The relationship between sowing dates and vernalization treatments and growth characters and some chemical components of *Beta vulgaris* L. cv. Pleno.

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Abstract: The aim of the present study was to study the effect of differs three sowing dates (15th October, 15 th November and 15 th December 2009 & 2010) and two vernalization treatments (5°C and -20° C) on growth and some chemical components of *B. vukgaris* L. cv. Pleno leaf. Maximum values of growth parameters were recorded at 15 th Oct. treatment. Whereas, the highest values of chl. a, b and a+b were shown at 15 Nov. treatment. At the same time, in most cases, reducing sugars and total phenols were the very height in their values at 15th December treatment. Regarding to cooling treatments, in most cases, decreased of plant length and number of leaves and increased of leaves fresh and dry weight. In addition, most of the studied cooling treatments decreased of chl. A, b, a+b ratio and carotenoids and increased by reducing sugars and total phenols.
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1. Introduction

Sugar beet is a biennial plant, in the first year, epigeal germination leads to the development of a rosette of glabrous dark green and glossy leaves. Leaf's production continues through the first season while the roots swell and accumulate sucrose (Ouda, 2001). Both sugar beet (*Beta vulgaris* L., Chenopodiaceae) and sugar cane constitute the only important sources of sucrose; nearly 40 % of world sugar production is obtained from sugar beet. Sucrose sugar has been a valued component of the human diet for thousands of years. Many attempts have been made to produce the ethylene from sugar for using as fuel. Sugar beet is an important crop in north Egypt Delta because of its tolerance to salinity.

Crop rotation is one of the most valuable agronomic strategies in improving farming system. Planting date have an active role on growth, yield and quality of sugar beet. The early sowing of sugar beet under the favorable climate and soil conditions will produce healthy plants and support a good chance for successful crop rotation. Under the environmental conditions of Egypt, there is a general agreement that early planting of sugar beet (September – October) produced the highest sucrose percentage as well as root and sugar yield per unit area (Bugbee, 1993, Leilah *et al.,* 2005 and Ozturk *et al.,* 2008).

Generally harvested in the first year after sowing, is the non reproductive tissues, either petals or leaves in the case of the chard and leafy types, or roots in the remaining crop types where end uses in suggested in the common name. Leaves differentiate to form a rosette; their size can vary in relationship to genotype, plant stage, climatic condition and the presence of leaf diseases. The first pairs of leaves are horizontally oriented to maximize light interception and subsequent leaves have a more erect position (Klotz, 2005 and McGrath *et al.,* 2007).

Exposure of seeds in many plant species for a prolonged period of cold before the sowing promotes flowering. This process termed vernalization (Reeves *et al.,* 2007).

In addition, Hassan *et al.* (2008) study the effect of different three sowing dates (15th Oct., 15th Nov. and 15th Dec.) and two vernalization treatments (5° C and -20° C) on growth and some chemical components of *B. vulgaris* L. cv. Universal Leaf under Ismailia governorate conditions and found that higher values of plant height, number of leaves/plant, fresh and dry weight per plant, chlorophyll a, b and a+b were shown in 15th Oct. treatment. The contrary trend was found at 15th Dec. Furthermore, reducing sugars, total phenols and auxin like-substances were increased by 15th Dec. treatment. Growth parameters, chl. a, b, a+b, a/b, reducing sugars, total phenols and auxin like-substances were differed according to the used cooling treatments compared with the control. All of the used cooling treatments decreased of auxin like-substances, reducing sugars at 90 days from sowing and total phenols at 90 and 120 days after planting in comparing the control.

The aim of present work is to study the effect of sowing dates and vernalization treatments on growth parameters and some chemical components of the

sugar beet *B. vulgaris* L. cv. Pleno leaf under Ismailia governorate conditions.

2- Material and Methods:

Field experiments were carried out at the Experimental Farm of Suez Canal University, Ismailia Governorate, Egypt 2009/2010 and 2010/2011. The following treatments were used:-

a- Sowing on 15th October 2009 & 2010 for seeds which cooled at 5° C for 30 days.
b- Sowing on 15th October 2009 & 2010 of seeds which cooled at -20° C for 30 days.
c- Sowing on 15th November 2009 & 2010 for seeds which cooled at 5° C for 30 days.
d- Sowing on 15th November 2009 & 2010 for seeds which cooled at -20° C for 30 days.
e- Sowing on 15th December 2009 & 2010 of seeds which cooled at 5° C for 30 days.
f- Sowing on 15th December 2009 & 2010 of seeds which cooled at -20° C for 30 days.

