RESEARCH ON THE INFLUENCE OF CULTIVAR ON KALE CULTURE GROWN IN SOLARIUMS

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Abstract

Kale has its origins in antiquity, it was widely cultivated in the Middle Ages in Europe. It has recently been rediscovered due to its benefits to the human body. Research has shown an abundance of vitamins and minerals, anticancer actions, beneficial effects in lowering cholesterol, improving digestion and more. We cultivate quite a bit, most of the production comes from imports. The pedoclimatic conditions in Romania allow the cultivation of kale with good results, without additional effort.

Keywords: Cabbage, kale, leaves

INTRODUCTION

Cabbage for leaves, or more recently called "kale", is part of the group of cabbage vegetables, being cultivated for over 2000 years. The name kale comes from the Danish word "kāle" of Danish, Swedish and Norwegian origin, from the German word "Khal" and from the Scottish-Welsh word "cal" or "kall". Due to the very low requirements for vegetation factors, especially resistance to low temperatures, this variety has been a real success over time being cultivated especially in Europe. Its resistance to low temperatures enriches the assortment of fresh vegetables during the cold periods of the year.

Traditionally used as a fodder plant, its consumption as human food has been gradually abandoned in many countries. At the beginning of the 21st century, its nutritional qualities were brought to light, making these green vegetables return to the market stalls that they had forgotten. (Wiki)

Kale has an attractive appearance, with strongly corrugated leaves and different colours, depending on the variety and can also be used as an ornamental plant. Kale has a slightly sweet taste with an astringent texture due to its high iron content. However, the taste can be different depending on the variety. Kale has attracted attention through the richness of vitamins, minerals, few calories, with many benefits on the human body. According to some studies, kale is low in carbohydrates, low in calories. It is a good

source of fiber, calcium, magnesium, potassium, vitamins B2 and B6. It is rich in beta-carotene (provitamin A), vitamins K, C and B9. It offers remarkable proportions of copper, iron, magnesium, vitamins E, B1 and B3. Simultaneously with the increase in the consumption of kale, the research in this direction has intensified. German researchers have conducted a study to confirm the benefits of kale. A regular intake of kale could maintain an optimal concentration of lutein and zeaxanthin in the macula (Arnold & al.,2013).

Other specific constituents of brassicas, glucosinolates and their derivatives, have been highlighted by researchers (Capuano et al). Kale contains glucosinolates - such as green or red cabbage, broccoli and Brussels sprouts - in varying proportions, depending on the variety (Hanh & al.,2016). These sulphur compounds (responsible for the strong taste of cabbage) are used to protect the cabbage from pests and are transformed in plants or the human body (especially due to enzymes in the intestinal microbiota) into isothiocyanates or indole-3-carbinol (Rouzaud & al.,2004). The latter could prevent cancer by multiple mechanisms: by neutralizing carcinogens, by protecting the DNA of cells, by blocking the proliferation of cancer cells or by promoting apoptosis, their natural death (Capuano et al).

Diets rich in vegetables from the Brassicaceae family are associated with lower levels of LDL cholesterol in the blood, "bad" cholesterol (C.N. Armah et al). Kale combines soluble fiber (pectin), which captures some of the fat in meals in the digestive tract and phytosterols, which limit the absorption of cholesterol (Souci,Fachmann & Kraut).

Vegetables rich in carotenoids or beta-carotene, including kale, are thought to help prevent breast cancer, and vegetables rich in vitamin C help prevent colon cancer. (https://www.wcrf.org/dietandcancer/contents)

MATERIAL AND METHOD

The research was carried out in a vegetable microfarm in the Husasău de Tinca village (NV of Romania), certified ecologically. Being cultivated only sporadically in our country, kale is demanded by Romanian consumers, the largest quantity from us coming from imports. In addition to the promotion of this vegetable, growers should also benefit from some data on the variety of cultivation, which will make their crop profitable. In the autumn of 2019, in a 500 m2 plot, a single-factor experiment was set up according to the subdivision blocks method, with nine variants in three repetitions, each variant had five plants. The nine cultivars were: Nero di Toscana, Westlander Winter, Red Ursa, Beurre Blond, Russian Frills, Wild Red, Hanover Salad, True Siberian, Siberian. The statistical processing of the experimental data was done by analyzing the variance. The media of the

experience was chosen as a witness. The culture was established in the last decade of October. At the time of planting, the seedling was 48 days old. The technology of cultivation applied was the ecological one for kale.

RESULTS AND DISCUSSIONS

Harvesting in the case of cabbage vegetables is differentiated according to variety. Thus, some, such as cabbage, are harvested in a single pass, while kale and others are harvested in stages. In the case of the present experiment, the harvest began in the first decade of February and lasted until the first decade of April. At each pass, the harvest was done on variants and repetitions, the average production of the repetitions was recorded in table 1. The leaves that reached the characteristic size of the variety were harvested each time, any delay in harvesting leads to a decrease in quality.

