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FERTILIZATION AND SALINE WATER IRRIGATION PHASE II.

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Introduction

The present report covers last year activities which were undertaken within the framework of the Project No. C11-131 dedicated to the results of field investigations carried out in the Philippine under the Philippine component of the Project. It also includes reprints of studies in Israel which have already been accepted for publication this year.

Since this is the last year of the project, we plan to convene again in Israel and to review the results in framework of project summary and conclusions. The meeting is scheduled for March 1996. Therefore this report should be taken only as a bridging report in which some raw material is also reported.

During the year, exchange of visits between collaborators in this Project took place. Professor Jiftah Ben-Asher visited Los Banos, Philippines. He had scientific discussions not only with the co-investigators but with other scientists in the University of the Philippines (UPLB).

Professor Jiftah Ben-Sher assisted in the conduct of field experiment. New technique for measuring soil moisture content was introduced. All these exchange of visits help to strengthen the international collaboration between the UPLB and BGU not only at the technical level but at the cultural level as well.

Double Emitter Source (DES) for Irrigation Experiments in Salinity and Fertilization .

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Double Emitter Source (DES) for Irrigation Experiments in Salinity and Fertilization .

Abstract

Double and crossed triple sprinkler line sources experiments are widely used for complex salinity and fertilization studies.

The preferred irrigation method of many crops, especially with saline water , is trickle rather than sprinkler. For these crops it is an advantage to conduct trickle irrigation experiments when salinity and fertilization treatments are required. A modification of the two line source design using trickle instead of sprinkler irrigation experiments is suggested. Two trickle laterals and their emitters connected to two tanks of stock (fertilizers or salt) solutions are coupled together forming a "double joint " lateral. Each line delivers different irrigating solution: (i.e. fresh or saline, or containing different fertilizer) . The emitters of the two lines have different and varying discharges to obtain various mixings between the two stock solutions while maintaining constant application rates. Good and proportional mixing between the two stock solutions is ensured by a set of small catch cans imbedded in the soil and collecting the droplets from the emitters . The layout produces any desired mixing between the maximal and minimal concentration . The method was tested for a salinity experiment on Globe Artichoke and a fertilization experiment (optimal N and K application) for Hippeastrum. The average electrical conductivity (EC) of the coupled laterals were 1.5 and 6.2 dSm^{-1} . The concentrations of N and K in the stock solution was 13.12 g l^{-1} ,and 9.38 g l^{-1} respectively. After diluting and mixing , these concentrations yielded maximum of 777 and 556 mg l^{-1} N and K at the irrigation solution. Electrical conductivity of saturated extract (ECe) in the Artichoke experiment were linearly correlated to their EC in the irrigation water. Due to salinity , yield of Artichokes was reduced by 60% when EC increased from 1.5 to 6.2

dSm^{-1} . N and K of the saturated extract were linearly correlated to their concentrations in the irrigation water. Diameter and weight increase of Hippeastrum bulbs was 35% for high N application and low K application . It was concluded that DES can be used for precise application of varying salts or nutrients concentrations in a multi-variable experiments. Advantages include prevention of canopy wetting by saline water , a precise distribution of the factor to be evaluated, small experimental plots and hence minimal time area and labor requirements.

Multi-factorial experiments require complex design and large experimental area associated with large labor and time requirements. The introduction of the sprinkler single, double and crossed triple line methods (Hanks et al. 1976; Lauer 1983; and Magnusson et al, 1989) helped to balance these requirements and are therefore well established as standard experimental methods. They are relatively inexpensive and simple to use since they reduce the size of the experimental area significantly. The use of sprinklers presents however several inconveniences: 1. Many sprinklers have a non linear water distribution function. Thus the major assumption involved in their application (namely a gradual monotonic trend of concentrations) is violated. In most cases the amount of water near the sprinklers is larger than its amount away from the sprinkler. That is, the borders required for the experimental plots with the sprinkler method are relatively large. 2. The preferred irrigation method of many crops is trickle rather than sprinkler irrigation, hence trickle irrigation experiments are required. 3. Results of sprinkler line source experiments are often affected by wind. 4. Sprinkler irrigation with a high salt or fertilizer concentration may cause scalds on the leaves. 5. Sprinkler double line source methods does not allow randomized layout. These disadvantages may be eliminated using the DES.

The overall goal of this study is therefore to apply the double line source concept to trickle irrigation. Specifically we shall describe the technical aspects of the DES ,demonstrate its feasibility and test it in salinity and fertilization experiments . Two experiments are briefly presented to demonstrate the DES : the first is salinity effect on the yield of Globe Artichokes and the second on the response of Hippeastrum to N and K application.

