

INFLUENCE OF LOW TEMPERATURES ON THE LETTUCE YIELD IN SOME LETTUCE VARIETIES CULTIVATED UNDER POLYETILENNE TUNNEL CONDITION

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Abstract

Lettuce is one of the basic crops of herbs and vegetables group of vegetables grown in wide spaces. Temperatures between -10 and -17°C have negative effect on the culture of lettuce cultivated under polyetilenne tunnel condition, the level of damage depending on the genetic resistance of the variety grown. Yield quality decreases in the same time with the yield from varieties with low resistance.

From group of vegetables herbs, lettuce is the most appreciated by consumers and occupying the largest areas. After Ciocârlan V. (1979) the species of this group belong to five botanical families: Compositae (lettuce, chicory garden, chard), Chonopodiaceae, Umbeliferae, Tetragoniaceae, Valerianaceae. Lettuce is grown in all countries with temperate and continental climate. Thus according to FAO Statistical Yearbook 2006 cultivated area at global level exceeded 1 million hectares and an yield about 23 million tons. The short period of vegetation and crop technology easy to apply allowed cultivation of these vegetable by vegetable growers especially in successive and associated cultures contributing to increased profits.

Key words: *low temperatures, polyetilenne tunnel, lettuce, yield*

INTRODUCTION

From the point of view of consumers, low calorie intake, abundance of vitamins, minerals, along with numerous compounds with favorable effects on health give the possibilities to consume high quantities of lettuce. However inside the lettuce can be found constituents with negative impact on health, nitrates being the dangerous ones. Their content is influenced by several factors. From these factors nitrogen fertilization and light intensity were found to have a major influence on the level of nitrates accumulated in lettuce (Cautlife 1974).

Molybdenum deficiency in the soil can also lead to the accumulation of nitrate in lettuce plants. Vitamin C is derived from the transformation of the nitrates to nitrites such as inside the plant tissues and in the human body too (Michael Hill, 1991).

Except the soil moisture, lettuce has moderate requirements to other factors of vegetation. After Ghenkov et al (1974) the optimum temperature for growth and formation of the head can be 20-22 ° C in sunny weather, 15 to 16 ° C in cloudy weather and during the winter months is 12-13 ° C and

even 7-8 ° C. Untemperate plants resists at - 4-5 ° C and hardened plants resists to - 12 ° C at common varieties and up to - 18 ° C winter varieties (Indrea, 1968).

MATERIAL AND METHOD

Regarding to the tolerance for cold of lettuce crop, the paper aims to analyze the influence of low temperatures exceeding the limits of resistance (mentioned in the literature) at several varieties on lettuce yield.

To achieve the objectives proposed, in autumn 2011 and 2012, in the polyetilenne tunnel condition area is 275 m² (L = 50 m, l = 5,5 m, h = 3 m), in a vegetable micro farm from Husasău de Tinca (NW Romania) was mounted an mono factor experience in a comparative crop of competition. Experience has seven variants in three repetitions; the settlement was made by the method plots subdivided blocks. Each variant has a number of 50 plants; experimental data was performed by analysis of variance.

Biological material was represented by 7 varieties of lettuce as: Polul Nord, Centore, Hanna, Sumy, Tuareg, Pia and Apia. The control plot was variety Polul Nord, winter variety grown for long time in Romania.

RESULTS AND DISSCUSIONS

In autumn of 2011 and 2012, the establishment of culture was made in the first decade of November, sowing being done in September. Victor Renaud and Ch. Dduet (1988) recommended sowing in 2-3 days decreasing period of new moon appear (according to the lunar calendar). The winter of 2011-2012 began with higher temperatures than normal, so that the lowest temperature in December was - 2 ° C. Lower temperatures occurred in mid-January when there were registered minimal - 9 ° C. February was very cold, so almost all the minimal temperatures were negative. By the middle of February in two consecutive nights were registered the lowest temperature of - 20 ° C. These temperatures were registered outside and inside of the polyetilenne tunnel the minimal temperatures were with 2-3 ° C higher (the minimum was - 17 ° C).

The winter months in the period 2012-2013 registered higher temperatures than normal averages, so that never fell below minimum - 18 ° C.

The data regarding on yield of lettuce during the two years of the study are presented in Table 1 respectively Table 2.