In addition the control treatments during 2009/2010 and 2010/2011 growing seasons were cultivated. The experiments were designed with randomized split-plot arrangement with three replicates for monogram *Beta vulgaris* L. cv. Pleno. The seeds were obtained from Sugar Institute Research, Agricultural Center Research, Ministry of Agriculture, Giza, Egypt. Nitrogen, phosphorous and potassium fertilization were incorporated in soil at the rate of 60, 15 and 50 units/feddan, respectively. The following parameters were calculated:-

I. Growth parameters:

Random samples of five plants were taken from each replicate were chosen from a median of the plot and each five were taken at 90, 120, 150 and 180 days after sowing. Plant height (Cm), number of leaves per plant and fresh as well as the dry weight of leaves (GM.) were recorded.

II. Some chemical constituents of leaf:

a- For estimation, reducing sugars, total phenols and auxin like-substances, leaves samples taken at 90, 120, 150 and 180 days were collected from each treatment and extracted as described by Abdel-Rahman *et al.,* (1975) then reducing sugars determined according to Nelson's method described by Moor (1974). Total phenols determined using a modified Folin-Ciocalteu method described by William *et al.* (1965), in addition, auxin like-substances determined according to the method of Gordan and Weber (1951) with a slight modification of the Ehrlish reagents (Fliosson, 1969).

b- For estimation of some photosynthetic pigments (chlorophyll a and chlorophyll b) leaves were collected and extracted with acetone 85% in dark bottles, and filtered by G4. The optical densities of the samples were then measured at wavelength 644 and 662 nm is using a Beckman DK-2 Spectrophotometer. Concentrations of chl. (a+b) were calculated as a fellow:

Chlorophyll a= (9.78 x E662) – (0.99 x E664) = mg/g D.Wt.

Chlorophyll b= (21.264 x E644) – (4.65 x E662)= mg/g D.Wt.

Carotenoids= (4.695 x E440.5) – 0.268 (chlorophyll a + chlorophyll b) = mg/g D.Wt.

E= optical density at the wavelength indicated (Wettstein, 1957 and Fald and Sari El-Deen, 1978).

Statistical Analysis:

The growth date were subjected one way analysis of variance (ANOVA) one using Costat Version 6.311 (CoHort software, Berkeley, Ca 94701) according to Steel and Torri (1980) with probability ≤ 0.05.

3- Results and Discussion:

Growth characters:-

Data in (Table 1) show that the maximum values of plant height (Cm), number of leaves/ plant and their fresh and dry weights in gm/ plant taken at different four sampling dates (90, 120, 150 1nd 180 days from planting) in the two studied seasons were recorded at 15th Oct. Treatment in comparison of other sowing dates (15th Nov. and 15th Dec.) treatments. At the same time, in all studied cases, minimal ones for the four above mentioned characters were observed in 15th Dec. treatment.

Regarding to cooling treatments (table 1) shows that most of vernalizaation treatments (5° C and -20° C) at 15 Oct., 15 Nov. and 15 Dec. in most cases decreased of both plant length (cm) and number of leaves per plant compared with the controls. At the same time, in most cases, the above mentioned treatments increased of both leaves fresh weight (gm) and leaves dry weight (gm) in comparison with the controls. These results are in agreement with the data which obtained by El-Kassaby and Lailah (1992), Leilah *et al.* (2005), Ozturk *et al.* (2008) and Hassan *et al.* (2008).

Some chemical contents of leaf:

1-Pigments:-

Data in (Table 2) show that chlorophyll a,b, a+b, a/b ratio and carotenoids were differed according to study treatments. Generally, in most cases, the highest values of chl. a, b and a+b were noticed at 15 Nov. treatment, whereas, maximum ones of chl. a/b and carotenoids were observed at 15 Oct. treatment. In addition, minimal values of chl. a/b ratio and carotenoids were shown at 15 Dec. treatment.

Table 2 indicates that most of the studied cooling treatments decreased Cl. a, b, a+b, a/b ratio and carotenoids in comparison the controls.

