沙漠研究 **19**-1, 193- 195 (2009)
Journal of Arid Land Studies
"Desert Technology IX "
Refereed Paper

Effect of Magnesium Sulphate on First Stadium of Development of Lucerne (*Medicago sativa*) Cultivated in Gabes Oasis

Mabrouka ABID[1], Mansour HADDAD[1], Ali FERCHICHI[1]

Abstract: In the South of Tunisia, water used in irrigation, especially geothermic water is rich in sulphate. The object of this study is to evaluate the effect of increasing concentrations of magnesium sulphate ($MgSO_4$) from 0 to 5g l^{-1} on the development of alfalfa (*Medicago sativa* L.) during its first stadiums of growth. Results showed that high percentages of germination (> 90%) were detected at even the high concentrations. However for the concentration 5g l^{-1} of $MgSO_4$, 90% germination was not induced until 36 hours after initiation of the experiment. High concentrations reduced leaf surface and induced decreasing of succulence sign and limited production (88% for the concentration 5g l^{-1}). In all cases leaves are rich in Na^+ and K^+.

Keys words: Development, Germination, Lucerne, Magnesium sulphate, Production

1. Introduction

In the oasis of Gabès, food production depends mainly on irrigation from underground resources. Therefore, these resources have been intensively exploited. The impact of this exploitation in the tablecloths hydrochemistry is using saline water (Mamou, 1993); this induces a progressive increase salinity of irrigation water as well as the soils of the oasis (Mtimet, 1994).

The extension of salinity and the scarcity of water are the most important problems of warms arid zones. Search of resistant plants to these conditions is very necessary for the restoration and the planning of the surroundings. Among many crops, lucerne (*Medicago sativa*) or alfalfa represents an important alternative given its potential for fodder production.

Crops are subjected under natural conditions to saline stress driven mainly by NaCl. However, other chloride, sulphate and others salts play a significant role in affecting plant growth and development.

The aim of this work is to study the effect of magnesium sulphate on the first stage of development of Lucerne *Medicago sativa* cultivated in the oasis of Gabes.

2. Materials and Methods

To study the effect of $MgSO_4$ on lucerne germination, 50 seeds were placed in Petri dishes which were sealed with water soaked cotton. Five concentrations were applied: 0; 2; 3; 4 and 5 g l^{-1} with three replications for each treatment. The capacity of germination was calculated using the following formula:

% PG = GG/TN*100

where: GG = number of germinated seeds, TN = total number of seeds.

A second experiment was conducted in plastic pots with 5 l volume each to study the effect of $MgSO_4$ on lucerne growth. In each pot, 20 seeds were grown with three replications. Five concentrations were applied C1:2 g l^{-1}; C2:3 g l^{-1}; C3:4 g l^{-1}; C4:5 g l^{-1}, the water used in irrigation in the oasis (1 g l^{-1} of $MgSO_4$) was chosen as a control treatment (T). Four cuts collected at the following intervals; 60, 90, 120 and 150 days respectively. Five plants by treatment are used to measure: leaves surface, succulence index and the nutrients content

3. Results and Discussions

3.1. Influence of magnesium sulphate on lucerne germination

Percentages of germination are illustrated by **Figure 1**. Seeds of Lucerne showed raised rates (> 90 %) even for the high concentrations of $MgSO_4$. The effect of the magnesium sulphate resulted in delayed of germination for the 5 g l^{-1} treatment that reduces the germination percentage to 50% for day 1as compared to the other treatments. NaCl is the most applied salt in studying germination, several studies

[1] Institute of Arid Regions, Arid and oasis cultivation Laboratory Km 22, 4119 ElFjé Mednine Tunisia
E-mail: abid.mabrouka@yahoo.fr, Fax number: 75228088

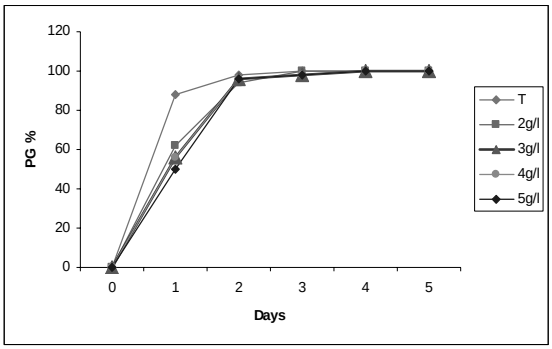

Fig. 1. Effect of $MgSO_4$ on % of germation.

showed that the percentage of wheat germination reduces until 3 g l^{-1} of NaCl (Bizid and Zid, 1986) and the effect of NaCl results in a delay of the germination speed (Belkhodja and Soltani, 1992).

3.2. Influence of magnesium sulphate on plant growth

3.2.1. Leaves surface

The leaf surface variation under different concentrations of $MgSO_4$ is outlined in **Figure 2**. The concentrations 2 and 3 g l^{-1} offers the most elevated leaves surface compared to the others treatments. The reduced surface (0.9 cm^2) was unregistered by the treatment 5 g l^{-1} of $MgSO_4$.

