غربله اصناف مختلفه من الحنطة (*Triticum aestivum* L.) لتحمل الالمنيوم باستخدام تراكيز مختلفه من الكالسيوم

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الخلاصه

استعملت في هذه الدراسه اربعه أصناف محليه من الحنطة الناعمه(الفتح.،ابوغريب، إباء-95 واباء- 99) لتقويم دور الكالسيوم في التقليل من التأثيرات السميه للألمنيوم في نمو وتطور بادرات الحنطة حيث نميت بادرات هذه الأصناف في محلول هوكلند والحاوي على 30 ملي مولر من الالمنيوم (محلول الغربله screening solution) والحاوي على خمسه تراكيز من الكالسيوم(0, 5. 0, 1.0, 5. 1 ,2.0 ملي مولر) وقد أظهرت النتائج انخفاض أطوال الرويشات والجذيرات للبادرات الناميه في محلول الغربله بسبب التاثيرات السميه للالمنيوم ٠اما بوجود الكالسيوم في وسط النمو ازداد معدل اطوال الرويشات والجذيرات نظرا للدور الايجابي للكالسيوم في زيادة تحمل بادرات الاصناف النباتيه لضرر الالمنيوم وانه أكثر الاصناف تحملا أبو غريب ويليه إباء-95 ثم الفتح ثم إباء- 99 .

Screening different wheat varieties (*Triticum aestivum* L .) for aluminum by using different calcium concentrations

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Summary

In this study were used four local varieties from wheat (Al-Fath, Abu-Graib ,IBaa-95 and Ibaa- 99) to evaluate the role of calcium in decrease the toxic effects of aluminum in growth and development of seedling of wheat. Plant were growth in hogland solution with 30 Mm of aluminum (screening solution) which contain five calcium concentrations (0 , 0.5 ,1.0 ,1.5,and 2.0 Mm) .The result of this study showed the adverse effects of aluminum in long of plumules and radicals .This toxic effects of aluminum were reduced by using calcium concentration with aluminum in the growth medium ,this due to the positive role for calcium .The result show the more tolerance of these varieties (Abu-Graib , Ibaa-95, Al-Fath and I BAA-99) respectively.

Introduction

Elements which present in soils which may be beneficial or toxic to the plants environment. Although excess of elements may produce some common effects on plants in general there are many case of specific effects of individual metals on different plants . the biota requires some of these metals in trace quantities but may be sensitive to higher concentrative of elements . Element toxicity in plants has been reported by many workers (Bollard and Butler, 1966 ;Foy and Chaney ,1978; Gotbold *et al*,1988). Aluminum is not regarded as an essential nutrient ,but low concentration can some times increase plant growth or induced other desirable effects(Foy and Chaney ,1978; Foy, 1992 ;Foy *et al* ,1993) . Soluble aluminum is often present in acidic soil in phytotoxic concentration, considered as an important growth limiting and resulting inhibition factor for plants in many acid soil particularly in PH of 5.0 or below but can occur is one of the principal factor limiting the volume of soil exploited by the roots of aluminum sensitive crops (Foy ,1974 ; Balsborg Pahlsson ,1990 ;Rout *et al*,2001) . Several mechanisms of aluminum damage to plumules and roots have been suggested including interference with normal uptake , transport and utilization of(P ,Ca ,Mg and Fe), most of the mineral elements have been well documented (Clarkson, 1965 , Jackson, 1967; Clark *et al* ,1981; Foy, 1992).Generally ,aluminum interferes with cell division in root tip and lateral roots ,increase cell wall rigidity by cross linking pectin and disturbance in root structure ,particularly cell wall loosing and activity due to the deficiency or reduction of calcium transport ,reduced DNA replication by increasing the rigidity of the DNA double helix , decrease root respiration , fixes phosphorous in less available forms in soils and on root surface , interaction with enzyme activity governing sugar phosphorylation and deposition of cell wall polysaccharides , and also use of several

essential nutrients (CA ,Mg ,K, P ,and Fe (Lance and Pearson, 1969; Horton and Kirkapatick,1976; Kotz *et al* , 1976 ;Roy *et al,1988*) . Species and varieties within species differ in the degree to which a given concentration of aluminum interferes with root growth (Foy, 1974) .When placed in the same solution , an aluminum sensitive variety may show severe inhibition of root growth of an aluminum ,

tolerance variety may be little affected this differential tolerance to aluminum at the same time provides a quick and reliable method of comparing plants for aluminum tolerance .The degree of stress imposed on roots by a given concentration of aluminum can be controlled to a large excess by the concentration of calcium and my present in solution (Rhue and Grogan,1977; Bengtsson, *et al* ,1988).The calcium increase the cell wall integrity and decrease its permeability (Hewitt ,1966; Leopold and Willing,1984).The purpose of this study is to describe a technique for screening wheat (*Triticum aestivum* L.) for aluminum tolerance in which calcium where used to control the degree of aluminum toxicity .This principles involved in this screening procedure should be applicable to screening other plant species where a knowledge of the wrong in tolerance to aluminum within the specie is desired . .

