

## RESEARCH REGARDING THE BEHAVIOUR OF SOME SOYBEAN CULTIVARS IN RELATION TO THE ENVIRONMENTAL FACTORS, DISEASES AND PESTS IN ECOSYSTEMS OF THE SOUTH MUNTENIA REGION

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### Abstract

In the recent years, there has been an increase of interest in conventional soybean culture due to its many uses in human nutrition, animal feeding but also in pharmaceutical industry. In our country, the cultivated area with soybeans has grown, and the quantity of soybeans exported by Romania has increased year by year. The expansion of the cultivated areas requires testing the existing cultivars on the market in different areas, in order to recommend the introduction into culture of suitable genotypes for each area. Thus, 7 cultivars of soybean were tested, in the climatic conditions of Dâmbovița county, during three years. These cultivars have been analyzed in terms of yields potential, drought tolerance, lodging and pods-shattering resistance as well as their behavior towards diseases and pests. Thus, the recommended cultivars in Dâmbovița county, resulted after testing, are Carla TD and SG Havane. Also, the ES Mentor and SG Kea cultivars can be used in irrigated fields, and the SG Albert cultivar in appropriate conditions of phytosanitary protection. That is because the SG Albert cultivar showed a good drought tolerance (in 2016) even though the rainfall was insufficient during the critical phenophases.

**Key words:** soybean, lodging resistance, pods-shattering resistance, diseases, pests

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### INTRODUCTION

Soybean is an important source of food, protein, and oil, and hence more research is essential to increase its yield under different conditions (Pagano and Miransari, 2016).

Almost 73% of the European Union (EU) soybean exports come from Romania, and over 20,000 tonnes of soybeans were supplied from Romania to non-EU markets during this period. Soybean production can be influenced by both environmental factors and the attack of various pathogens and pests.

Soybean yields, in case of compliance of all technological stages, are frequently reduced by specific, accidental or polyphagous harmful organisms, with 3-12%, sometimes even 70%, if no specific protective measures are applied. Bărbulescu, 2001; Bărbulescu et al., 2001; Jinga and Lupu, 2014; Mureșanu, 2014; Popov, 2002, 2003, 2004; Popov et al., 2006, 2007; Popov and Bărbulescu, 2007; Troțuș and Popov, 2005; Troțuș, 2006 – cited by Troțuș et al., 2014).

Research done in soybean fields, under Central Moldavia conditions (Troțuș et al., 2014) have shown that in the soybean crops, there are 9 species of pathogen agents and the frequency of the attacked plants ranged from 1.0% (*Marmor sojae*, *Ascochyta sojaeola*) to 18.0% (*Pseudomonas glycine*). Regarding the harmful entomofauna, in the soybean crops, 10 species of polyphagous and specific pests were identified. The frequency of the attacks produced by the harmful species ranged between 0.3% (*Delia florilega*) and 45.6% (*Tetranychus urticae*).

### MATERIALS AND METHODS

Following the analyzes carried out during 3 years of testing (2015 – 2017), 7 cultivars of soybean were evaluated, in terms of drought tolerance, lodging and pods-shattering resistance, diseases and pests behaviour.

Larisa și Carla TD were witness cultivars in the experiments. The drought tolerance was evaluated using a rating scale from 1 – very good tolerance to 9 – very weak tolerance.

The lodging resistance was evaluated with grades between 1 and 7, grade 1 - completely erect plants, grade 7 - totally fallen plants.

The pods-shattering resistance, a very important characteristic, was evaluated with grades from 1 to 9, grade 1 being given to cultivars whose pods are totally indecisive.

The behavior to diseases and pests was evaluated by assessing the frequency, the intensity and the degree of attack. For rating the intensity of attack, the rating scale from 0 to 6 was used.

## RESULTS AND DISCUSSION

In the agricultural year 2015 (table 1) the distribution of rainfall and its volume determined high average yields. The average yield was of 2.98 t/ha, a very good one compared to the average obtained in the country for this crop.

