

STUDY OF SOME VEGETABLES TOLERANCE AT LOW WINTER TEMPERATURES

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INTRODUCTION

The seasons: fall, winter, and spring, can increase the risk of injury by cold weather for many species of vegetables. The damage can be caused by anything from a light, overnight frost or period of freezing temperatures.

Some economic loss from cold injury can happen every year, depending on the vegetable species and level of temperatures. The tomatoes, beans, cucurbits, melon originated in tropical areas can be severely injured by even a light frost. Cool season crops, such as broccoli, cabbage, peas, and onions, originated in northern areas can tolerate frost and light freezes of short durations with little damage (Calin, 2010).

Losses are result directly from damaged or killed plants, and indirectly from reduced quality, quantity or delayed maturation (K.M. Khokhar et al., 2007, Clinton et al., 2007). As onion the bulbs are soft, grayish-yellow, and water-soaked in cross section. Sometime the severe freeze in winter or spring killed many plants of spinach or lettuce (Barbara Pleasant, 2013). Of the plants which survived, many were seriously weakened, making them more susceptible to diseases or physiologic disorders.

This paper tries to identify the tolerant varieties of vegetable species at injuries caused by cold weather for suitability for sowing or planting them in autumn. Many research had as objectives to identify the tolerant varieties for reducing the degree of injury at cold temperature. The obtaining data are very useful for farmers in planning a defense against cold injury.

MATERIAL AND METHODS

During 2012– 2014 years, field experiments were performed in Vegetable Research-Development Station Bacau - Romania, in order to evaluate the behaviour of vegetable species to the low temperature of winter. We refer at the following species and varieties:

- white cabbage: V1 - Silviana, V2 -De Buzau and V3 - De Ișalnița;

- lettuce: Marilena V1 sowing in autumn and V2 sowing in spring;
- spinach: Premier V1 sowing in autumn and V2 sowing in spring;;
- onion - Orizont, V1 from seed, V2 – from bulbs; chives – V3

The seeds of lettuce: Marilena – V1; spinach: Premier – V1; onion (*Allium cepa* L.): Orizont – V1, were sown in the field in September.

The seeds of lettuce: Marilena – V2; spinach: Premier – V2, were sown in the field in March.

The bulb of onion *Allium cepa* L.: Orizont, V2; chives – *Allium schoenoprasum* L.) – V3 and the plants of white cabbage: V1 - Silviana, V2 -De Buzau and V3 - De Ișalnița were planted in October.

Tolerance of low temperature from winter have been made by decadal observations regarding survived plants and pathogen attack.

The observations were made every 10 days during Mars and April. The attack estimation of diseases was accomplished according with following indicators:

- Frequency of attack (F%),
- Intensity of attack (I%),
- Degree of attack (DA%).

Ratings were based on Pathogenically Rating Scale 0-5 (0 is no disease, 5 is terminally infected). The plants were visually evaluated. The following scale was used:

- 1 - No spots and lesions,
- 2 - 1 - 3 spots or lesions present on stem or leaves,
- 3 - 4 - 8 spots present on stem, leaves and bracts,
- 4 - Lesions and spots present on stem, bracts, leaves, flowers and stems,
- 5 - Collapse of plant.

RESULTS AND DISCUSSIONS

The dynamic emergence of cabbage plants was as it follows (fig. 1). Analyzing the data presented it is seen that Silviana variety created at SCDL Bacău had the largest % of the emerged plants: March II decade - 15.3%; March III decade - 65.4%; April I decade - 76.5%; April II decade - 88.6% in April III

decade - 82.5%. It was followed by variety Işalnița with data: March II decade 13.1%; March III decade - 62.3%; April I decade - 74.2%; April II decade - 83.5% April III decade - 78.4%. The low tolerance at winter temperature had the variety De Buzău. The emergence of plant being in: March II decade - 16,2%; March III decade - 54,3%; April I decade - 74.6%; April II decade - 88.679,3% in April III decade - 72.8%. Observations confirms that local varieties are best adapted to the climatic conditions specific to the crop.

