STUDY ON THE BEHAVIOR OF SOME MANGOLD VARIETIES CULTIVATED IN THE WESTERN AREA OF ROMANIA

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Abstract: Mangold (Beta vulgaris ssp.cicla L.) is cultivated for leaf stalks (petioles) but can also be consumed in their different culinary dishes. In Europe, it is grown on larger surfaces in Italy, France and Spain. It is an important source of beta carotene and vitamins (C and A). Petiole is rich in sodium and potassium and leaves contain potassium, calcium and phosphorus (Indrea et al., 2012, Lagunovschi-Luchian and Vânătoru, 2016).Experience was carried out in 2017, in a vegetable farm, in the locality of Săcuieni, Bihor County, a favorable area for mangold culture due to specific pedoclimatic conditions.

Keywords: mangold, cultivar, plant growth, production.

INTRODUCTION

Beet or mangold beet (Beta vulgaris L., ssp.vulgaris (sin.ssp.cycla), convar.*vulgaris*, var. *flavescens* DC., is grown for whole leaves or only for petiole which has a pleasant taste, is very fleshy, tender and juicy (Ciofu et al., 2004) Petiole is separated from the leaf, boiled slightly in salted water and prepared like asparagus or cauliflower, rest of the leafs are used for the preparation of soups or pizzas, such as spinach (Stan et al. , 2003).

Mangold has it's origin in wild beet, that is spontaneously growing in Mediterranean Sea area. Mangold has been known since antiquity and is growing on larger areas in the U.S., Japan, India, and in Europe, Italy, France and Spain. In Romania, it is a less cultivated species, present in some areas of Transylvania. Being a species with lower temperature requirements can be cultivated in all areas, except mountain areas. It has resistance to high temperatures (over 35^{o}C), thus it is an excellent summer vegetable also for the southern areas (Lagunovschi-Luchian and Vînătoru, 2016). Leaves and petiole contain vitamin C, carbohydrates, cellulose, protein substances, mineral salts (potassium, sodium, phosphorus, calcium). It is recommended in diabetes patients diet, it is a good digestive, has anti-infectious properties and contributes to good circulation of blood. Vitamin C content in 12 mangold cultivars averaged 72 mg/kg in fresh petiole) and 307 mg/kg, respectively, in fresh leaf limbs (Pokluda et Kuben, 2002). Leaves content in mineral elements, quantitative and qualitative production are influenced by fertilization (Santamaria et al., 1999). Shannon et al. (2000) considers mangold to be a vegetable with high tolerance to soil salinity, which is why plants have higher amounts of sodium in the leaves compared to other vegetables grown in soils with higher pH. Leaf petiole is white in most varieties, but there are cultivars and varieties with petiole colored in different shades of red, yellow-orange or violet, and thus have a distinctive decorative aspect (Apahidean and Apahidean, 2000, Cristea, 2014).

Generally, culture is set up by sowing directly into the field, in spring, second decade of April. Depending on the capitalization period, sowing can take place until July 15th. However, spring crop production may be double compared with autumn culture (Kolota et al., 2010). Short period of vegetation is characteristic, so is ready to be harvested 60-70 days after crop establishment.

MATERIALS AND METHODS

Experience was carried out in 2017, being located in a vegetable farm, in Săcueni, Bihor County, in the western part of Romania. Climate of the area has elevated heliothermal values and high water resources. Number of days without frost is 213 days, average active day temperatures of 18.7° C, the length of the vegetation period of 175 days. The average monthly multiannual temperature in the experimental area has positive values starting from February (0.3°C), then reaches 5.0°C in March, 10.5° C in April, May 15.8 ° C. The average annual temperature is 8-10° C. In 2017, the precipitation value was 604.7 mm. Land on which the experience was placed was alluvial. Experience purpose was to determine how more mangold cultivars, cultivated in the field, behave in the conventional culture system. Objectives were to determine the vegetative growth of plants and production.

