EVALUATION OF GERMINATION ABILITY OF COTTON CULTIVARS UNDER ARTIFICIAL STRESS CONDITIONS (*Gossypium hirsutum* L.)

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INTRODUCTION

- Germination and seedling establishment is one of the most critical stage for plant development.
- The selection of appropriate cotton genotypes, which are better adapted to adverse environmental conditions as the drought, is of great importance.
- In Greece, is critical the early sowing and use of cotton varieties resistance to drought because it is in the margins of cotton belt with usually cool temperatures at planting time.

- Polyethylene glycol (PEG), has been used wordlwide, in order to estimate the resistance of various seeds to germinate under drought laboratory conditions because results have very close relationship with the results in the field.
- Increasing gradually the concentrations of PEG achieved conditions of high osmotic pressure and increase the negative pressure the plant needs to absorb water.

AIM OF THE STUDY

- Eleven cotton cultivars were evaluated for germination efficiency concerning both, the relevant percentage and the germination rates with the use of different concentrations of PEG solutions in the laboratory of Cotton and Industrial Plants Institute.

MATERIALS AND METHODS

- 11 cotton commercial varieties were selected by their market share
- PEG (Molecular weight 6000)
- 50 seeds in petri + 10ml of PEG
- Concentrations of PEG

  0, 40, 80, 120, 160 g/100ml H_2O
- Growing chambers (28^{o}C – 7 days)
- Four repetitions for every PEG concentration and variety

EXPERIMENTAL DESIGN

- The Split-plot design was used, which allows the testing of two factors in combination. The main effect was the concentrations of PEG and serves as a replication for the second factor, the cultivars.
- The analysis of variance is similar to that used with the experimental design completed randomized (CR)
- Daily observations of the radicle (>0.5cm)

CALCUALTIONS

- **Germination percentage**
  (number of germinated seeds %)
- **Germination rate=Σnx/dx**
  nx seeds number germinated the **x** day
  dx days number from the beginning of germination till **x** day.
- Data obtained were analyzed for significance by testing the difference of means LSD (P=0.05)

TABLE 1. Analysis of variance of germination percentage and rate of cotton seeds in different PEG solutions.

		Mean square		F	
		Germination		Germination	
Source of variance	Degrees of freedom	Percentage	Rate	Percentage	Rate
PEG (A)	4	11611,7	2306,3	**	**
Error A	15	30,5	7,6		
Varieties (B)	10	355,7	97,5	**	**
Interaction	40	75,3	10,5	**	**
Error B	150	11,4	2,8		
Total	219				

** P < 0,01

TABLE 2. Mean values of germinated cotton seeds in different PEG solutions.

	Varieties (B)											
PEG (A)	CELIA	BOLINA	HERMES	NOVA	OPAL	ELINA	CARMEN	ETHIAGE - 1	VOLCANO	SANDRA	MIDAS	**Average**
Blank	84,0	85,0	83,0	84,0	84,0	83,0	84,0	83,0	83,0	84,0	84,0	**83,7**
40g/100ml H_2O	79,0	78,5	85,5	61,5	68,0	71,5	77,5	45,5	81,0	45,0	66,5	**69,0**
80g/100ml H_2O	66,5	70,5	81,0	38,5	49,5	61,0	69,5	49,5	66,0	37,5	44,0	**57,6**
120g/100ml H_2O	42,5	43,0	57,0	7,0	26,0	28,5	46,5	24,0	33,0	13,5	11,0	**30,2**
160g/100ml H_2O	3,0	3,5	1,0	2,0	5,5	5,0	0,5	1,0	2,0	1,0	0,0	**2,2**
Average	**55,0**	**56,1**	**61,5**	**38,6**	**46,6**	**49,8**	**55,6**	**40,6**	**53,0**	**36,2**	**41,1**	
LSD $_{0,5}$												
5,02 between two A averages,												
4,22 between two B averages,												
9,44 between two B averages in the same A level,												
10,31 between two A averages in the same or diffeerrent B level.												