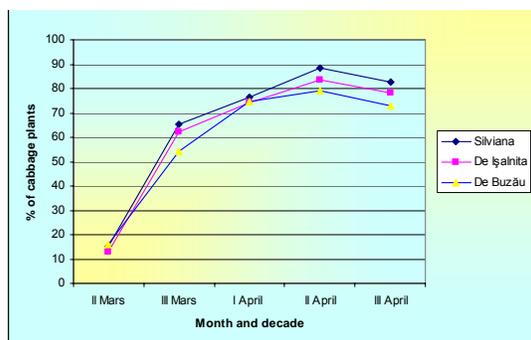


Fig. 1. Dynamic of cabbage plant emergence

The dynamic of spring and autumn plants of lettuce is showed in fig 2.

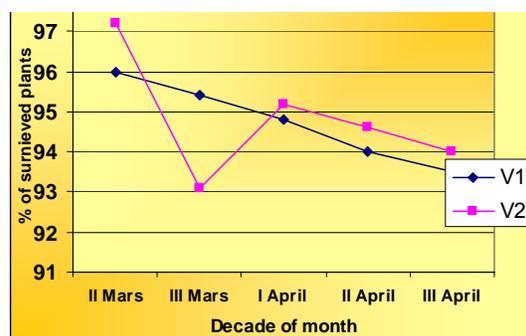


Fig. 2. The dynamic of winter and spring plants of lettuce

The data presented it is seen that the lettuce from V1 sowing in autumn had the very good survived plants: March II decade - 96,0%; March III decade - 95.4%; April I decade - 94,8%; April II decade - 94,0% in April III decade - 93,5%. The V2 - lettuce from spring has no significant difference regarding the growth of plants: March II decade 97,2%; March III decade - 93,1%; April I decade - 95,2%; April II decade - 94,6% April III decade - 94%.

The autumn and spring of spinach plants were followed (fig. 3). You can see that the V1 sowing in autumn has a very good % of survived plants:: March II decade - 97,2%; March III decade - 96,8%; April I decade - 96,8%; April II decade - 96,5% in April III

decade - 96,3%. V2 sowing in spring has not significant difference compared with V1: March II decade 98,1%; March III decade - 97,8%; April I decade - 97,2%; April II decade - 97,1% April III decade - 97,0%.

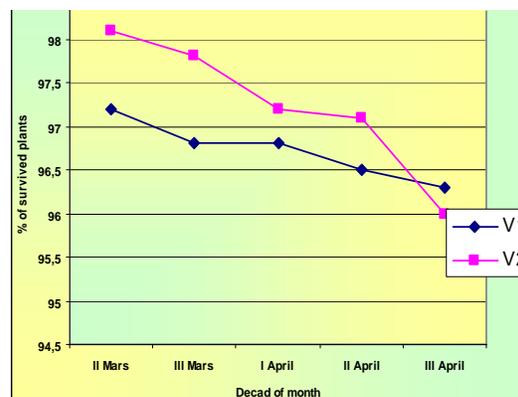


Fig. 3. The dynamic of winter and spring plants of spinach

The dynamic emergence of onion and chives plants is showed in fig 4. The presented data show the following emerged plants:

- V1: March II decade - 91,2%; March III decade - 90,3%; April I decade - 89,4%; April II decade - 88,2% in April III decade - 84,5%.
- V2: March II decade 85,4%; March III decade - 88,6%; April I decade - 91,4%; April II decade - 93,2% April III decade - 94,0%.
- V3: March II decade - 92,4%; March III decade - 95,6%; April I decade - 96,0%; April II decade - 96,0% in April III decade - 96,0%. All variants are local varieties with best adaptation to the climatic conditions specific to the crop.

