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The influence of sodium selenite on biometric parameters of wheat, barley and oat seedlings

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Abstract It was studied the influence of sodium selenite (5 ppm Se, 10 ppm Se) on the biometric parameters (height and biomass) of germinated wheat, barley and oat. The study was made on germinated wheat, Lovrin 34 variety, barley (Sistem variety) and oat (Lovrin 1 varietie). The results showed the folowing: the height of wheat seedlings was insignificantly (p>0,05) directly correlated with sodium selenite doses; the barley seedlings height was not influenced by sodium selenite dose and the oat seedlings height was insignificantly (p>0,05) negatively correlated with Se dose. The results regarding the influence of Se on the biomass of seedlings cereals showed that for winter wheat, the biomass was insignificantly (p>0,05) directly correlated with Se dose. For barley seedlings, increasing the Se dose, produce an insignificant(p>0,05) increase of biomass.The direct correlation between oat seedlings biomass and sodium selenite was significantly(p<0,05).

Key words

seedlings, wheat, barley, oat, sodium selenite, height, biomass

Wheat germs are the embryo of seeds, rich in protein, fiber, polyunsaturated fats, vitamin E, vitamin B_1, B_2, B_6, phosphorus, zinc, thiamine, magnesium and pantothenic acid. Considering the large number of essential nutrients from the cereals germs, they bring many benefits to our health. The germs contains a high amount of natural antioxidants (11).

Seedlings are growing from germs. Sprouted grains are thought of as having exceptional nutritive value. Sprouting of grains causes increased enzyme activity, a loss of total dry matter, an increase in total proteins, a change in aminoacyds composition, a decrease in starch, increases in sugars, a slight increase in crude fats and crude fibers, and slightly higher amounts of certain vitamins and minerals(8,12).

It is known that Se is necessary for sustaining life and it is essential for physiological functions and ist importance for animal and vegetal organism is recognized (1,2,3,4,5,6,7,9).

Among the benefits of Se fortification is mentioned the increasing levels of another bioactives substances(cholorophil, xantophil, C vitamin(10,13).

Material and Method

Seedlings were obtained by germinating of wheat seeds in the presence of sodium selenite (Na_2SeO_3). For germination were used textile germination beds. Application of sodium selenite solution and distilled water it was made 24 in 24 hours and equal volumes for all lots of the same species, seedlings benefit from the same environmental conditions (temperature, humidity, light).

We had eight groups , two witness (M and M') and six experimental (E) for each culture(Table 1).

Table1

Control and experimental groups of wheat, barley and oat

Group	WHEAT	BARLEY	OAT
	Variant	Variant	Variant
Control	M_1 (distilled water)	M_2 (distilled water)	M_3 (distilled water)
	M'_1 (potable water)	M'_2 (potable water)	M'_3 (potable water)
Experimental $E_{x.5\text{-}x.6}$ (sodium selenite)	$E_{1.5}$ (5 ppm Se)	$E_{2.5}$ (5 ppm Se)	$E_{3.5}$ (5 ppm Se)
	$E_{1.6}$ (10 ppm Se)	$E_{2.6}$ (10 ppm Se)	$E_{3.6}$ (10 ppm Se)

For every type of cereal we germinated 100 seeds. Application of sodium selenite solutions and distilled or potable water it was made 24 in 24 hours and equal volumes for all lots of the same species, seedlings benefit from the same environmental conditions (temperature, humidity, light). The experiment took place for 14 days, then we evaluated: the humidity, the biomass and the height of germinated wheat, barley and oat.

The biometric evaluation of germinated wheat, barley and oat consecutive selenium compounds treatment is presented in Figure 1. For the biomass evaluation we counted the plants than we weighted the vegetal material and we calculated the rapport between biomass(in grams) and numbers of plants.

Fig. 1 – Biometric evaluation of germinated seeds

Results

The results regarding wheat, barley and oat seedlings mean height(cm) obtained by seeds germination in the presence of sodium selenite are presented in Table 2 and 2-4 Figures.

