

## RESEARCH REGARDING THE INFLUENCE OF TILLAGE ON PATHOGENS ATTACK IN SOYBEAN CULTURES

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**Abstract:** The soybean cultures are yearly affected, with different frequency and intensity, by the bacterial blight of soybean (*Pseudomonas savastanoi* pv. *glycinea*) and by the downy mildew (*Peronospora manshurica*). In the years with favourable conditions, they can produce significant losses, the data from the speciality literature mention losses of up to 100% in the Far East. Together with the main symptom from the plant leaves, the infected plants make few pods, with few seeds or sterile pods. In the years 2018 and 2019, under the conditions from SCDA Turda, the attack of bacterial blight and downy mildew was monitored at the Felix variety, in three different tillage systems: classic (SC), conservative – minimal tillage (MT) and conservative – no tillage (NT). Following the observations made, we can say that the tillage system influences the growth and the development of plants, as well as the occurrence and the intensity of the illnesses and pest attack. The highest values in the frequency and intensity of the bacterial blight attack were recorded in systems of direct sowing of the soybean. As for the attack of downy mildew, the lowest values were obtained within the conservative tillage system.

**Keywords:** *soybean, tillage systems, downy mildew, bacterial blight*

## INTRODUCTION

Soia (*Glycine max*), cu conținutul ei de 40% proteine și 20% uleiuri, își are originea în China. Soybean (*Glycine max*), with its contents of 40% of proteins and 20% of oils, originates from China. In Oriental Asia, countries like Japan and China have cultivated soybean for more than 7000 years for its nutritional and agricultural value. Between 1829 - 1840, soybean was cultivated in America, in our country it appeared in Transylvania in crops on limited areas after 1876, and then between 1930-1933 its cultivation spread all over the country (Muntean et al., 1995). Soybean is used for human consumption, for animal feeding and as raw material for obtaining oil. From agronomic point of view, the soybean crops have a special importance due to the fact that they leave in the soil a large amount of nitrogen (approx. 80-120 kg/ha), from the symbiosis with nitrogen-fixing bacteria. Soybean is a good pre-emergent plant, especially the early varieties, for autumn cereals (Ion, 2010).

Soybean is attacked by a large number of pathogens, more than 135 pathogens have been described for this crop and approximately 30 of them cause significant losses (Vidić et al., 2013).

In Transylvania, the most frequent diseases in the soybean culture are bacterial blight (Figure 1) (*Pseudomonas savastanoi* pv. *glycinea*) and downy mildew (Figure 2) (*Peronospora manshurica*). In the years with favourable conditions, they can produce significant losses, the data from the speciality literature mention losses of up to 100% in the Far East. Together with the main symptoms from the plant leaves, the infected plants make few pods, with few seeds or sterile pods



**Figure 1.** Bacterial blight *Pseudomonas savastanoi* pv. *glycinea*  
(sursa: <https://www.nexles.com/articles/soybean-treatments-most-common-diseases-and-pests-of-this-technical-plant/>)



**Figure 2.** Downy mildew *Peronospora manshurica*  
(sursa: <https://www.nexles.com/articles/soybean-treatments-most-common-diseases-and-pests-of-this-technical-plant/>)

## MATERIAL AND METHOD

To study the influence of the tillage system on the pathogen agents attack for soybean cultures, in the years 2018 and 2019, under the conditions from SCDA Turda, the bacterial blight and downy mildew attack was monitored at the Felix variety, in three different tillage systems: classic (SC), conservative - minimal tillage (MT) and conservative - no tillage (NT).

On the experimental field, observations have been carried out regarding the downy mildew and bacterial blight attack, in all the experimental variants. Data collection focussed on the frequency and the intensity of the attack on the plant leaves.