Materials and Methods

wheat seeds (local varieties ,AL-Fath, Abu-Graib, Ibaa-95 and Ibaa-99) were placed between layers of filter paper towel in petri dishes and incubated at approximately 32 C .Within 24-36 hours, these seeds had germinated and have produced radicals ranging from 3-5 mm long . These 2-Day-old seedling were then grown for 7 days in complete nutrient solutions containing treatment consisted of Ca as $Ca(NO_3)_2$ at the levels (0 , 0.5 , 1.0 , 1.5 , and 2.0 Mm :T_1 ,T_2 ,T_3 ,T_4 , and T_5) respectively .All other nutrients plus aluminum were added to each solution 30 Mm. Aluminum was added as $AL_2(SO_4)_2.18H_2O$. five seedling with three replication of each often of wheat varieties were grown together in a screening solution containing one of the Ca treatments. The plants were harvested and the lengths of the plumule and primary roots measured (Relative root lengths) were calculated for each wheat varieties by dividing the plumule and root length obtained in a given Ca treatment by that obtained in a control solution which had received aluminum only(T1) .The data were analyzed by C RD the PH of screening solution immediately after dissolving at the $AL_2(SO_4)_2.18H_2O$ was about 4.0 the PH was adjusted to 4.6 with KOH immediately before placing the seedling in this solution.

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Results and discussion

At the end of 9 days in these solution , plumule of various wheat varieties rang from severely damaged to wall enveloped .Table (1) shows the different effects of aluminum on plumule of four wheat varieties which had been grown together for 9 days in (control T_1, screening solution) the result show significant decrease in plum length for Ibaa-99 comparative with other varieties ,

while the Ibaa-95 show the high plumule length in compare with the other varieties , has been many workers (Foy and chaney, 1978; Gotbold *et al*, 1988; Foy ,1992).The result in Table (1) show when calcium added in these screening solution reduced the toxicity of aluminum in plum seedling length s ,the reduced toxicity was expressed as an increase in relative plumule lengths. (Clarkson ,1965 ;Kotze *et al* ,1976) The increases was significant special in (T_3) for the two variety(Abu-Graib and Ibaa-95)comparative with control (T_1) this result show the positive role of calcium in decrease of aluminum toxicity through the maintain of the cell membrane integrity and decreased its permeability (Hewitt,1966). The result also show decreasing in plum length when increasing Ca concentration in growth medium as a result of high osmotic effect composed with Ca increased. The result in Table (2) show the effect of aluminum and the interaction between AL and Ca in root lengths for different wheat varieties. The roots system of wheat varieties had different tolerance for aluminum toxicity (T_1),the several damage were observe in Ibaa-99 and Al-fath respectively while the highest rates of roots length were observed in Abu-Graib and Ibaa-95 respectively the semi result were observed by (Foy,1974; Gotbold *et al*,1988; Balsberg Pahlsson,1990).The relative root length increased significantly for Abu-Graib at T_2 and T_3 while in Ibaa-95 at T_3 comparative with T_1 .This result show the positive role of Ca in increase of root growths as a decrease of several effects of AL (Kotze *et al*,1976; Jackson, 1967 ;Rhue and Grogan, 1977) as well as calcium play important role in decrease of potassium leakage from the root tip cells (Hewitt,1966 ;Leopold and Willing,1984).From this result in Table(1 and 2) the wheat varieties show different tolerance for aluminum toxicity this due to the different in genotype, this result give varieties method for select a best variety for AL-toxicity for growing in acidic soil .

Table(1) Effect of aluminum and aluminum interaction with calcium in rate of plum length (Cm) of different wheat varieties.

