PLANT PROTECTION TESTING OF GARLIC VARIETIES

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Abstract: *We can group the garlic (Allium sativum) varieties in two ways: by the time of planting there are winter and spring varieties. From morphological view there are softneck varieties (Allium sativum convar. sativum) and the hardneck varieties (Allium sativum convar. ophioscordon). In our experiments were involved a winter variety and a spring variety garlic. This study used the following methods to determine the degree of damage: pathogens, pests, and weeds.*

Key words*: Garlic, plant protection, testing, open field, garlic varieties*

INTRODUCTION

Garlic is native to Central Asia, present-day Turkmenistan, Pamir-Alai, and Tien Shan [5,9,12]. Garlic has long been used as a spice or herb, one of the most important ingredients in Chinese medicine. It is one of the oldest cultivated plants in Hungary [9,13]. In the 16th century, garlic moved from Central Asia through the Balkans to Makó, Hungary. At the end of the 18th century, garlic was exported from Hungary to the south-southeast direction. Onions from Makó won the trust of foreign countries at the Vienna World's Fair in 1873 and in Brussels in 1888 [9,15]. Garlic contains: 65 % water; 28 % carbohydrate; 2.3 % organosulfur compounds; 2 % protein; 1.2 % free amino acid; 1.5 % fiber [1,9]. The dry matter content is high, 35 % [9,14]. Energy content: 1.35 kcal / g. It contains the following vitamins: B_1, B_2, B_3, B_5, B_6, C and E. Garlic contains nearly 33 sulfur compounds, 17 amino acids, mineral salts, and enzymes [9,16]. The average mineral composition of garlic (per 100 grams) is shown in Table 1 [2,9].

Table 1.

The average mineral composition of garlic (per 100 grams)

Mineral element	Value (mg / 100 g)
Potassium (K)	446
Sulfur (S)	200
Phosphorus (P)	144
Calcium (Ca)	38
Magnesium (Mg)	21
Sodium (Na)	10
Chlorine (Cl)	30
Iron (Fe)	1.4
Zinc (Zn)	1
Manganese (Mn)	0.46
Skin (B)	0.4
Copper (Cu)	0.15
Nickel (Ni)	0.01
Molybdenum (Mo)	0.07
Iodine (I)	0.003
Selenium (Se)	13.5

China was by far the largest garlic producer (21.2 million tons), accounting for nearly 80 % of world production in 2016. Large quantities of garlic are produced in India, Bangladesh, Egypt. In Europe, the highest garlic yields are reached in Russia and Ukraine. Garlic production in Hungary was 6.6 tons in 2016. [6].

Plant protection of garlic:

1, Major plant pathological diseases: Garlic Common Latent Virus (GCLV); Onion Yellow Dwarf Virus (OYDV); Shallot Latent Virus (SLV); Leek Yellow Stripe Virus (LYSV); Garlic Latent Virus (GLV); *Fusarium oxysporum f. sp. cepae*; *Sclerotium cepivorum*; *Melampsora allii-fragilis*; *Botrytis* spp. [3,7,17].

2, Major plant zoological pests: *Elateridae*, *Melolonthidae*; *Ditylenchus dipsaci*; *Aceria tulipae*; *Rhizoglypus echinopus*; *Thrips tabaci*; *Dyspessa ulula*; *Delia antiqua* [4,10,11].

3, Most common weeds in onions: *Capsella-bursa pastoris; Lamium spp.; Veronica spp.; Galium aparine; Stellaria media; Sinapis arvensis; Amaranthus spp.; Chenopodium album; Datura stramonium; Portulaca oleracea; Cirsium arvense; Convolvulus arvensis* [8].

The aim of the experiment is to determine the pathogens, pests, and weeds of winter and spring garlic cultivars. In the experiment, one variety of winter (Makói őszi) and one variety of spring garlic (Makói tavaszi) were examined. Description of the **Makói őszi variety:** cultivated in autumn, the foliage is dense, medium green in color, the height of the plant is 60-70 cm, the bulbs are on average 50-60 grams, onion heads 3-7 cm in diameter, the growing season is medium, less can be stored. Description of the **Makói tavaszi variety:** cultivated in spring, the foliage is sparse, light green in color, the height of the plant is 40-50 cm, the bulbs are on average 30-50 grams, onion heads 2.5-5 cm in diameter, well stored [9,18].