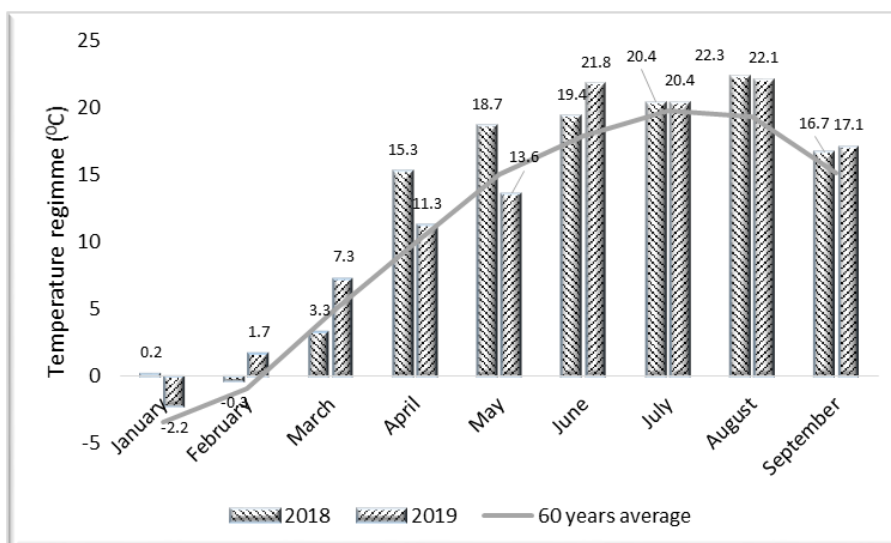
Frequency (F%). It represents the relative value of the number of attacked plants or plant organs (n) in relation to the total number of analysed plants or plant organs (N)  $F = n \times 100 / N$  (Puia, 2005). In our case, N = the average number of leaves on the plant and n = the average number of attacked leaves per plant.

Intensity (I%). It represents the percentage (estimated „by eye”) with which the plant or the plant organ is attacked, or the crop loss for a specific plant or for a specific culture on the area unit, compared to a healthy culture  $I\% = \sum (i \times f) / n$ ; i and f result from the notes taken (Puia, 2005).

Based on the frequency and on the intensity of the attack, the degree of the attack was calculated:  $Ga\% = F \times I / 100$ .

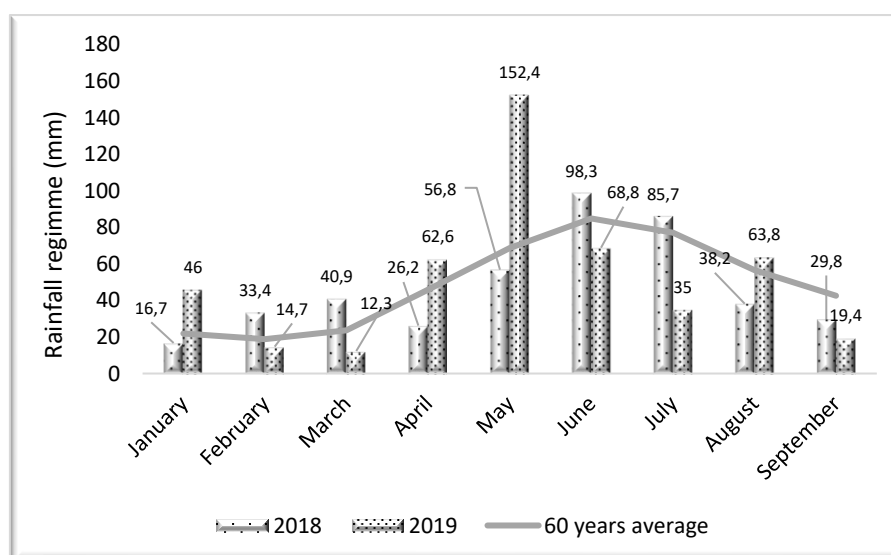
## RESULTS AND DISCUSSIONS

The climatic conditions of the experimental years were different, regarding both recorded temperatures and rainfall, and this aspect has had influence on the manifestation of the pathogen agents. From the data presented in figure 3 we can notice that April and May 2018 were very warm months, the recorded temperatures exceeding the average of the last 60 years. The same months in 2019 registered temperatures closer to the average in April, but below the average of the last 60 years in May (13.6°C), thus the month being considered chilly. In both experimental years, in June and August the weather was warm, the recorded temperatures exceeding the average for the last 60 years, while in July it was normal from the point of view of the recorded temperatures, in the years 2018 and 2019 (Figure 3).