Yields above average obtained the SG Albert cultivar (3.6 t/ha), but also ES Mentor (3.2 t/ha) and SG Kea (3.1 t/ha), the less productive cultivars being SG Havane with an average yield of 2.7 t/ha and Larisa, with an average yield of 2.68 t/ha. From the point of view of the behavior towards the environmental factors, it can be observed that all cultivars had both very good drought tolerance, very good lodging and pods-shattering resistance.

The two-spotted spider mite and the downy mildew were identified from pests and diseases.

The two-spotted spider mite - *Tetranychus urticae* can cause significant damage.

Adults and larvae colonize the lower part of the leaves, the tissue cells are degraded and

**Table 1:** Behavior of some soybean cultivars against environmental factors, diseases and pests in the year 2015

Crt. no	Cultivar name	Plot surface mp	Average production kg	Drought tolerance grade	Lodging resistance grade	Pods-shattering resistance grade	Pests			Pathogens		
							<i>Tetranychus urticae</i>			<i>Peronospora manshurica</i>		
							F	I	GA	F	I	GA
							%	%	%	%	%	%
1.	Larisa	10	26.75	1	1	1	1	10	0.10	1	16	0.16
2.	Carla TD	10	28.00	1	1	1	1	11	0.11	1	12	0.12
3.	ES Mentor	10	31.75	1	1	1	1	12	0.12	14	34	4.76
4.	SG Albert	10	36.25	1	1	1	1	15	0.15	1	16	0.16
5.	SG Havane	10	27.00	1	1	1	1	23	0.23	2	21	0.42
6.	SG Kea	10	31.25	1	1	1	1	25	0.25	11	23	2.53
7.	Viorica	10	27.50	1	1	2	1	42	0.42	5	10	0.50

depleted of their content following the stinging and sucking of their juice, the air penetrating inside. The attacked leaves have characteristic spots of a shiny gray or reddish color and are slightly curved. In case of strong attacks the leaves gradually dry and fall, and the plants do not grow normally resulting low productions (Paşol et al., 2007).

The downy mildew is produced by the *Peronospora manshurica* fungus. This creates angular spots of 1-6 mm in diameter on leaves, greenish-yellow at first, then yellow, and as a result of tissue necrosis, the spots become brown. On the underside of the leaves, near the stains, a fine, gray-purple fluff develops. In case of a strong attack, the leaves become yellow and fall prematurely (Severin et al., 2001).

Regarding the attack of the two-spotted spider mite, the degree of attack was between 0.10% and 0.60%, insignificant for the production of soybean, all cultivars presenting a good tolerance. Regarding the attack of the pathogen *Peronospora manshurica*, the most resistant cultivars were Carla TD (0.3%) and SG Kea (0.3%). All cultivars had a very good resistance to the downy mildew.

In the second year of experiments - 2016 - the total volume of rainfall was approximately 200 mm higher than the multiannual average. Although the total rainfall/year was higher than in previous years, there was unevenly distributed throughout the year, in February being recorded only a volume of 9.3 mm rainfall.

**Table 2: Behavior of some soybean cultivars against environmental factors, diseases and pests in the year 2016**

Crt. no	Cultivar name	Plot surface	Average production	Drought tolerance	Lodging resistance	Pods-shattering resistance	Pests			Pathogens		
							<i>Tetranychus urticae</i>			<i>Peronospora manshurica</i>		
							F	I	GA	F	I	GA
		mp	kg	grade	grade	grade	%	%	%	%	%	%
1.	Larisa	10	29.75	3	2	2	3	29	0.87	1	10	0.10
2.	Carla TD	10	32.50	3	2	3	3	16	0.48	1	10	0.10
3.	ES Mentor	10	17.75	5	1	1	39	40	15.60	1	10	0.10
4.	SG Albert	10	18.29	2	1	2	43	40	17.20	1	10	0.10
5.	SG Havane	10	31.29	3	2	3	12	30	3.60	1	10	0.10
6.	SG Kea	10	15.50	5	2	2	29	45	7.25	1	10	0.10
7.	Viorica	10	22.00	1	2	3	2	30	0.60	1	10	0.10

The average yield was of 2.4 t/ha this year, which was 0.5 t/ha less than in the previous year. From the analysis of table 2 it can be seen that higher yields than the average were obtained this year by Carla TD (3.2 tha), SG Havane (3.1 t /ha) and Larisa (3 t/ha) cultivars. The other cultivars obtained yields below average, the smallest being for SG Kea (1.6t/ha).