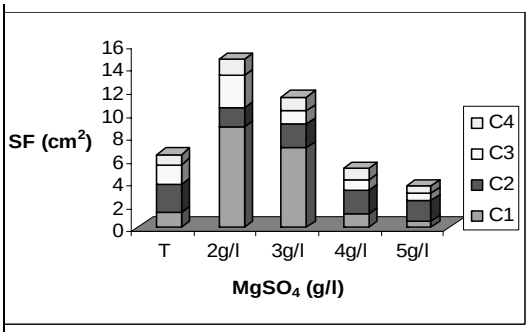

Fig. 2. Influence of $MgSO_4$ on leaves surface (C1:60days, C2:90days, C3:120days and C4:150days).

3.2.2. Succulence index

Water status of plant is expressed by DM/FM (DM: dry matter, FM: fresh matter) report of aerial parts (**Figure 3**). During the second cut, this index was increased; despite in the fourth cut, this parameter declined and was significantly lower for the 5 g l^{-1} treatment compared to the other treatment. This impacts drought and dehydration.

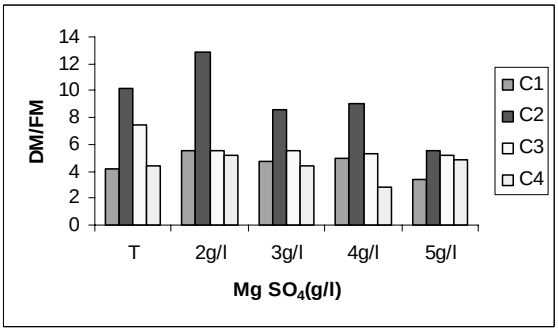

Fig. 3. Influence of $MgSO_4$ on succulence index (C1:60days, C2: 90days, C3: 120days and C4:150days).

3.3. Influence of magnesium sulphate on nutrients content

Results illustrated by **Table 1** indicated an increase in sodium content with the increase of $MgSO_4$ concentration. The largest concentration showed the highest content (4%). Our results showed a significant increase of potassium content in leaves and steams of lucerne (between 2 and 5%) for all treatments. Our results showed a capacity of alfalfa to maintain an elevated content in K^+ in presence of increase of Na^+. Lachaal (1996) considers this phenomenon as criteria of tolerance. The same author showed the existence of a positive interrelationship between tolerance to salt and the content of leaves in K^+ of lentil.

Table 1. Leaves and stems contents in sodium and potassium during the second and the fourth cut for the different concentrations of $MgSO_4$.

	Second cut		**fourth cut**	
	Leaves	Stems	Leaves	Stems
	Na^+ (%)			
T	0.44	0.79	0.79	0.59
C1	0.39	0.49	0.63	0.59
C2	0.34	0.34	0.59	0.2
C3	0.44	0.54	0.59	0.59
C4	0.56	1.7	1	1
	K^+ (%)			
T	2.08	3.39	2.6	2.61
C1	2.43	3.39	2.86	2.86
C2	2.62	0.74	1.21	0.73
C3	1.98	3.39	2.27	2.38
C4	2.05	8.96	3.39	3.45

4. Conclusion

In this study, lucerne showed a higher percentage of germination (up 50%) for all the treatments. There was a strong decrease in leaf surface especially in the seedling treated with 5 g l^{-1}. The presence of $MgSO_4$ induces an increase of the content of sodium, observed for all the treatments. This increase is reputed among characteristic of plant tolerance to salt. Thus, the plant appears capable to surmount increase of $MgSO_4$ concentrations. This adaptation may lead to the cultivation of lucerne in the oasis of Gabès.

References

Belkhoja M, Soltani (1992): Response of been (*Vicia faba* L.) to salinity. Study of germination of the some lineage. *Bull. Soc. Bot.fr*, **139**: 375-368.

Bizid E, Zid E. (1986): Ionic aspect of the wheat adaptation to the chloride of sodium. *Colloquium about plants in arid environment*. Djerba 8-10 September, 1986, Fac.Sci of Tunis, 450-459.

Lachaal Mr. (1996): *Variability of the response of lentil to salinity and variation according to the stadium of development*. PhD Thesis, Faculty of sciences, Tunis: 226p.

Mamou A. (1993): *Filling of deficit in water of the oasis of Gabès, Technical report*. Direction of Resources in Water and Soil (DRE), Tunisia.

Mtimet A. (1994): The edaphically characteristic of oasien environment. *Seminary. Enhancement of Saharan firings*, Gabès 4-6 November, Tunisia, Ceres: 19pps.

Rush D.W., Epstein E. (1981): Comparative studies on tea sodium, potassium and chloride relations of a wild halophytic and a domestic salt- sensitive tomato species. *Plant physiology*, **68**: 1308-1313.