

RESEARCH ON THE GROWTH AND DEVELOPMENT OF PETIOLES AND LEAVES IN SEVERAL SWISS CHARD VARIETIES

Silagy Dorin, Cărbunar Mihai, Popovici Mariana

University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048,
Oradea, Romania, e-mail: carbunar@yahoo.com

**Agricultural Research and Development Station Oradea, 5 Calea Aradului St., Oradea,
Romania, e-mail: scdaoradea@yahoo.com

Abstract

The chard is a plant cultivated for its leaves and its stalk and it has been known since very long time ago. It is very poor in calories and rich in vitamins, mineral salts and active principles. As the aerial part of the plant is the one eaten the characteristics of the leaf are very important for the production as well as the thickness and size of the stalks.

Key words: chard, characteristics of the plant, stalk, thickness of stalk

INTRODUCTION

According to botanists and historians, the chard had appeared in the heat of the mediterranean basin as tracks of consumption and of chard cultures have been found in Mesopotamia as well as in Ancient Rome. Although it is not as much consumed as other vegetables it is still a vegetable with deep roots in history.

Eaten raw or cooked, the stalks and the leaves be them consumated together or separately, the chard is very much used in gastronomy, due to its pleasant taste and to the finesse of the dishes prepared with it. Being poor in calories but very rich in vitamins and in mineral salts it is recommended in weight losing diets and for the people who perform a sedentary work.

The richness in vitamins and mineral salts, the color of the stalks and of the leaves have drawn the attention of the researchers, the chard thus becoming a vast material for research.

The chemical composition has been researched and the nutritious qualities of the different types of chard respectively, for example of the *Beta vulgaris* and its subspecies *cicla*, in order to discover the biological activities of the plant related to its anti cancer, anti diabetes and anti oxidizing properties. (Ninfali et al, 2007; Ninfali and Angelino, 2013; Pyo et al, 2004; Sacan and Yanardag, 2010; Gil and co., 1998; Bozokalfa and co., 2011; Tomas-Callejas et al., 2011; Pokluda and Kuben, 2002; Gennari and co., 2011; Santos et al, 2014; Yanardag and Colak, 1998; Bolkent and co., 2000; Ninfali and Bacchiocca, 2003). The phenolic content and the anti

oxidizing activities of the plant have the most often studied. In comparison with other vegetables from the Mediterranean diet which are largely consumed the chard represents a great antioxidizing activity. (Bolken și colab., 2000).

In Turkey, in popular medicine the chard is used as an anti diabetes agent. One of the studies related to the hypoglycemic properties (Yanardag și Colak, 1998) has shown that one dose of 2-8g from a kilogram of wet extract from dry chard leaves has led to the decrease of the glucose from the blood of the rabbits that had been induced with diabetes through alloxan whereas the methanol extract from the same plant has not done the same thing.

The methanol – water (8.2) extracts have been compared, from two types of chard (green and yellow) in order to observe the content and composition of the flavonoids as well as what quantity of C vitamin do the plants contain. The effects of cooking the chard have also been analyzed, as well as what happens to the plant if it is preserved or if it is packed. Five types of flavonoids have been identified in the green chard as it follows: 2-xylosylvitexin (1), 8-C-B-D-(2"-B-D-xylopyranosyl-6"-malonyl), glucopyranosil apigenin (2"-xylosyl-6"-malonylvitexin)(2, 6"-malonyl-2"-xylosylvitexin), kempferol 3-gentiobiosid (3), isorhamnetin 3-gentiobiosid (4), isorhamnetin 3-vicianosid (5), but only two, 1 and 2 in the yellow type (Gil and co., 1998). The total content of flavonoids has been of 2.76 and of 1.26mg/g (calculated at the weight of the fresh plant). In what the C vitamin content was concerned both types have had quantities of 0.45mg/g (calculated at the weight of the fresh plant). The processing of the plant also affects its content of C vitamin as well as its content of anti oxidizing phenols, as follows: 50% of the flavonoids have been extracted during the time the plant was cooked and the rest has remained in the cooked leaves while 80% from the C vitamin present in the initial tissue had lost during the cooking process. (Gil et al., 1998).

MATERIAL AND METHODS

The study of how certain types of chard behave, chard of different sizes and colors cultivated out in the open field, has been done in the year 2016, in Bihor county, in Săcuieni locality, in a private micro farm where an experimental field of 500 m² has been organised.

The soil and weather conditions are extremely favorable. The average annual temperature is of 10.2°C with cold winters and moderate summers.

The average annual rainfall has values of 615.2 mm, spread non uniformly and with torrential character, the poorest period in rainfall being the months August – October thus facilitating a corresponding harvesting.