Table (1): Effect of the three sowing dates and two vernalization treatments on plant height, leaves number, fresh and dry weight of sugar beet *(B. vulgaris* L. cv. Pleno) during the two growing seasons 2009/2010 and 2010/2011.

Sowing dates	Vernalization treatments	Plant length (cm)								Number of leaves/ plant							
		90 days		120 days		150 days		180 days		90 days		120 days		150 days		180 days	
		2009/10	2010/11	2009/10	2010/11	2009/10	2010/11	2009/10	2010/11	2009/10	2010/11	2009/10	2010/11	2009/10	2010/11	2009/10	2010/11
15 Oct.	Control	7	46.3	39.8	40.5	31	30.7	30.7	30	14	15.3	22.14	23.67	25.3	24.7	34.67	33
	5°C	38.4	43.7	36.9	33	38	37	33	34.7	13	14	20.19	23.67	31	30.3	37.35	28.7
	-20°C	35.9	38.7	37.7	35.33	31	31	35	36.7	13	15	21	22	30.3	30	47.7	45
15 Nov.	Control	24.4	23	22.3	21.7	21.3	25	25.8	29	13.7	15.3	22.3	22	28.7	30.3	30	33.3
	5°C	27.4	30.7	21	20.7	23	24.3	20.7	21.7	14.68	16.7	23	22.7	26.4	28	30	30.3
	-20°C	24.7	30.3	22.5	20.3	24.4	27	21.3	23	12.67	13.3	26	26	23.6	25.7	30	33
15 Dec.	Control	17.33	17	22.3	25.7	24.2	23.7	23.3	28.3	12.3	11.7	17.33	16.7	14	15	17	16
	5°C	20	19.7	21.3	23	21.3	23	25	30.7	10.67	10.7	14	14.3	19	22	18	19
	-20°C	14.3	14.3	21.5	25	22.3	23.3	25.9	32.7	11	10	14.67	13.3	14.3	15	18.5	22
	L.S.D at 0.05	n. s	4.9	3.8	3.6	3.9	3.7	n. s	n. s	2.47	n. s	n. s	n. s	4.37	3.71	3.8	2.8
		Leaves fresh weight (gm)								Leaves dry weight (gm)							
		90 days		120 days		150 days		180 days		90 days		120 days		150 days		180 days	
15 Oct.	Control	306.3	409	250	336.3	236	223.3	382	249	28.3	13	42	53.7	34	33.3	72.3	72
	5°C	299.3	202	281.2	202	465	476	543	463	17.7	11.7	25.3	29.3	66	64.7	88.2	73
	-20°C	416.3	415	416.3	415	334	324.7	459	380	32.7	13.3	29.7	25.7	55.7	54	85	68
15 Nov.	Control	74.7	93.7	74.7	55.7	303	178	192	146	8.15	12	32.7	46	41.2	58	59	50
	5°C	127.5	119.3	127.5	135.7	203.9	175.7	201.5	235	13.2	12	32	42.7	21	29.3	57.5	32
	-20°C	61.15	92.3	61.15	92.3	257.4	175.7	240	248	10.9	9.7	31	43	27	35.3	60.5	73
15 Dec.	Control	32.19	36.7	32.19	36.7	85	100.3	29.7	39	3.67	3.5	9.5	12.7	11.7	15.7	13	9
	5°C	55.3	54.6	55.3	54.6	89.4	63.7	74.9	126	6.33	5.7	6.7	5	18.8	22.7	16.7	12.3
	-20°C	28.15	25.3	31	25.3	91.5	102	48.4	78	3	3.7	8.35	11.7	17.8	21.7	14	10
	L.S.D at 0.05	18.7	6.7	26.8	3.9	32.3	3.69	26.4	5.2	3.87	2.3	4.2	3.4	4.67	3.12	4.9	2.9

Table (2): Effect of the three sowing dates and two vernalization treatments on some studied chemical constituents of sugar beet (B. vulgaris L. cv. Pleno) taken at 90, 120, 150 and 180 days from planting in 2009/2010.