Rate	Ibaa-99	Ibaa-95	Abu-Graib	Al-Fath	Treatment
4.7	2.96	5.92	5.1	4.98	T_1
4.5	3.1	5.34	4.64	5.24	T_2
5.5	3.53	6.97	6.3 1	5.34	T_3
4.5	3.06	5.92	4.3	4.8	T_4
4.1	3.02	5.81	4.17	3.6	T_5
	3.1	6.0	4.9	4.8	Rate

L.S.D 5% Concentrations = 1.0 Variety= 1.2 C*V=1.7

Table(2) Effect of aluminum and aluminum interaction with calcium in rate of root length (cm) for different wheat varieties

Rate	Ibaa-99	Ibaa-95	Abu-Graib	Al-Fath	Treatment
4.4	3.5	5.1	5.5	4.0	T_1
5.3	4.23	5.5	7.0	4.5	T_2
6.2	4.4	6.7	8.74	5.52	T_3

5.2	4.2	6.0	6.5	4.19	T_4
5.1	4.0	5.8	6.0	4.6	T_5
	4.0	5.8	6.7	4.4	Rate

L.S.D 5% C = 1.2 V = 1.4 C * V = 1. 8

References

Balsberg Pahlsson A.M. 1990 .Influence of aluminum on biomass, nutrients ,soluble carbohydrate , and phenols in beech (*Fagus sylvatica*),Physio. Plant . 78:79-84.

Bengtsson B., Asp H ., Jensen P., Berggren D .1988. Influence of aluminum on phosphates and calcium uptake in bech,(*Fagus sylvatica*) ,grown in nutrient solution and soil solution , Physiol.Plant.74:299-305.

Bollard E. G., Butler G. W.1966. Mineral nutrition of plants , Annu .Rev. Plant Physiol.17:77-112.

Clark R.B.. Piier H.A., Knudsen D., Maranville J. W.1981. Effect of trace element deficiencies and excesses on mineral nutrients in sorghum, J. Plant Nutr.3:357-374.

(Clarkson D.T.1965. The effect of aluminum and some other trivalent metal action on cell division in the root apices of (*Allium cepa*), Ann .Bot. 29:309-315.

Foy C.D.1974. Effect of soil calcium on plant growth .In: Carson E.W(Ed.)The plant root and its environment, Charlottesville, Univ. Press, VirginiaPP.565-600.

Foy C.D.1992. Soil Chemical factors limiting plant root growth ,In:Hatfield J.L., Stewar B.A.(Eds.), Advances in Soil Sciences: Limitations to plant root growth ,Vol.19, Spring Verlag , New York Pp.97-149.

Foy C.D., Chaney R.L., White M.C.1978. The physiology of metal toxicity in plants , Annu. REV .Plant Physiol. 29:511-566.

Foy C.D., Carter T.E., Duke J.A., Devine T.E.1993. Correlation of shoot and root growth and its role in selecting for aluminum tolerance in soybean, J. Plant Nutr.16:305-325.

Gotbold D.L., Dictus K., Huettermann A.1988. Influence of aluminum and nitrate on root growth and mineral nutrition of Norway spruce (*Picea abies*), seedling, Con .J. For. Res.18:1167-1171.

Hewitt E.J.(Ed.) .1966.Sand and water culture method used in the study of Plant Nutrition, 2nd ed., Commonwealth Agricultural Bureau, Farnaham Royal, UK, Technical Communication No 22.

Horton B.D., Kirkapatick H.C.1976. Aluminum toxicity symptoms in peach trees, J. Am .Soc. Hort Sci. 101:139-142.

Jackson W.A.1967. Physiological effects of soil acidity, In: pearson R.W., Adams F (Eds.), Soil Acidity and Liming, Am. Soc. of Agron ., Madison ,USA, pp.43-124.

Kotze W.A., Shear C.B., Faust M.1976. Effect of nitrogen source and the presence or absence of aluminum on the growth and calcium nutrition of apple seedlings,J.Am.Sci.101:305-309.

Lance J.C., Pearson R. 1969. Effect of law concentrations of aluminum on growth and nutrient uptake by cotton roots, Soil Sci Soc. Am. Proc. 33 :95-98

Leopold A.C., Willing R.P.1984. Evidence for toxicity effects of salt on membrane. In salinity tolerance in plants, strategies for crop improvement. Edited by Richarde staples Gary H. Tonniessen, New York.

Rhue R.D., Grogan C. O.1977. Screening for aluminum tolerance, in: Wright M.J., Ferrari S.A.(Eds.), Plant adaptation to mineral stress in problem Soil, Comell Univ .Agric . Exp. STN., Ithace, New York, PP.420-422.

Rout G.R., Samantaray S., Das P.2001. Aluminum toxicity in plants: a review .Agro. J.21:3-21.

Roy A.K., Sharma A., Talukder G.1988. Some aspects of aluminum toxicity in plants, Bot.Rev.54: 145-177.