**Figure 3.** The temperature regime at ARDS Turda in 2018-2019

Regarding rainfall, the two experimental years were very different compared to each other, but also compared to the average of the last 60 years. In 2018, in February and March the average of the last 60 years was exceeded, followed by drier months, April and May, with reduced rainfall. There was little rain in June and July, with average values slightly exceeding the average of the last 60 years (Figure 4). The year 2019 started with excessive humidity in January, followed by two months of drought. April was a rainy month (62.66mm) followed by May with abundant rainfall, especially in the last ten days, the monthly amount exceeding 152mm. The vegetative stage of soybean was followed by two dry months, with reduced rainfall especially in July. In August, the recorded rainfall exceeded the average of the last 60 years (Figure 4).



**Figure 4.** The rainfall regime at ARDS Turda in 2018-2019

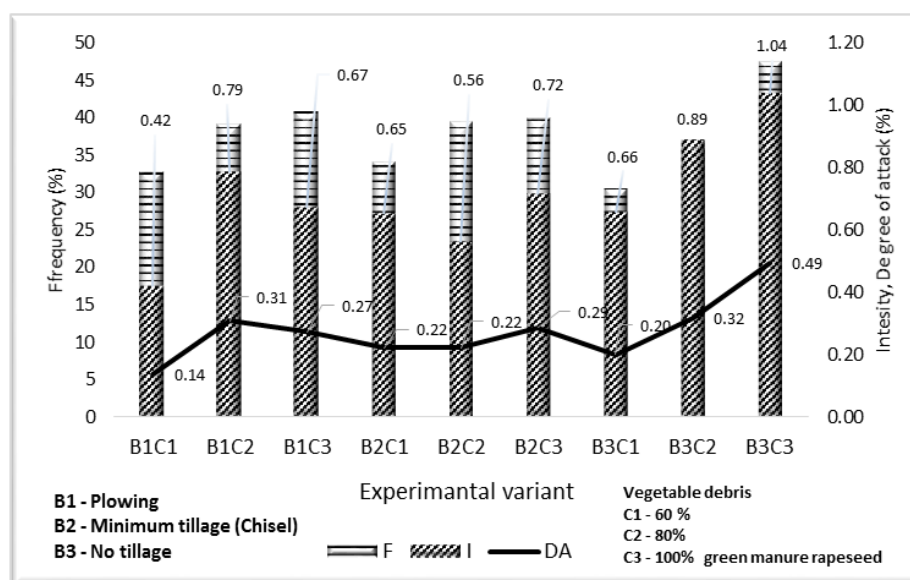
Against the background of the climatic conditions of the year 2018, on the experimental field from SCDA Turda bacterial blight was present in very low percentage in

the soybean culture and only in the no tillage variant. Downy mildew occurrence was higher in percentage, in all experimental variants.

The occurrence of downy mildew in 2018 was influenced by the tillage system and the vegetable debris (table 1). From the data presented in the table we can conclude that at the Felix variety the frequency of the annual downy mildew attack was more severe in the variant with 100% rapeseed green manure, in all tillage systems. The values of the intensity of the attack varied between 0,42-1,04%, the greatest value of the intensity being at the variety with direct sowing and with 100% rapeseed green manure (1,04%). In the experimental varieties no statistically assured differences were recorded (table 1).

**Table 1.** Interaction of soil tillage system and vegetal debris on *P. manshurica* frequency and intensity at Felix variety, 2018

No ctr.	The soil tillage system	Plant debris	Frequency (%)	The difference from the control	Intensity (%)	The difference from the control	
1.	Plowing	60 %	33.00	Control	0.42	Control	
2.		80%	39.00	6.00	0.79	0.37	
3.		100% green manure rapeseed	41.00	8.00	0.67	0.25	
4.	Minimum tillage	60 %	34.00	Control	0.65	Control	
5.		80%	34.50	0.50	0.56	-0.09	
6.		100% green manure rapeseed	40.00	6.00	0.72	0.07	
7.	No tillage	60 %	30.50	Control	0.66	Control	
8.		80%	36.00	5.50	0.89	0.23	
9.		100% green manure rapeseed	48.00	17.50	1.04	0.38	
LSD (p 5%)					19.24		0.58
LSD (p 1%)					29.13		0.87
LSD (p 0.1%)					46.80		1.40