Cultivars Carde blanche d'Ampuis, Bright Yellow, Liscia verde da Taglio, Charlotte, Verte of carde blanche, Lucullus and Couleurs rainbow were used in the experience (7 experimental variants, placed in three rehearsals). *Carde blanche d'Ampuis* is a variety in which leaf petiole reaches a width of 10-12 cm, it is also flattened and white. It is a rustic variety, of special quality, with vertical dark green leafs. *Bright Yellow* is a cultivar with yellow petiole and leaf veins, with a strong contrast which ensures a special decorative aspect. In the young state it can be used in salads. It is resistant to premature flowering, can be cultivated from early spring to late autumn. The height of leaves reaches up to 50 cm and the width up to 40 cm. *Liscia verde da Taglio* is an early variety from which leaves are consumed like spinach. The plant has an erect port, leaves are green-glossy. It is harvested after 50 days after emergence. It is adapted to cold, temperate climate. *Charlotte* is a variety that forms red petioles with vivid, ornamental shades. Young leaves or leaf petiole at full development can be used. Also suitable for crops in containers. *Verte a carde blanche* is a typical long petiole, well-developed, white-creased mangold. Leaf are corrugated and dark green. Young plants are used in salads or preparations like spinach and leaf petioles are cooked or steamed, like celery petiole. In order to obtain vigorous petioles, spring cultures are recommended. *Lucullus* is a mangold cultivar that forms well-developed petioles of medium length, white, leaves are dark green with white veins, reaches maturity about 60 days after emergence, is resistant to high summer temperatures. *Couleurs rainbow* is a variety with well-developed red-orange petioles. Leaves are lightly corrugated with orange red veins, which ensures the ornamental appearance of plants. It is adapted to a warm climate, harvested after at least 45 days from emergence. Experience was placed in the field and was set up by direct sowing, on 11.05.2017, on a properly prepared land (fertilized from autumn with 40 t/ha semi-compounded manure). After emergence, plants were rarified, then the usual maintenance work was carried out. Leaves harvesting began in July and lasted until December. Observations on plant growth, plant height, leaf rosette diameter, leaf length, leaf/plant number, petiole length and thickness at the base of the plant were made.

RESULTS AND DISCUSSIONS

Approximately one month after crop establishment, mangold plants reached a height of 28.75 cm to 34.08 cm (Table 1). For Carde blanche d'Ampuis, Bright Yellow, Liscia verde da Taglio, Verte a carde blanche and Couleurs rainbow, plants have exceeded 30 cm. After 50 days of sowing, plants reached a height of 52.46 cm (Verte a carde blanche) and 65.00 cm (Couleurs rainbow). Leaf rosette diameter was, after one month from sowing, between

43.75 cm and 55.62 cm (Table 1). Four of the seven varieties cultivated exceed 50 cm in diameter (Carde blanche d'Ampuis, Bright Yellow, Verte a carde blanche and Couleurs rainbow). Within 20 days, mangold plants formed a leaf rosette of 24.25 cm to 38.66 cm. Average daily growth rate of leaf rosette diameter ranged from 1.21 cm/day at Charlotte variety and 1.93 cm/day at Lucullus variety.

Table 1

Cultivar influence upon growth of mangold plants

Cultivar	Plant Height(cm)				Rosette diameter (cm)			
	16.06	7.07	Difference	cm/ day	16.06	7.07	Differnce	cm/ day
Carde blanche d'Ampuis	30.75	58.70	27.95	1.39	51.50	81.04	29.54	1.48
Bright Yellow	33.08	64.92	31.84	1.59	54.79	85.50	30.71	1.53
Liscia verde da Taglio	32.00	53.08	21.08	1.05	49.54	85.33	35.79	1.79
Charlotte	28.75	48.16	19.41	0.79	43.75	68.00	24.25	1.21
Verte a carde blanche	34.00	62.75	28.75	1.44	55.25	89.91	34.66	1.73
Lucullus	29.58	52.46	32.88	1.64	49.58	88.24	38.66	1.93
Couleurs rainbow	34.08	65.00	30.92	1.55	55.62	88.58	32.96	1.65

One month after crop establishment, the seven varieties of mangold plants cultivated had leaves between 26.25 cm (Charlotte) and 30.55 cm (Couleurs rainbow), (Table 2). After 50 days from sowing, leaves reached 41.18 cm to 50.75 cm. Average daily growth rate of leaves was between 0.75 cm/day (Charlotte) and 1.04 cm/day (Carde blanche d'Ampuis).