Fig. 1. Effects of different PEG solutions in germination cotton seeds percentage.

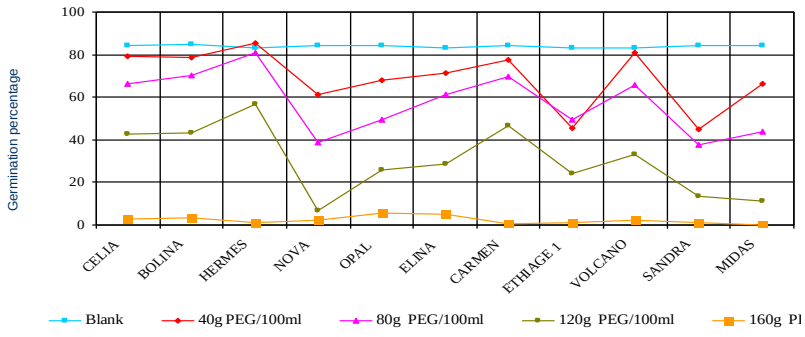
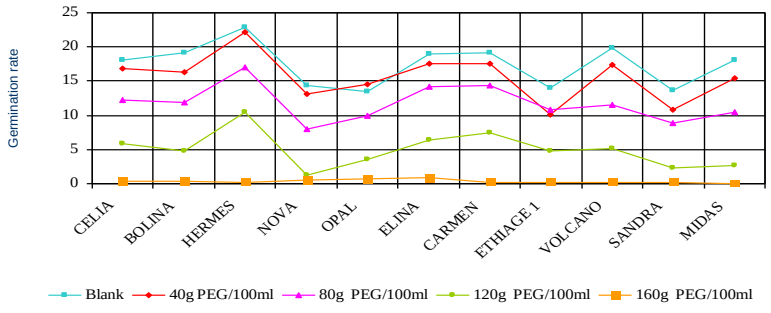


TABLE 3. Mean values of germination rates of cotton seeds in polyethylene glycol solutions.

	Varieties (B)											
PEG (A)	CELIA	BOLINA	HERMES	NOVA	OPAL	ELINA	CARMEN	ETHIAGE - 1	VOLCANO	SANDRA	MIDAS	**Average**
Blank	18,1	19,2	22,8	14,3	13,4	18,9	19,2	14,0	19,9	13,7	18,1	**17,4**
40g/100ml H_2O	16,8	16,4	22,2	13,2	14,6	17,5	17,6	10,1	17,3	10,8	15,5	**15,6**
80g/100ml H_2O	12,3	11,9	17,1	7,9	10,0	14,1	14,4	10,9	11,5	8,9	10,5	**11,8**
120g/100ml H_2O	5,9	4,7	10,4	1,2	3,5	6,3	7,5	4,8	5,2	2,3	2,7	**4,9**
160g/100ml H_2O	0,3	0,3	0,2	0,5	0,7	0,8	0,1	0,1	0,2	0,2	0,0	**0,3**
Average	**10,7**	**10,5**	**14,5**	**7,4**	**8,4**	**11,5**	**11,7**	**8,0**	**10,8**	**7,2**	**9,3**	
LSD $_{0,5}$												
1,25 between two A averages,												
1,05 between two B averages,												
2,34 between two B averages in the same A level,												
2,41 between two A averages in the same or diffeerrent B level.												

Fig. 2. Effects of different PEG solutions in germination rates of 11 cotton cultivars.



CONCLUSSIONS

1. Germination ability of cotton cultivars reduced under artificial stress conditions with the use of PEG.
2. The negative effect is directly related to the concentration of PEG.
3. A differentiation in cultivars behavior concerning the percentage and the germination rate was observed.
4. Among the eleven cultivars tested “HERMES” was the least and “SANDRA” was the most affected concerning the two measured parameters.
5. In all cases the cultivar x polyethylene-glycol interaction was significant.

THANK YOU
FOR YOUR ATTENTION