**Figure 5.** The frequency, intensity and degree of attack of *P. manshurica* in Felix variety, 2018

The degree of the attack of *P. manshurica* is presented in Figure 5. The lowest degree of attack was recorded at the direct sowing variety and 60% vegetable debris (0,14%), and the highest degree of attack was recorded at the direct sowing variety and with 100% rapeseed green manure (0,49%). Against the background of the climatic conditions of the year 2019, the soybean culture was affected by both the attack of downy mildew and of bacterial blight.

The attack of downy mildew was more reduced in 2019, the data presented in Figure 6 show that the frequency and the intensity of the attack were different, depending on the experimental variety. The variety with plowing and reduced percentage of vegetable debris recorded no attack of downy mildew. The highest values of frequency and intensity of downy mildew attack were recorded at the direct sowing variety and 100 % vegetable debris (F - 27,5%; I – 0,80% ).

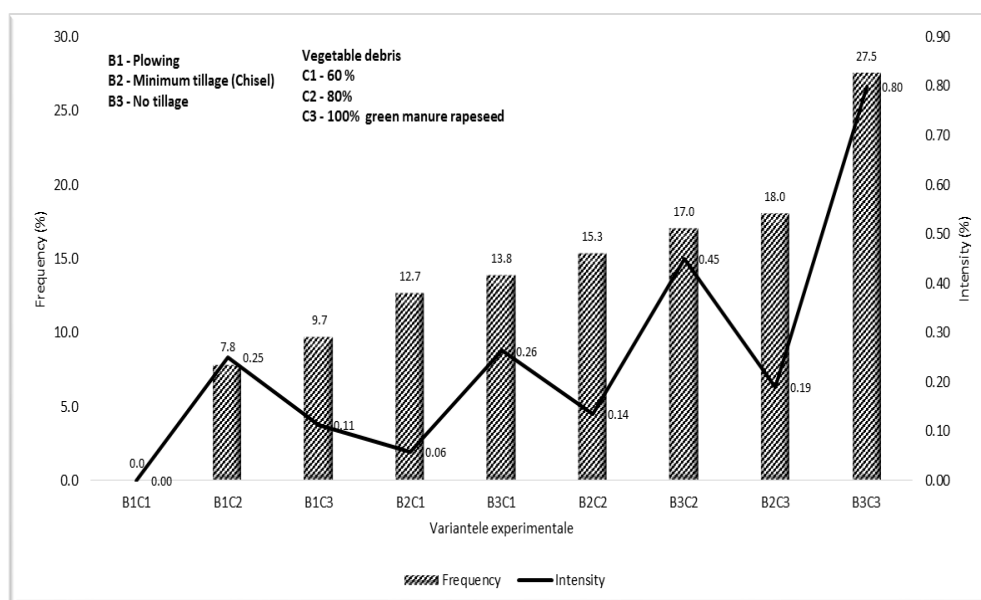


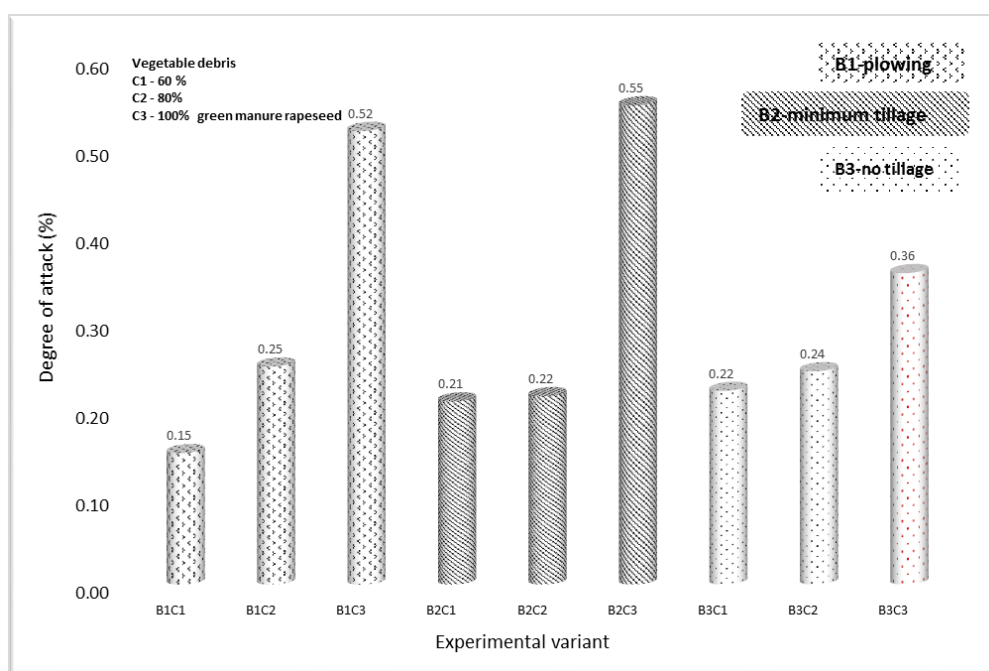
Figure 6. The frequency and intensity of *P. manshurica* attack in Felix variety, 2019

Regarding bacterial blight attack, the frequency and intensity of attack had different values, depending on the experimental variety. The data presented in table 2 show that the variant with vegetable debris 100% rapeseed green manure recorded the highest frequency of attack, with all the experimental variants. The highest intensity of attack was recorded in the tillage system with chisel plows and 100% rapeseed green manure (1.32%) (table 2).

Table 2. Interaction of soil tillage system and vegetal debris on *P. savastanoi* pv. *glycine* frequency and intensity at Felix variety, 2018

No crt.	The soil tillage system	Plant debris	Frecuence (%)	The difference from the control	Intensity (%)	The difference from the control