The period with the most rainfall is during the winter months when a reasonable reserve of water is created in the soil and the same thing happens in May and in June. The soil on which the experimental field exists is clay-sandy on an aluvisol pedological horizon.

The monofactorial experience has been organized after the subdivided blocks' method, with 14 variants in three repetitions. Each variant had 10 plants. The biological material has been represented by 7 types of chard: VERTE A CARDE BLANCHE 3, COULEURS RAINBOW, CHARLOTTE, LISCIA VERDE DA TAGLIO, BRIGHT YELLOW, LUCULLUS, CARDE BLANCHE, AMPUIS. The average of the experience was the witness. The processing of the experimental data has been performed by analyzing the variants.

RESULTS AND DISCUSSIONS

As mentioned above the chard is consumed for its leaves and for its stalks which represent the eatable part. For chard cultivators and because of economical reasons these 2 parts of the plant represent the basic elements and in the case of a comparative study of more types of chard those two elements represented the basis of the research.

In order to reach the targeted objectives for each of these types of chard the following things have been analyzed: number of leaves on the plant, the total length of the leaf, the width of the leaf, the length and thickness of the stalk. In what the chard is concerned the harvesting of the eatable parts is done in more stages. Therefore the measurements related to the characteristics of the leaves have been done in more stages too., before harvesting. For the current experience there have been 2 measurements: one on 18.06 and the other one on 05.07.

Table 1 represents the number and characteristics of the leaves on the 18th of June 2016. The table presents average data from each variant. In what the number of leaves is concerned these were of 4.66 at the Lucullus type of chard and up to 6.58 at the Liscia Verde da Toglio type. The type of chard with the biggest leaves was Verte a Card Blanche, with a total length of 32,72 cm while the Charlotte type of chard had a leaf 24,89 cm long. The leaf of the Ampuis type has been very close to that of the Charlotte type as length was concerned, that meaning 24.92. The Verte a Carde Blanche, Rainbow and Luculus type of chard have had even bigger leaves, of over 30 cm long whereas the rest of the types had leaves of less than 30 cm long. The width of the leaf had dimensions between 9.48 cm at the Charlotte type and 14, 03 at the Verte a Card Blanche type. The length of the stalk had 7,02 cm at the Ampuis type and 10.84 at the Verte a Card Blanche type. In what the thickness of the stalk was concerned that was analyzed separately

and later and it has been between 8.46 mm at the Charlotte type and 16.13 mm at the Verte a Card Blanche type.

Table 1

Characteristics of the chard leaves
(the first measurement 18.06)

Săcuieni 2016

Crt. No.	Type	No. of leaves	Total length of the leaf (cm)	Width of the leaf (cm)	Length of the stalk (cm)	Thickness of the stalk (mm)
1	AMPUIS	6.50	24.29	10.87	7.02	10.63
2	LISCIA VERDE DA TAGLIO	6.58	29.78	11.14	10.36	8.85
3	CHARLOTTE	4.66	24.89	9.48	8.03	8.46
4	COULEURS "RAINBOW"	4.75	32.55	13.82	9.90	13.48
5	LUCULLUS	4.66	30.76	13.28	7.43	11.51
6	BRIGHT YELLOW	6.08	26.11	9.85	7.99	9.17
7	VERTE A CARDE BLANCHE 3	5.50	32.72	14.03	10.86	16.13

The analysis of the leaf's characteristics measured in July and presented in table 2 shows differences in comparison to the first measurement.

Regarding the number of leaves that was of 7,08 at the Ampuis type and of 9,00 at the Liscio Verde Da Toglio type. A considerable increase is to be noticed at the total length of the leaf which reached even 45,76 cm at the Rainbow type, with 13,21 cm more than at the first measurement. As well as at the first measurement the smallest leaf had been measured at the Charlotte type of chard (31,93 cm). The width of the leaf has registered less significant increases. If at the first measurement the Verte a Card Blanche type of chard has had the highest value (14,03), at the second measurement the Rainbow type, with a width of 20,01 cm has won the first place. As usually the Charlotte type of chard has had the lowest value, of 10,73 respectively.

The values of the stalks' length have been between 9.46 cm at the Ampuis type and of 14.02 at the Rainbow type, the latter registering the highest increase as well since the first measurement (9.90→16.02).

The width of the stalks has also registered value increases, from 10.45 at the Liscio Verde Da Toglio type to 21.49 at the Verte a Card Blanche type.

