioxidant Potential of Brassica, Brassica Germplasm - Characterization, Breeding and Utilization. Mohamed Ahmed El-Esawi, IntechOpen. DOI: 10.5772/intechopen.76120.

Popescu, A. (2013). Considerations on Romania's Vegetable Market. *Scientific Papers. Series "Management, Economic Engineering in Agriculture and rural development",* 13(4), PRINT ISSN 2284-7995, 227–234.

Prajapati, N. K, Anjali, Meena, R. C, Razauddin, Kumar, S., Kumar, P., & Chand, K. (2024). Cabbage Breeding Tools for Biotic and Abiotic Resistance. *Romanian Journal of Horticulture*, 5, 23–32.

Šamec, D., Pavlović, I., & Salopek-Sondi, B. (2017). White cabbage (Brassica oleracea var. capitata f. alba): botanical, phytochemical and pharmacological overview. *Phytochem Rev,* 16, 117–135.

Soare, R., Dinu, M., Babeanu, C., & Fortofoiu, M. (2016). Bioactive compounds and antioxidant capacity in some genotypes of white cabbage (Brassica oleracea var. capitata f. alba). *Conference Proceedings*, ISBN 978-619-7105-68-1/ISSN 1314-2704, (Nano, bio and green-technologies for a sustenaible future) Book 6(1), 437–444.

Soare, R., Dinu, M., BĂbeanu, C., & Popescu, M. (2017). Antioxidant Enzyme Activities of Some Brassica Species. *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca*. Horticulture, 74, 191.

Soare B. E. (2025). Brassica oleracea var. Capitata f. Alba: Cultivation, Phytochemical Content and Health Effects. A Mini Review. *Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series*, 55(1), 154–162.

Stoleru, V. V., Munteanu, N., C., Stoleru, C. M.V., & Rotaru, L. G. (2012). Cultivar Selection and Pest Control Techniques on Organic White Cabbage Yield. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, *40*(2), 190–196.

Ștefan, I., M. A., & Ona, A. D. (2020). Cabbage (*Brassica oleracea* L.). Overview of the health benefits and therapeutical uses. *Hop and Medicinal Plants*, Year XXVIII, No. 1-2, ISSN 2360–0179 print, ISSN 2360–0187.

https://madr.ro/comunicare, 2025

https://www.fao.org/faostat/en/#data/QCL, accesed 29.11.2025

https://www.statista.com/outlook/cmo/food/vegetables/, accesed 29.11.2025

http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table, accesed 29.11.2025