Materials and Methods

Description of the DES.

A trickle irrigation lateral is composed of two lines coupled together to form a "double joint " lateral. One line is delivering fresh and the other saline water. (Similarly, the coupled lateral can be used to deliver two different fertilizers or other dissolved substances in the water) . The emitters on the two coupled lines have different discharges but their cumulative discharge at each dripping point is constant along the lateral.

Figure 1 shows two contiguous lines forming a single lateral. In this figure C1 and C2 represent two stock solutions of fertilizers or salinity. The discharge of the emitters on line q_1 increases from $q_{1,1}$ at C1 to $q_{1,n}$ at C2 . The discharge of the emitters on line q_2 increases in the opposite direction (from $q_{2,1}$ at C2 to $q_{2,n}$ at C1) The increased darkness of the patterns in Fig 1 represents the increasing salinity at each point while the discharge of each set of emitters is:

$$Q_i = q_{1,i} + q_{2,(n-i+1)}; \quad i=1.....n \qquad [1]$$

where Q_i is the total discharge at the i'th location on the coupled lateral , $q_{1,i}$ is the discharge of the i'th emitter on the first lateral and $q_{2,n}$ is the discharge of the last emitter on the second lateral with n emitters on each line .

Consequently , the mass of solutes applied at each point Mi is:

$$M_i = q_{1,i}\, C1 + q_{2,(n-i+1)} C2; \qquad [2]$$

and the resultant weighted concentration $< C_i >$ at point i is:

$$< C_i > = M_i / Q_i \qquad [3]$$

or, for constant Q:

$$< Ci >= Mi/Q \qquad [3a]$$

Thus the number of treatments is n and the concentration of solutes of each treatment is a function of four factors: $q_{1,i}$; $q_{2,(n-i+1)}$; C1 and C2.

Two field experiments were conducted on a sandy soil (Fine, Typic, Torripsamments) of the central Negev of Israel to test the applicability of the system for salinity and fertilization studies.

The salinity experiment

Artichokes (*Cynara Scolymus L cv. Violet de Provence*) were planted on 8/4/93. and harvested between12/1/93 and 4/22/94 . Plants density was approximately 6700 plants/ha. Distance between plants along the laterals was 1m and between rows 1.5 m. The experiment included 7 treatments and 6 replications , as specified in column 1 Table 1 . (total 42 plots).

Columns 2 to 4 of Table 1 summarize the discharge combinations between each two sets of emitters. The designed sets formed a point discharge of 8 Lh^{-1}. For example treatments No. 1 and 7 included only one (8Lh^{-1})emitter connected to the brackish and the fresh lines respectively. Treatments No. 2 and 6 symmetrically created mixing of 7 and 1 Lh^{-1} with a set of four emitters. The emitters used were "Netafim" self compensating emitters The distance of the bounded emitters along the double laterals on the rows was 1 m. and the distance between each lateral which was composed of a set of the two lines was 1.5 m. (see Fig.1) ,so each plant had the proper group of emitters.

The actual EC of the water in the first lateral was 6.2 dSm^{-1}. and in the second 1.5 dSm^{-1}. To form a gradual salinity along the laterals, combinations of different discharges of emitters were arranged as in table 1

To ensure proper mixing of the two qualities of water the droplets from all emitters on the double lateral were collected through tublets into a single small mixing can. The cans were open and imbedded in the ground. Water flew from them into the soil.

Samples of EC were taken from the mixing cans after each of the 49 irrigation's from the 7 treatments and three replications. At the end of the experiment soil samples from each treatment and replication were taken to obtain electrical conductivity of saturation paste extract (ECe) at three depths below the emitters . The soil was leached at the beginning of the experiment through a 100 mm. sprinkler irrigation The initial ECe of the leached soil was tested at 7 random sites and was about 2.5 dSm^{-1}. at 0 to 0.6 m. depth.

The yield weight and the number of artichoke headlets were measured as indicators of the stability and validity of the system

The Fertilization Experiment

Bulbs of Hippeastrum ,also commonly called Amaryllis (*Hippeastrum cv. red-lion*), were planted on Jan 20.1993 and harvested on July 10.1993 . The parameters selected to evaluate the response of Hippeastrum to N and K concentrations in the irrigation water were the average increase in both diameter and dry weight of the bulbs.

The fertilization experiment consisted of two laterals as described in Fig.1 where C1 contains Ammonium Nitrate and C2 contains Potassium chloride (instead of fresh and saline water as in the previous experiment) . The discharges of the emitters used in this experiment were 1, 2 and 4 lh^{-1} from which six combinations (treatments) were obtained while maintaining total discharge of 5 lh^{-1} as shown in Table 2.