The experimental data in Table 1 show that the cultivar significantly influences the production of leaves. Thus the absolute production / m2 varied from 1.03 to the Westlander Winter variety and reaching 3.61 to Red Ursa, which is 3.5 times more than the first variety. At Red Ursa, the increase in production compared to the average experience was 57.65%, the difference was ensured statistically very positive. The second cultivar that exceeded in absolute production 3 kg / m2 (3.12), was True Siberian. From this, 0.49 kg / m2 more leaves were harvested than the control. The difference was statistically assured, very significant positive. The Russian Frills variety recorded in absolute production, with 4.6 t / ha more than the average of the experience, the difference being statistically assured, a significant significant positive. Of the nine crops grown in the studio, the weakest leaf harvest was recorded at Westlander Winter, only 1.03 kg / m2, less by 1.26 kg / m2 compared to the average experience, the difference being ensured statistically very significant negative. Another very poorly produced variety was Nero di Toscana. He managed to get only 55.48% of the witness's output. The difference from it was statistically assured, very significant negative. The varieties, Beurre Blond and Hanover Salad, had close leaf yields, but below the average production level of experience. In both varieties, the differences from the control were statistically assured, distinctly significant negative. Leaves from the Wild Red variety were harvested in quantities close to the average of the experiment, but the difference compared to this did not exceed the threshold p = 5%, not being statistically assured.

Table 1

Production of kale
Husasău de Tinca, 2020

Cr. no.	Variant	Absolute production of kale kg/m^2	Relative production of kale %	± d kg/m^2	Signifi cance
1	**Nero di Toscana**	1.25	55.48	-1.04	000
2	**Westlander Winter**	1.03	44.97	-1.26	000
3	**Red Ursa**	3.61	157.65	+1.32	xxx
4	**Beurre Blond**	1.82	79.47	-0.47	00
5	**Russian Frills**	2.75	120.08	+0.46	xx
6	**Wild Red**	2.45	106.98	+0.16	-
7	**Hanover Salad**	1.83	71.91	-0.46	00
8	**True Siberian**	3.12	136.94	+0.83	xxx
9	**Siberien**	2.78	121.39	+0.49	xxx
10	Average Mt.	2.28	100.00	0.00	-

$LSD_{5\%}$=0,27 $LSD_{1\%}$=0,35 $LSD_{0,1\%}$=0,48

Table 2 shows the quality of leaf production for the analyzed varieties, both in absolute value and in % of total production. Regarding this aspect, it can be seen that, if in the case of quantitative production the differences between the varieties were quite large, the quality of the leaves was highlighted in most of them. Thus, the extra quality production exceeded 40% of the total production for all varieties analyzed. In this respect, the Red Ursa variety stood out with 63.15% of the total production, respectively 22.8 t / ha, in absolute production. The lowest amount of extra quality leaves was obtained from the True Siberian variety, only 44.23% of the total production. For the other varieties, the values of extra quality production as a percentage of the total were between 44.80 for the Hanover Salad variety and 56.73 for the Wild Red variety. The production of quality I leaves had values from 24.80% of the total for the Nero di Toscana variety, to 40.98% for Hanover Salad. It can be noticed that the leaves of extra quality cumulated with those of quality I, for all varieties, represent over 70% of the total production. Finally, the second quality represented very little for the Red Ursa variety (3.23%), but quite a lot for the Nero di Toscana variety (28.80%).

Tabel 2

The quality of the kale production
Husasău de Tinca 2020

Cr no.	Variant	Absolute production kg/m^2	Extra quality out of total		1st quality out of total		2nd quality out of total	
			Kg/m^2	%	Kg/m^2	%	Kg/m^2	%
1	**Nero di Toscana**	1.25	0.58	46.4	0.31	24.80	0.36	28.8
2	**Westlander Winter**	1.03	0.47	45.63	0.34	33.00	0.22	21.35
3	**Red Ursa**	3.61	2.28	63.15	1.21	33.51	0.12	3.32
4	**Beurre Blond**	1.82	0.95	52.19	0.57	31.31	0.30	16.48
5	**Russian Frills**	2.75	1.40	50.90	0.75	27.27	0.60	21.18
6	**Wild Red**	2.45	1.39	56.73	0.69	28.16	0.37	15.10
7	**Hanover Salad**	1.83	0.82	44.80	0.75	40.98	0.26	14.20
8	**True Siberian**	3.12	1.38	44.23	1.15	36.85	0.59	18.91
9	**Siberien**	2.78	1.35	48.56	0.94	33.81	0.49	17.62

CONCLUSIONS

The researches carried out in an ecological microfarm from NW Romania regarding the influence of the cultivar on the kale cabbage culture, highlighted some conclusions, namely:

1. The cultivation of kale in the ecological system is very suitable for the winter in a protected (solar) system.
2. Kale cabbage leaves harvested in late winter and early spring, enrich the assortment of green vegetables, the demand being quite high during this period.
3. Comparing the average production of the nine cultivars grown in the studio with the yields of other green vegetables, they are close, so the crop could be implemented by other vegetable producers.
4. With an absolute production of 36.1 t / ha and an increase in production exceeding 57% compared to the average experience, the Red Ursa variety had the highest amount of leaves, compared to the other varieties studied.
5. The lowest production potential of kale leaves was recorded at the Westlander Winter cultivar (1.03 kg / m2), at the same time with a lower leaf quality.
6. The analysis of the quality of the production of kale leaves showed a very good quality of the leaves in the Red Ursa variety, 63.15% of the total, extra quality and over 96% cumulated extra quality and quality I.
7. True Siberian was the variety with the lowest leaf quality.

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