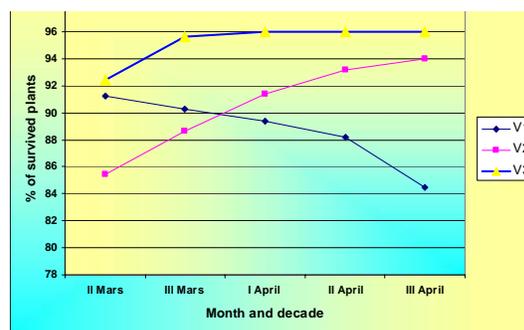


Fig. 4. The dinamic plants of onion and chives

Monitoring pathogen show the attack of *Erwinia carotovora* at cabbage:

- V1 Silviana - 17,5%
- V2 De Isalnița - 21,6%
- V3 De Buzău - 27,2%

CONCLUSIONS

The study of tolerance of any varieties of: white cabbage, lettuce, spinach, and onion show a good resistance at low temperature from winter.

Silviana variety created at SCDL Bacău had the largest % of the emerged plants: March II decade - 15.3%; March III decade - 65.4%; April I decade - 76.5%; April II decade - 88.6% in April III decade - 82.5%. It was followed by variety Ișalnița with the following data: March II decade 13.1%; March III decade - 62.3%; April I decade - 74.2%; April II decade - 83.5% April III decade - 78.4%. The low tolerance at winter temperature had the variety De Buzau. The emergence of plant being: March II decade - 16.2%; March III decade - 54.3%; April I decade - 74.6%; April II decade - 88.679,3% in April III decade - 72.8%. Observations, confirms that local varieties are best adapted to the climatic conditions specific to the crop.

The lettuce from V1 sowing in autumn had the very good survived plants: March II decade - 96,0%; March III decade - 95,4%; April I decade - 94,8%; April II decade - 94,0% in April III decade - 93,5%. The V2 - lettuce from spring has no significant difference regarding the grow plants: March II decade 97,2%; March III decade - 93,1%; April I decade - 95,2%; April II decade - 94,6% April III decade - 94%.

The V1 spinach sowing in autumn has a very good % of survived plants: March II decade - 97,2%; March III decade - 96,8%; April I decade - 96,8%; April II decade - 96,5% in April III decade - 96,3%. V2 sowing in spring has not significant difference compared with V1: March II decade 98,1%; March III decade - 97,8%; April I decade - 97,2%; April II decade - 97,1% April III decade - 97,0%.

The onion and chives plants had a good tolerance at winter climatic conditions. The survived plants were: V1: March II decade - 91,2%; March III decade - 90,3%; April I decade - 89,4%; April II decade - 88,2% in April III decade - 84,5%; V2: March II decade 85,4%; March III decade - 88,6%; April I decade - 91,4%; April II decade - 93,2% April III decade - 94,0%; V3: March II decade - 92,4%; March III decade - 95,6%; April I decade - 96,0%; April II decade - 96,0% in April III decade - 96,0%. All variants are local varieties with best adaptation to the climatic conditions specific to the crop.

Monitoring pathogen show the attack of *Erwinia carotovora* at cabbage: V1 Silviana - 17,5%; V2 De Isalnita - 21,6%; V3 De Buzău - 27,2%.

ABSTRACT

During 2012– 2014 years, field experiments were performed in Vegetable Research-Development Station Bacau - Romania, in order to evaluate the behaviour of vegetable species to the low temperature at the winter. It was studied the following species and varieties: white cabbage: V1 - Silviana, V2 -De Buzau and V3 - De Ișalnița; lettuce: Marilena V1 sowing in autumn and V2 sowing in spring; spinach: Premier V1 sowing in autumn and V2 sowing in spring; onion - Orizont, V1 from seed, V2 - from bulbs; chives - V3. The study of tolerance of this varieties show a good resistance at low temperature from winter.

Monitoring pathogen show the attack of *Erwinia carotovora* at cabbage: V1 Silviana - 17,5%; V2 De Isalnita - 21,6%; V3 De Buzău - 27,2%.

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