Two stock solutions were prepared. One contained 13.12 gl^{-1} N and the second contained 9.38 gl^{-1} K . The stock solutions were injected at rate of 8 lh^{-1} to the main distributing pipe which delivered tap water at a rate of 135 lh^{-1}. Thus, the

resulting concentrations of the irrigation solution were 777 mgl^{-1} N and 556 mgl^{-1} 8 K . The upper limit of the coefficient of variation (CV) of fertilizer's concentration obtained was 12% . Irrigation was set to one hour every second day. All other technical details are as described in the previous experiment .

Results and Discussions.

Salinity of the irrigation water.

Temporal changes of EC as a function of the mixing ratio are shown in Fig. 2 . It can be taken as a measure of the stability of the treatments. According to this figure , for most of the season the points deviated very little from the average EC. It should be noted that the two water sources used in this experiment are natural ground water that are pumped from wells and are not specifically prepared for the experiment. This results in some deviations from the mean. Salinity of the fresh water source fluctuated between 1.2 and 2.6 dS m^{-1} throughout a period which started in September and lasted until June of the following year. At the same time the salinity of the saline source fluctuated between 5.6 and 6.5 dSm^{-1} . The saline water comes from an unstable fossil source and hence the resultant EC and the temporal fluctuations are affected by both the fresh and the saline sources . In spite of the fluctuations , the differences between the proposed treatments were maintained and average EC values did not cross or interfere with one another (Fig.2) .

ECe and N-K concentration of the saturated past extract

The DES system was also evaluated through the correlation between EC of the irrigation water and ECe of the soil . Thus, soil sampling at the end of the experiments was used as an additional validation of the DES methods. The correlation between ECe and EC is shown in Fig 3.

The EC of the irrigation water and the ECe were significantly correlated with a slope of 0.997 (very close to 1.) The electrical conductivity of saturated paste extract (ECe) at all depths was higher than water EC by about 2-3 dS m^{-1} and hence the calculated

intercept of ECe versus EC was 2.3 . The acceptable (r^2=0.64) agreement between EC and ECe , verifying the functionality of the DES as a method to control soil salinity underneath the emitters. Many studies on ECe profile under drip irrigation indicated that below the emitter ECe is closer to the EC of the irrigation water than ECe's in other points on the ECe profile.(See for example the review of Rhoades and Loveday 1990) . Hence, ECe below the emitter was used only as an indication for the correlation between ECe and EC of the irrigation water. It was not used to represent the saline situation in the root zone of the crop since it varies in both space and time. To overcome this difficulty , Bresler (1987) used a theoretical model to determine an average ECe value for the case of high frequency irrigation . This approach is applicable to drip irrigation which falls within the category of high frequency irrigation and therefore it can be adopted by the DES method. However, since this study was focused on the technical aspect of the method , the theoretical determination of average ECe in the root zone was not treated here directly. It was ,however , treated indirectly in the next section , through the salinity-crop yield relationship which was assumed to reflect the average salinity of the root zone.

A similar approach was used in the N-K fertilization experiment also. The relationships between concentrations of N and K in the irrigation water and in the soil solution are shown in Fig's 4 and 5 . Both K and N of the saturated soil extract near the emitter are linearly correlated to their concentrations in the irrigation water. The correlation coefficient was r^2=0.82 and 0.83 which is good for field experiments . It is noteworthy that the slope of the regression line is only 0.12 for K and 0.27 for N . This moderate slope indicates smaller concentrations of K and N in the soil solution that may result from the consumption of these nutrients by the plants. It was smaller than the slope of 1. found in the EC-ECe regression analysis and does not indicate ions uptake . The high regression coefficients and the good agreement between water and soil nutrients concentrations further strengthen the verification of the functionality of the DES as a tool for fertilization experiments

Yield response to the DES experiments

The salinity-crop yield relationship was assumed to reflect the average salinity of the root zone and the yield parameters of Artichoke are given in table 3 .

Total yield was reduced to 40-50% of it's maximum as irrigation water salinity increased from 1.5 to 6.2 dSm^{-1} . Note also that the range of standard deviation from the mean yield and the coefficient of variation (average CV=31%) is acceptable for field experiments . The estimated rating of the salt tolerance category of Artichokes is moderately tolerant (MT) but data on the slope and the threshold value are not available (Rhoades and Loveday 1990) . The MT crops are characterized by a threshold value of 3-6 dSm^{-1} and a slope of 9-10 % per dSm^{-1}. Regression analysis of the data presented in table 3 resulted in a typical "MT " slope of -8.7 % per dSm^{-1}. and $r^2 = 0.72$.

The response of Hippeastrum to fertilization treatments is shown in table 4 .