1.	Plowing	60 %	30.20	Control	0.50	Control
2.		80%	24.80	-5.40	1.01	0.51
3.		100% green manure rapeseed	43.50	13.30	1.20	0.70
4.	Minimum tillage	60 %	35.30	Control	0.59	Control
5.		80%	31.20	-4.10	0.69	0.10
6.		100% green manure rapeseed	41.65	6.35	1.32	0.73
7.	No tillage	60 %	25.25	Control	0.89	Control
8.		80%	38.85	13.60	0.78	-0.11
9.		100% green manure rapeseed	40.65	15.40	0.68	-0.20
LSD (p 5%)				36.05		1.24
LSD (p 1%)				54.59		1.87
LSD (p 0.1%)				87.69		3.01

The degree of attack, although it did not exceed the value of 1%, can offer us an overview of the bacterial blight attack in 2019 at the Felix variety, with different tillage systems and vegetable debris. From the data presented in Figure 7 we can notice that the values of the degree of attack had similar values, in the majority of the experimental variants, with the exception of the tillage systems involving plowing and chisel plows plus 100% rapeseed green manure, where the degree of the attack exceeded the value of 50%.



**Figure 7.** The degree of attack by *P. savastanoi* pv. *glycine* in Felix variety, 2019

## CONCLUZII

In the soybean culture, pathogen agents occurrence are influenced by the cultivated genotype, the applied technologies, as well as climatic conditions.

In the year 2018, the Felix variety was affected by the *Peronospora manshurica* attack, the frequency and intensity of the attack having the highest values with the direct sowing variety and 100% rapeseed green manure (F - 48.00% și I - 1.04%).

Against the background of the climatic conditions of the year 2019, the soybean culture was affected by both the attack of downy mildew and of bacterial blight, the latter having higher percentages.

Due to the low degree of the attack of the two pathogen agents, from the data presented we can conclude that the three tillage systems are suitable for the soybean culture.

## ACKNOWLEDGEMENTS

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