Table 2

Wheat, barley and oat seedlings mean height (cm)

	Group	x±Sx	D.S.	Minimal values	Maximal values	Confidence level 95%
WHEAT	M_1 (distilled water)	10,06±3,16	5,48	6,9	16,4	13,62
	M'_1 (potable water)	11,50±2,10	3,63	9,3	15,7	9,03
	$E_{1.5}$ (5 ppm Se)	9,13±0,68 ns ns'	1,18	8,4	10,5	2,94
	$E_{1.6}$ (10 ppm Se)	9,56±0,91 ns ns'	1,58	8,2	11,3	3,93
BARLEY	M_2 (distilled water)	7,70±0,76	1,32	6,7	9,2	3,28
	M'_2 (potable water)	6,93±0,16	0,28	6,6	7,1	0,71
	$E_{2.5}$ (5 ppm Se)	7,80±0,64 ns ns'	1,11	6,8	9,0	2,76
	$E_{2.6}$ (10 ppm Se)	7,80±0,40 ns ns'	0,7	7,1	8,5	1,73
OAT	M_3 (distilled water)	8,10±1,45	2,51	6,6	11	6,24
	M'_3(potable water)	9,26±0,43	0,75	8,5	10	1,86
	$E_{3.5}$ (5 ppm Se)	8,00±0,76 ns ns'	1,32	7,0	9,5	3,28
	$E_{3.6}$ (10 ppm Se)	7,56±1,11 ns ns'	1,93	6,4	9,8	4,8

s – significant comparative with M, p<0,05; s' significant comparative with –M', p<0,05;
ns – insignificant comparative with M, p>0,05; ns' – insignificant comparative with M', p>0,05.

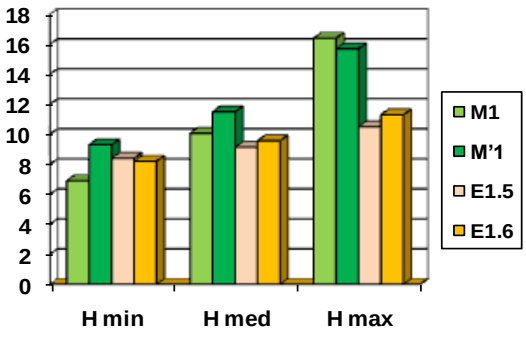

Fig. 2 –Wheat seedlings height(cm) dynamics

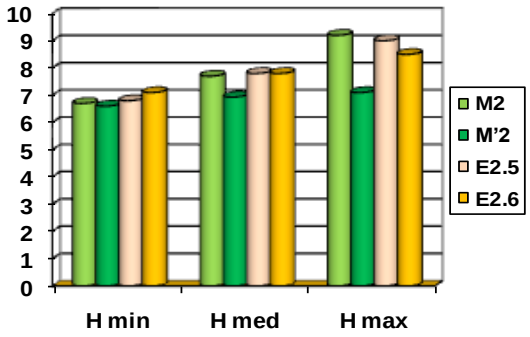

Fig. 3 – Barley seedlings height(cm) dynamics

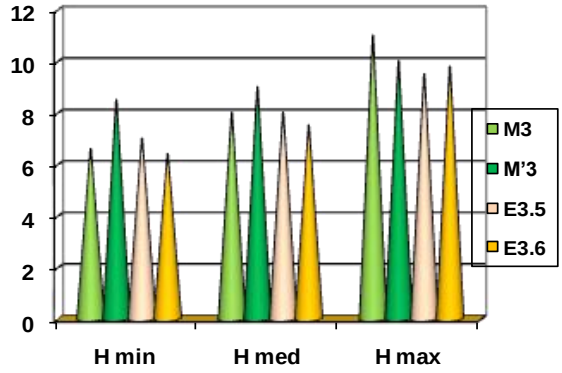

Fig. 4 – Oat seedlings height(cm) dynamics

Wheat, barley and oat seedlings biomass obtained by seed germination is presented in Table 2 and Figures 5-7.

Table 3

Wheat, barley and oat seedlings biomass

	Group	$\bar{X}$±Sx	
		biomass (weight in grams/number of wet plants)	**(biomass/water)x100 (biomass of dry substance)**
WHEAT	M_1 (distilled water)	0,163±0,05	0,1958±0,02
	M'_1 (potable water)	0,165±0,07	0,2008±0,03
	$E_{1.5}$ (5 ppm Se)	0,168±0,06 ns ns'	0,1996±0,06 ns ns'
	$E_{1.6}$ (10 ppm Se)	0,171±0,04 ns ns'	0,1993±0,05 ns ns'
BARLEY	M_2 (distilled water)	0,208±0,06	0,2447±0,03
	M'_2 (potable water)	0,212±0,03	0,2510±0,02
	$E_{2.5}$ (5 ppm Se)	0,213±0,05 ns ns'	0,2506±0,06 ns ns'
	$E_{2.6}$ (10 ppm Se)	0,215±0,05 ns ns'	0,2499±0,04 ns ns'
OAT	M_3 (distilled water)	0,157±0,02	0,1879±0,02
	M'_3((potable water)	0,155±0,03	0,1858±0,04
	$E_{3.5}$ (5 ppm Se)	0,160±0,02 ns ns'	0,1878±0,02 ns ns'
	$E_{3.6}$ (10 ppm Se)	0,170±0,06 s s'	0,1985±0,04 ns ns'

s – significant comparative with M, p<0,05; s' significant comparative with –M', p<0,05;
ns – insignificant comparative with M, p>0,05; ns' – insignificant comparative with M', p>0,05.