Average leaf/plant number ranged between 4.91 and 6.33, depending on the variety (Table 2). After another 20 days, number of leaves/plant was between 11.50 (Bright Yellow and Couleurs rainbow) and 12.50 (Carde blanche d'ampuis and Verte a carde blanche). The average daily rate of leaves formation was 0.26 to 0.37.

Table 2

Cultivar influence on growth and formation of mangold leaves

Cultivar	Leaf lenght (cm)				Number of leaves			
	16.06	7.07	Diffe-rence	cm/day	16.06	7.07	Diffe-rence	pieces/day
Carde blanche d'Ampuis	27.10	47.91	20.81	1.04	5.33	12.50	7.17	0.36
Bright Yellow	30.28	50.75	20.47	1.02	5.16	11.50	6.34	0.32
Liscia verde da Taglio	29.19	44.55	15.36	0.77	6.33	11.58	5.25	0.26
Charlotte	26.25	41.18	14.93	0.75	5.58	11.91	6.33	0.32
Verte a carde blanche	29.46	49.76	20.30	1.01	5.56	12.50	6.84	0.34
Lucullus	26.63	43.73	17.10	0.85	4.91	12.33	7.42	0.37
Couleurs rainbow	30.55	48.85	18.30	0.91	5.25	11.50	6.25	0.31

Petiole growth rate was different, depending on the cultivar (Table 3). Lenght growth of petioles was more accelerated in Carde blanche d'Ampuis (0.47 cm/day), Bright Yellow (0.41 cm/day), Liscia green da Taglio (0.39 cm/day) and respectively Couleurs rainbow (0.38 cm/day). Petioles diameter at the base of the plant ranged between 14.85 cm and 31.68 cm at the beginning of July, and the growth rate averaged between 0.36 cm/day and 0.94 cm/day (Table 3) .

Table 3

Cultivar influence on the formation of mangold petiole

Cultivar	Petiole lenght (cm)				Diameter at the base of the plant (cm)			
	16.06	7.07	Diferența	cm/zi	16.06	7.07	Diferența	cm/zi
Carde blanche d'Ampuis	7,28	16,61	9,33	0,47	11,73	29,82	18,09	0,90
Bright Yellow	8,81	17,11	8,30	0,41	10,92	20,43	9,51	0,47
Liscia verde da Taglio	9,96	16,82	7,86	0,39	8,25	14,85	7,60	0,38
Charlotte	8,02	13,56	5,54	0,28	8,66	15,87	7,21	0,36
Verte a carde blanche	14,56	15,84	1,28	0,06	12,83	31,68	18,85	0,94
Lucullus	6,15	11,52	5,37	0,27	10,25	20,05	9,80	0,49
Couleurs rainbow	8,50	16,21	7,71	0,38	12,69	21,35	8,66	0,43

CONCLUSIONS

On the basis of the results obtained from the research on mangold cultivated in open field, in the specific conditions of Western Romania, using the cultivars Carde blanche d'Ampuis, Bright Yellow, Liscia verde da Taglio, Charlotte, Verte a carde blanche, Lucullus and Couleurs rainbow has come to the following conclusions: 50 days after sowing the plants reached a height of 52.46 cm (Verte a carde blanche) and 65.00 cm (Couleurs rainbow);

- The average daily growth rate of leaf rosette diameter was between 1.21 cm/day in Charlotte variety and 1.93 cm/day in Lucullus variety; 50 days after sowing, leaves reached 41.18 cm to 50.75 cm;

- Average daily growth rate of leaves was between 0.75 cm/day (Charlotte) and 1.04 cm/day (Carde blanche d'Ampuis); Petiole growth rate was different, depending on the variety being between 0.06 cm/day (Verte a carde blanche) and 0.47 cm/day (Carde blanche d'Ampuis).

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