MATERIALS AND METHODS

The experiment was carried out in the educational farm of University of Szeged, Faculty of Agriculture in Hódmezővásárhely (Csongrad county) in 2019-2020.

The 2019 experiment: The winter garlic variety: “Makói őszi” winter varieties were used in the experiment. The time of planting was 8-9 October 2019. The experimental area is 50 m^2. Two replicates were used. Garlic was planted at 30 cm row spacing and 10 cm stem spacing. After planting, 250 kg / ha of fertilizer (Yara Mila Cropcare: 11 N – 11 P_2O_2 – 21 K_2O) was applied to the experimental area. Mechanical weeding and manual hoeing were used in the area. Karate Zeon 5 CS herbicide (lambda-cyhalothrin) was applied at a dose of 0.15 l / ha. Dates of treatment of insecticides: 3rd May 2020 and 20th May 2020. The area was irrigated. Tazer 250 SC fungicide (250 g / l azoxystrobin) was applied at a dose of 0.9 l / ha. Time of protection: 15th May 2020. Hardvest of *Allium sativum* on 24th June 2020. After harvesting the garlic, the weight was measured.

The 2020 experiment: The spring garlic variety: “Makói tavaszi” spring varieties were used in the experiment. The time of planting was 3-4 March 2020. The experimental area is 50 m^2. Two replicates were used. Garlic was planted at 30 cm row spacing and 10 cm stem spacing. After planting, 250 kg / ha of fertilizer (Yara Mila Cropcare: 11 N – 11 P_2O_2 – 21 K_2O) was applied to the experimental area. Mechanical weeding and manual hoeing were used in the area. The area was irrigated. Karate Zeon 5 CS herbicide (lambda-cyhalothrin) was applied at a dose of 0.15 l / ha. Insecticide treatment time: 8th May 2020. Tazer 250 SC fungicide (250 g / l azoxystrobin) was applied at a dose of 0.9 l / ha. Time of protection: 25th May 2020. Hardvest of *A. sativum* on 22th July 2020. After harvesting the garlic, the weight was measured.

Fertilizer used in the research was Yara Mila Cropcare 11-11-21. Technical data of the fertilizer: 11.0 % total nitrogen (N); 11.0 % phosphate (P_2O_5); 21.0 % potassium oxide (K_2O); 17.43 % potassium (K); 2.6 % magnesium oxide (MgO); 1.57 % magnesium (Mg); 25.0 % sulfate (SO_3); 10.0 % sulfur (S); 0.05 % total boron (B); 0.03 % total copper (Cu);

0.08 % total iron (Fe); 0.25 % total manganese (Mn); 0.002 % total molybdenum (Mo); 0.04 % zinc (Zn); chlorine-free. The rate of application is 250 kg / ha.

RESEARCH RESULTS

Experimental results of winter varieties of garlic (Makói őszi): Deloped rapidly, by December 91 % of the stock had developed. During the experiment, the most common damages were caused by pests of *Thrips tabaci* and *Dyspessa ulula* (Table 2).

Table 2.

Damaging insects (%) in winter garlic

Time of protection	*T. tabaci*		*D. ulula*	
	1 repeat	2 repeat	1 repeat	2 repeat
Before 3rd May 2020	5	6	4	3.6
After 3rd May 2020	2	3	2	1.8
Before 20th May 2020	3	3.5	2.3	2
After 20th May 2020	1	1.1	0.7	0.5

During the examined period, the following pathogenic agents damaged of winter garlic (%) in the Educational farm of University of Szeged, Faculty of Agriculture in Hódmezővásárhely: *Fusarium oxysporum* f. sp. *cepae* and *Botrytis* spp. (Table 3).

Table 3.

Major pathogens (%) in winter garlic during the experiment

Time of protection	*Fusarium oxysporum f. sp. cepae*		*Botrytis spp.*	
	1 repeat	2 repeat	1 repeat	2 repeat
Before 15th May 2020	10	12	8.2	11.4
After 15th May 2020	6	5	4.7	6.3

Mechanical weeding were four times: 15th November 2019; 5th March 2020; 19th April 2020; 30th May 2020. The following weeds were in of winter garlic: *Ambrosia artemisiifolia, Chenopodium album, Convolvulus arvensis, Capsella bursa-pastoris, Sorghum halepense.*

Allium sativum weight (g) values (winter garlic: Makói őszi, and spring garlic: Makói tavaszi) are shown in Table 4. The weight (gram) of winter garlic variety is 30-40% more than that of spring garlic variety.