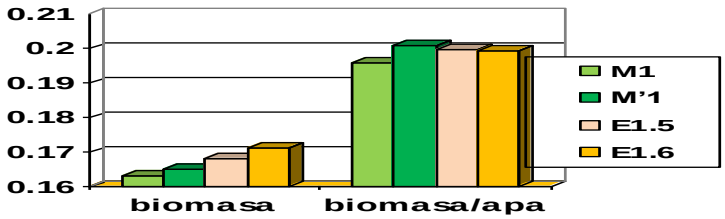

Fig. 5 –Wheat seedlings biomass dynamics

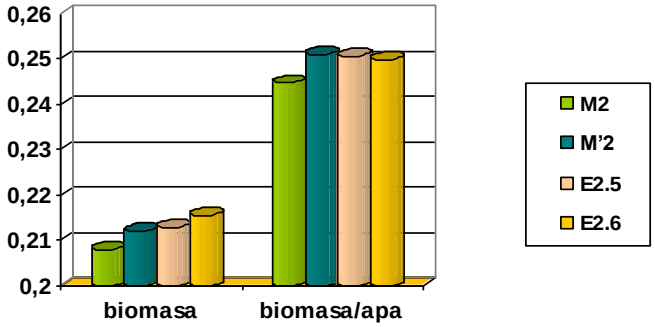

Fig. 6-Barley seedlings biomass dynamics

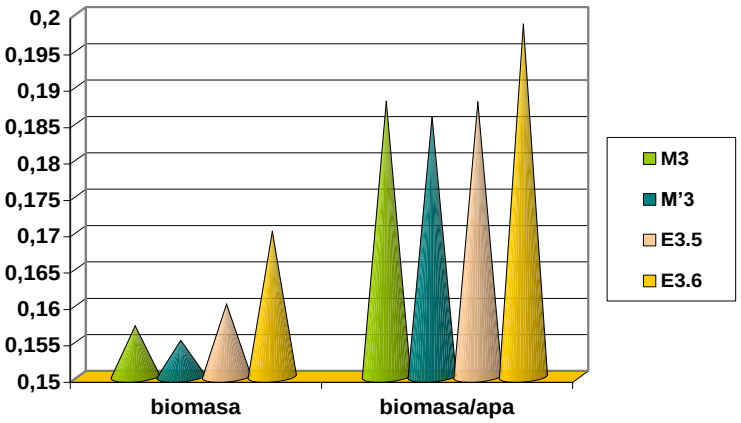

Fig. 7 –Oat seedlings biomass dynamics

Pearson correlation coefficients between biometric parameters in wheat, barley and oat shoots after sodium selenite treatements is presented in Table 4. We observe that after Se adding in germination process, there are positive correlations :

- for wheat: between germination rate and height ;
- barley: between germination rate and height;
- for oat: between biomass and height.

Table 4

Correlations between biometric parameters in wheat, barley and oat shoots after sodium selenite treatment

	WHEAT			BARLEY			OAT		
	Germination	*Biomass*	*Height*	*Germination*	*Biomass*	*Height*	*Germination*	*Biomass*	*Height*
Germination	1			1			1		
Biomass	-0,3553	1		-0,9513	1		-0,6987	1	
Height	0,9340	-0,5365	1	0,6792	-0,7906	1	-0,6405	0,1075	1

Conclusions

Researches on the biometric parameters of winter wheat, barley and oat seedlings in the presence of sodium selenite (5 ppm Se, 10 ppm Se) for 14 days showed:

The height of wheat seedlings was insignificantly ($p>0,05$) directly correlated with sodium selenite doses ($E_{1.6}/E_{1.5}$: +4,7%).

The barley seedlings height was not influenced by sodium selenite dose ($E_{2.6}/E_{2.5}$: 0%).

The oat seedlings height was insignificantly ($p>0,05$) negatively correlated, with Se dose ($E_{3.6}/E_{3.5}$: -5,5%).

For winter wheat, the biomass was insignificantly ($p>0,05$) directly correlated with Se dose ($E_{1.6}/E_{1.5}$: +1,78%).

For barley seedlings, increasing the Se dose, produced an insignificant($p>0,05$) increase of biomass ($E_{2.6}/E_{2.5}$: +0,93%).

The direct correlation between oat seedlings biomass and sodium selenite was significantly($p<0,05$) ($E_{3.6}/E_{3.5}$: +6,25%).

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