Table 1

Yield of lettuce bulbs in the period 2011-2012 (kg/m²) at Husasău de Tinca

No.	Variant	Absolut Yield Kg/m ²	Relative yield %	±d Kg/m ²	Semnification
1	Polul Nord Mt.	2,68	100,00	0,00	-
2	Centore	3,15	117,53	+0,47	XX
3	Hanna	1,71	63,80	-0,97	000
4	Suny	1,63	60,82	-1,05	000
5	Tuareg	3,74	1139,55	+1,06	XXX
6	Pia	2,97	110,82	+0,29	-
7	Apia	2,32	86,56	-0,36	0

LSD 5 % = **0.32**

LSD 1 % = **0.44**

LSD 0,1 % = **0.63**

Table 2

Yield of lettuce bulbs in the period 2012-2013 (kg/m²) at Husasău de Tinca

No.	Variant	Absolut yield Kg/m ²	Relative yield %	±d Kg/m ²	Semnification
1	Polul Nord Mt.	2,93	100,00	-	-
2	Centore	3,49	119,11	+0,56	XX
3	Hanna	3,36	114,67	+0,33	X
4	Suny	3,45	117,74	+0,53	XX
5	Tuareg	3,92	133,78	+0,99	XXX
6	Pia	3,43	117,06	+0,50	XX
7	Apia	3,67	125,25	+0,74	XXX

LSD 5 % = **0.35**

LSD 1 % = **0.47**

LSD 0.1 % = **0.68**

From all the varieties studied not all show resistance to low temperatures. This can be seen in Table 1, where the polyethylene tunnel the minimum temperature fell to - 17 ° C. However variety Tuareg achieved the highest absolute yield (3,74 kg / m²) and an yield gain of 39,55% compared to the control variant, the difference from the Polul Nord variety was statistically assured, very significantly positive. The absolute yield of bulbs by 3,15 kg / m² variety Centore occupy second place. The difference from the control plot was statistically assured, positively distinct significant. Variety

Pia, even if had a superior yield compared with the control variant, did not exceed the threshold $P = 5\%$ and was not statistically assured. The varieties most affected by low temperatures were Hanna and Suny. From these were collected only 63,80% at Hanna, respectively 60,82% at Suny, and control variant yield. At both varieties the difference beside control variant was ensured statistical negative very significant. Apia variety failed to reach the yield obtained by Polul Nord variety, making only 86,55% of it. The difference was statistically negative significant. The negative influence of low temperatures on the heads of lettuce at varieties under study is motivated by analyzing Table 2, winter 2012-2013 being much milder, whose negative temperatures not fallen below $- 8^{\circ} \text{C}$. The data in this table show that all varieties obtained higher yields compared with control variant (Polul Nord variety). The high potential of yield from Tuareg variety is demonstrated by absolute yield of 39,2 t / ha, an yield gain of 33,78% compared to the control variant, difference beings positive statistically very significant. The biggest difference from the previous winter yield was registered at variety Suny.

Table 3

Quality of lettuce bulbs ,
Husasău de Tinca 2011-2013

No.	Variant	Absolut yield Kg/m ²		Extra quality from total				First quality from total			
		2012	2013	2012		2013		2012		2013	
				Kg/m ²	%	Kg/m ²	%	Kg/m ²	%	Kg/m ²	%
1	Polul Nord Mt.	2,68	2,93	2,13	79,47	2,35	80,20	0,34	12,68	0,41	13,99
2	Centore	3,15	3,49	2,34	67,82	2,76	79,08	0,52	16,50	0,32	9,16
3	Hanna	1,71	3,36	0,79	46,19	2,63	78,17	0,65	38,01	0,46	13,69
4	Suny	1,63	3,45	0,92	56,43	2,72	78,84	0,46	28,22	0,53	15,36
5	Tuareg	3,74	3,92	2,98	79,67	3,18	81,12	0,51	13,63	0,58	14,79
6	Pia	2,97	3,43	1,74	58,58	2,69	76,96	0,79	28,31	0,45	13,11
7	Apia	2,32	3,67	1,27	54,74	2,96	80,65	0,65	28,01	0,39	10,62

Table 3 shows the quality of lettuce bulbs and the way it was affected by low temperatures the varieties studied. It is noticed that at varieties where the yield have been affected also the quality were affected. Thus if at variety Hanna in 2012 extra quality was only 46,19% in 2013 quality increasing to 78,27%. At Tuareg variety with the highest yield extra quality differences between the two years were quite small. In the winter of 2013 with higher temperatures, at all varieties the lettuce bulbs with extra quality exceeded 75%, up to 81,12% at variety Tuareg.

CONCLUSIONS

Experience concerning to the influence of low temperatures on lettuce crop (with several varieties) grown under polyethilenne tunnel conditions, has permitted some conclusions as follows:

1. Varieties that do not show resistance to low temperature are strongly affected both quantitatively and qualitatively; their cultivation in winter is quite risky.
2. The incidence of crop loss could be highlighted only two years of study with a mild winter and other with very low temperature values.
3. Varieties Hanna, Suny and Apia were very affected by negative temperatures (below 10 ° C).
4. Control variant (Polul Nord variety) cultivated for a long time in Romania, even if it has a low potential of yield, manifested good resistance to lower temperatures.
5. From the studied varieties, Tuareg highlighted both in terms of strength at low temperatures and also of high potential of yield high quantitative and qualitative.
6. The cold affects not only the yield of lettuce but also it's quality, damage degree depends on the genetic resistance of the variety.

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