Table 4.

Garlic (winter and spring) weight (g) values in the experiments

Time of harvesting	*Makói őszi*		*Makói tavaszi*	
	1 repeat	2 repeat	1 repeat	2 repeat
24th June 2020	58.6	61.2	---	---
22th July 2020	---	---	42.3	37.5

Experimental results of spring varieties of garlic (Makói tavaszi): The spring variety developed 96% of the herd in the 3 weeks after planting. During the experiment, the most common damages were caused by pests of *Thrips tabaci* and *Dyspessa ulula* (Table 5).

Table 5.

Damaging insects (%) in spring garlic

Time of protection	*T. tabaci*		*D. ulula*	
	1 repeat	2 repeat	1 repeat	2 repeat
Before 8th May 2020	4.1	5.2	3.7	3.1
After 8th May 2020	1.3	2.1	1.1	0.9

During the examined period, the following pathogenic agents damaged of spring garlic (%) in the Educational farm: *Fusarium oxysporum* f. sp. *cepae*, *Sclerotium cepivorum* and *Botrytis* spp. (Table 6).

Table 6.

Major pathogens (%) in spring garlic during the experiment

Time of protection	*Fusarium oxysporum f. sp. cepae*		*Botrytis spp.*		*Sclerotium cepivorum*	
	1 repeat	2 repeat	1 repeat	2 repeat	1 repeat	2 repeat
Before 25th May 2020	13	14.2	7.8	10.1	10.4	12.3
After 25th May 2020	7.5	6.8	3.9	5	5.9	6.1

Mechanical weeding were three times: 16th April 2020; 18th May 2020; 29th June 2020. The following weeds were in of spring garlic: *Ambrosia artemisiifolia, Chenopodium album, Setaria glauca, Fragmites communis, Panicum miliaceum, Plantago major, Convolvulus arvensis, Capsella bursa-pastoris, Sorghum halepense.*

CONCLUSIONS

The winter varieties of garlic (Makói őszi): Deloped rapidly, by December 91 % of the stock had developed.

During the experimental period, 2 pests (*Thrips tabaci* and *Dyspessa ulula*) caused great damage to winter garlic. Insect damage was reduced to 1.1% after plant protection. With the Karate Zeon 5 CS (lambda-cyhalothrin) insecticide, we were able to successfully defend against pests.

The largest pathological disease is *Fusarium oxysporum* f. sp. *cepae* and *Botrytis* spp. With the fungicide Tazer 250 SC (azoxystrobin), we were able to defend ourselves effectively against pathogens.

We controlled the weeds in time in the experimental area, so there was no big loss to the garlic. The following weeds were in of winter garlic: *Ambrosia artemisiifolia, Chenopodium album, Convolvulus arvensis, Capsella bursa-pastoris, Sorghum halepense.*

The weight (gram) of winter garlic variety (Makói őszi) is 30-40% more than that of spring garlic variety (Makói tavaszi). The highest weight value was measured in 2 repetitions (61.2 gram) in winter garlic.

The spring variety (Makói tavaszi) developed 96% of the herd in the 3 weeks after planting.

The same two pests (*Thrips tabaci* and *Dyspessa ulula*) also occurred in the spring garlic variety as in the winter variety. The Makói tavaszi variety was less disturbed by insects than the Makói őszi variety. With the Karate Zeon 5 CS (lambda-cyhalothrin) insecticide, we were able to successfully defend against pests.

The largest pathological disease is *Fusarium oxysporum* f. sp. *cepae*, *Botrytis* spp. and *Sclerotium cepivorum*. Fusarium infection is higher, Botrytis infection lower than that of winter garlic. *Sclerotium cepivorum* disease was not present in the Makói őszi variety. With the fungicide Tazer 250 SC (azoxystrobin), we were able to defend ourselves effectively against pathogens.

Mechanical weeding were three times. The following weeds were in of Makói tavaszi garlic: *A. artemisiifolia, C. album, S. glauca, F. communis, P. miliaceum, P. major, C. arvensis, C. bursa-pastoris,* and *S. halepense.*

The weight of the spring garlic (Makói tavaszi) variety is less than that of the winter (Makói őszi) variety.

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