Table 2

Characteristics of the chard leaves
(the second measurement 05.07)

Săcuieni 2016

Crt. No.	Type	No. of leaves	Total length of the leaf (cm)	Width of the leaf (cm)	Length of the stalk (cm)	Thickness of the stalk (mm)
1	AMPUIS	7,08	33,27	14,35	9,46	20,15
2	LISCIA VERDE DA TAGLIO	9,00	33,49	13,85	14,17	10,45
3	CHARLOTTE	7,25	31,93	10,73	10,82	10,72
4	COULEURS "RAINBOW"	8,42	45,76	20,01	16,02	16,90
5	LUCULLUS	8,53	40,40	14,76	9,68	16,13
6	BRIGHT YELLOW	7,16	40,49	13,41	13,18	14,61
7	VERTE A CARDE BLANCHE 3	8,66	40,47	17,28	14,53	21,49

The thickness of the stalks represented a special study. In table 3 we have registered the average thickness of the two measurements statistically processed. The witness was represented by the average of the experience. In comparison to the average of the experience we can notice positive as well as negative variations. Thus, the highest value of the stalks' thickness belonged to the Verte a Card Blanche type of chard (21.49 mm) with 59.53% more than the witness. The difference towards this has been statistically and positively ensured very significantly. The latter one registered values over average at the first measurement too, with 2.64 mm, the difference towards the witness having been very significantly statistically ensured.

If at the first measurement the Ampuis type of chard has only reached 78,91% out of the value of the witness, the difference being negatively and statistically ensured very significantly, at the second measurement this has overtook the average with 6,68 mm, the difference towards the witness being very significantly positively and statistically ensured. Not the same thing can be said about the Liscia Verde da Toglio type of chard which registered values under the average of the experience at both measurements, at the first one it registered 65.70% and at the second one 77.57% from the value of the witness. At both measurements the differences have been very significantly negatively and statistically ensured.

Even if it registered some progress at the second measurement, the Charlotte type of chard did not succeed to reach the value of the average experience but it only reached 62.80 mm at the first measurement and 79,58 at the second measurement. At the latter one the difference in comparison to the witness has been significantly distinctively negatively statistically ensured.

Table 3

Thickness of chard stalks

Săcuieni 2016

Crt. No.	Variant	Absolute thickness of the stalks(mm)	Relative thickness of the stalks %	± d mm	Significance
1	AMPUIS	10.63	78.91	-3.07	000
2	LISCIA VERDE DA TAGLIO	8.85	65.70	-4.62	000
3	CHARLOTTE	8.46	62.80	-5.01	000
4	COULEURS "RAINBOW"	13.48	100.07	+0.07	-
5	LUCULLUS	11.51	85.44	-1.98	0
6	BRIGHT YELLOW	9.17	68.07	-4.30	000
7	VERTE A CARDE BLANCHE 3	16.13	119.74	+2.66	xx
8	AMPUIS	20.15	149.59	+6.68	xxx
9	LISCIA VERDE DA TAGLIO	10.45	77.57	-3.02	000
10	CHARLOTTE	10.72	79.58	-2.75	00
11	COULEURS "RAINBOW"	16.90	125.46	+3.43	xxx
12	LUCULLUS	16.13	119.74	+2.66	xx
13	BRIGHT YELLOW	14.61	108.46	+1.14	-
14	VERTE A CARDE BLANCHE 3	21.49	159.53	+8.02	xxx
15	AVERAGE Ct.	13.47	100.00	0.00	-

LSD_{5%}=1.16

LSD_{1%}=2.17

LSD_{0,1%}=2.9

CONCLUSIONS

The research performed in Săcuieni, Bihor county related to the growth and development characteristics of the chard have led to the issue of certain conclusions:

1. The values differ between the two measurements, we have noticed value increases at the second measurements higher or lower, according to the type of chard.
2. The higher increase of the number of leaves from the first to the second measurement happened at the Luculus type of chard with 3.87, but

the highest number of leaves has been registered at the Liscia Verde da Toglio type of chard.

3. Rainbow was the type of chard with the biggest leaves, type which at the first measurement situated itself on the second place and which gained supremacy at the second measurement with 45.76 cm.

4. Rainbow is the type that has the widest leaf having an average value of 20.01 at the second measurement and the second place belongs to the Verte a Card Blanche type.

5. The length of the stalk represents a characteristic that many times leads to an increase of the sale price and from this point of view the Rainbow type of chard has got the longest stalks (16.02) plus a very attractive color.

6. The thickness of the stalks has registered significant increases from the first to the second measurement especially at the Ampuis and the Rainbow types.

7. The Verte a Card Blanche type of chard has emphasized itself from the very first measurement with the highest value of stalk thickness (21.49).

8. According to the characteristics of its leaves the chard can be cooked and eaten in different ways.

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