Sowing dates	Cooling treatments	Chlorophyll a (as mg/g D.W.)				Chlorophyll b (as mg/g D.W.)				Chlorophyll a + b (as mg/g D.W.)				Chlorophyll a /b ratio			
		90 days	120 days	150 days	180 days	90 days	120 days	150 days	180 days	90 days	120 days	150 days	180 days	90 days	120 days	150 days	180 days
	Control	0.74	0.39	0.34	0.29	0.78	0.1	0.05	0.14	1.5	0.49	0.39	0.43	3.9	6.8	2.1	2.67
15 Oct.	5°C	0.66	0.64	0.31	0.17	0.43	0.5	0.33	0.11	1.09	1.14	0.64	0.28	1.28	0.93	1.5	2.07
	-20°C	0.48	0.47	0.31	0.64	0.71	0.17	0.11	0.75	1.19	0.64	0.42	1.39	2.8	2.8	0.85	2.22
	Control	0.25	1.03	0.74	0.64	0.16	0.27	0.61	0.49	0.41	1.3	1.35	1.13	3.8	1.2	1.3	2.54
15 Nov.	5°C	0.29	0.44	0.58	0.28	0.12	0.3	0.57	0.18	0.41	0.74	1.45	0.46	1.5	1.01	1.6	1.62
	-20°C	0.55	0.44	0.52	0.74	0.1	0.16	0.85	0.63	0.65	0.6	1.37	1.37	2.8	0.61	1.17	0.85
	Control	0.77	0.45	0.11	0.48	0.32	0.3	0.21	0.38	1.1	0.75	0.32	0.86	1.5	0.5	1.26	2.34
15 Dec.	5°C	0.31	0.5	0.37	0.17	0.28	0.76	0.54	0.18	0.59	1.26	0.91	0.35	0.66	0.69	0.94	2.02
	-20°C	0.34	1.12	0.11	0.16	0.22	1.69	0.21	0.17	0.56	2.8	0.32	0.33	0.66	0.5	0.94	3.26
		Carotenoids (as mg/g D.W.)				Reducing sugars (as mg/g D.W.)				Total phenols (as mg/g D.W.)				Auxin like-substances (as mg/g D.W.)			
		90 days	120 days	150 days	180 days	90 days	120 days	150 days	180 days	90 days	120 days	150 days	180 days	90 days	120 days	150 days	180 days
	Control	0.35	0.23	0.33	0.24	2.67	0.81	1.25	0.88	3.59	0.95	1.65	1.18	0.67	0.4	0.18	0.12
15 Oct.	5°C	0.28	0.32	0.36	0.16	2.07	1.75	1.99	1.16	2.03	1.18	1.46	1.2	0.46	0.91	0.41	0.13
	-20°C	0.3	0.16	0.23	0.43	2.22	0.95	1.29	1.14	2.29	0.87	1.43	1.34	0.68	0.37	0.17	0.19
	Control	0.34	0.14	0.25	0.28	2.54	1.59	1.46	1.57	1.77	1.55	1.39	2.56	0.55	0.44	0.44	0.89
15 Nov.	5°C	0.19	0.25	0.28	0.19	1.62	2.48	1.04	1.92	3.23	1.89	1.48	2.2	1.41	0.33	0.39	0.44
	-20°C	0.11	0.18	0.16	0.26	0.85	2.2	1.37	1.76	1.08	2.09	2.73	3.1	0.42	0.46	0.27	0.31
	Control	0.26	0.2	0.09	0.3	2.34	1.43	2.18	2.42	3.61	1.47	2.79	3.29	0.38	0.47	0.28	0.04
15 Dec.	5°C	0.24	0.03	0.25	0.26	2.02	1.69	2.08	2.37	1.46	2.12	2.23	3.37	0.33	0.32	0.52	0.57
	-20°C	0.08	0.22	0.09	0.28	3.26	2.01	2.48	4.19	4.3	2.41	2.69	2.61	1.84	0.46	0.5	0.28

2- Reducing sugars, total phenols, auxin like-substances:-

Data in (Table 2) indicate that reducing sugars and total phenols values were almost similar trend, where, in most cases, were increased by 15th Dec. treatment and decreased by 15th Oct. treatment. While, auxin like-substances were very, in most cases, as a result of 15th Oct. treatment.

From (Table 2) painted out that behavior by reducing sugars, total phenols and auxin like-substances were deferred. In general, most of the cooling treatments increased by reducing sugars and total phenols in comparison the controls. Such results are in agreement with Hassan *et al.* (2008) who reported that most of the cooling treatments increased by reducing sugars and total phenols in *B. vulgaris* cv. Universe.

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