We can see from the analyzes that a very good drought tolerance presented the Viorica cultivar, followed by SG Albert, a good tolerance had Larisa, Carla TD and SG Havane. A medium tolerance presented ES Mentor and SG Kea. The lodging and pods-shattering resistance were very good for all the analyzed cultivars.

Regarding the attack of the two-spotted spider mite the Albert SG and ES Mentor cultivars had the highest value of the attack degree. The degree of attack of the downy mildew was insignificant.

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During the last year of testing the rainfall was evenly distributed, a sufficient reserve being formed in spring for the first critical phase of the soybean crop (the rising phase). In the other critical phase, the grain filling (June, July and August) sufficient rainfall has been recorded for development under optimal conditions. All these were reflected in the obtained productions.

The average yields this year were higher than in the other two years of testing, the SG Albert cultivar, as in the first year of testing, was able to obtain a higher average yield than the other cultivars tested. The average yield of this cultivar exceeded by about 400 kg/ha the average of the year. The lowest average yield, of 2.8 t/ha, had the Viorica cultivar, with 0.4 t/ha higher than the average of the previous year. It was found that the resistance to the environmental factors had very good values for all cultivars.

**Table 3: Behavior of some soybean cultivars against environmental factors, diseases and pests in the year 2017**

Crt. no	Cultivar name	Plot surface	Average production	Drought tolerance	Lodging resistance	Pods-shattering resistance	Pests			Pathogens		
							<i>Tetranychus urticae</i>			<i>Peronospora manshurica</i>		
							F	I	GA	F	I	GA
		mp	kg	grade	grade	grade	%	%	%	%	%	%
1.	Larisa	10	30,00	2	1	1	1	10	0,10	4	50	2,0
2.	Carla TD	10	32,25	1	1	2	1	20	0,20	3	10	0,3
3.	ES Mentor	10	29,00	2	1	1	1	24	0,24	12	52	6,24
4.	SG Albert	10	34,25	2	1	2	2	18	0,36	10	10	1,00
5.	SG Havane	10	28,75	1	1	1	1	18	0,18	1	30	0,30
6.	SG Kea	10	32,00	1	1	1	1	22	0,22	22	34	7,48
7.	Viorica	10	28,25	2	2	2	2	30	0,60	36	23	8,28

The degree of attack of the two-spotted spider mite was very small, but on the attack of *Peronospora manshurica* fungus, 3 cultivars (ES Mentor, SG Kea and Viorica) had values of the attack degree between 6.24% and 8.28%

## CONCLUSIONS

In recent years, there has been an increased interest for conventional soybean culture due to its multiple uses in human nutrition, animal feeding but also in the pharmaceutical industry. Almost 73% of the European Union (EU) soybean exports come from Romania, and over 20,000 tons of soybeans were supplied by Romania on non-EU markets during this period (agroteca.ro).

Given the average yields recorded throughout the period 2015 - 2017 and their constancy over time, as well as the resistance to environmental factors, diseases and pests, the recommended cultivars, after testing, for culture in the South Muntenia region are Dare, Carla TD and SG Havane. There can be also cultivated under irrigation conditions ES Mentor and SG Kea, and under conditions of appropriate phytosanitary protection the SG Albert cultivar. We consider this because SG Abert showed a good drought tolerance (2016) even though the rainfall was insufficient in the critical phenophases (the phenophases in which the beans were in the phase of filling and defining the bean size).

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