In this table there are two distinct groups differing from one another by the average increase in bulbs' diameters and weights. Fertilization treatments # 1,2 and 3 with amounts of N varying from 0 to 310 mgl^{-1} and amounts of K varying from 334 to 556 are characterized by a small increase in diameter (1.3-1.6 cm) . Treatments # 4,5 and 6 with amounts of N varying from 466 to 777 mgl^{-1} and amounts of K varying from 334 to 556 mgl^{-1} are characterized by a large increase in diameter (about 2 cm) and weight. (13-14 gr.) .

Conclusions

The above results indicate that the DES can be used for precise application of varying salinity or nutrient concentrations in a multi-variable experiment. It provides an accurate and cost reducing tool for examining crop response to varying salinity in the soil solution or to varying ratios between quantities of two fertilizers. The experimental design is simple and the actual operation involves a very small area , time and materials consumption.

References

Bresler E 1987 Application of a conceptual model to irrigation water requirements and salt tolerance of crops Soil Sci. Soc. Am.J. 51:788-793

Hanks R.J., J.Keller , V.P. Rasmussen and G.D. Wilson 1976 Line source sprinkle for continuous variable irrigation-crop production studies. Soil Sci. Soc. Am. J. 40: 426-428.

Lauer D.A. 1983 Line source sprinkler system for experimentation with sprinkler applied nitrogen fertilizers. Soil Sci. Soc. Am.J.47:124-128.

Magnusson D.A , J.Ben Asher and Y. DeMalach 1989 A continuos two variable design using the line source concept. Agron. J. 81:132-133

Magnusson D.A , J.Ben Asher 1990 Simulated water and solute distribution from a crossed triple line source. Irr. Sci.11:31-36

Rhoades J.D. and J. Loveday 1990 Salinity in Irrigated Agriculture in: B.A.Stewart and D.R.Nielsen (eds.) Irrigation of Agricultural Lands. Agronomy series No.30 . ASA publisher Madison Wisconsin. USA

List of Figures.

Fig.1. Layout of the DES (Double Emitter System) design. The two contiguous lines are forming a "double joint " lateral.. C1 and C2 are the stock solutions . The varying discharges of the emitters are q_{ij} where i and j represent the stock solution and the number of the emitters on the lateral respectively. The darkness represents increasing salinity The neighboring lateral and the appropriate spacing is represented by two additional dark wetted areas .

Fig. 2. Electrical conductivity of irrigation water , sampled from small catch-cans under the emitters , throughout the salinity experiment.

Fig. 3 Electrical conductivity of the saturated paste extract (ECe) under the emitters as a function of the EC of the irrigation water at three soil depths.

Fig. 4 Average concentration of K at 0-0.15 m depth as a function of K concentration in the irrigation water.

Fig. 5. Average concentration of N at 0-0.15 m depth as a function of N concentration in the irrigation water.

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Table 1 Discharge of the emitters on a lateral and resultant electrical conductivity for the salinity experiment with DES.

Note: a calculated example for the last column of treatment #3:EC=(2*6.4+6*1.9)/8=3.0)]

Table 2 Discharge of the emitters on a lateral and resultant concentrations of N and K for the fertilization experiment with DES.

Table 3. Yields and yield parameters of Artichokes for salinity treatments with DES

Table 4. Increase of diameters and weights of Hippeastrum bulbs at the end of fertilization treatments with DES.

Treatment	Discharge			Average electric conductivity		
	Brackish water	Fresh water	Total	Measured (ds/m)		Planned (ds/m)
				Mean	SD	
	lh^{-1}	lh^{-1}	lh^{-1}			
1	0	8	8	1.5	0.3	1.9
2	1	4+2+1	8	2.2	0.3	2.5
3	2	4+2	8	2.9	0.2	3.0
4	4	4	8	3.5	0.4	4.2
5	4+2	2	8	4.7	0.4	5.3
6	4+2+1	1	8	5.4	0.3	5.8
7	8	0	8	6.2	0.3	6.4

Table 1

Treatment	Discharge		Total	Concentration Measured	
	N lh^{-1}	K lh^{-1}	lh^{-1}	N mgl^{-1}	K mgl^{-1}
1	0	4+1	5.0	0.0	556
2	1	4	5.0	155	445
3	2	1+2	5.0	310	334
4	2+1	2	5.0	466	222
5	4	1	5.0	621	111
6	4+1	0	5.0	777	0.0

Table 2

Treat	Yield		Headlets		Relative yield
	$g.m^{-2}$	SD	$Number.m^{-2}$	weight.g	%
1	1530	738	8.7	176	100.00
2	1070	384	12.2	88	69.93
3	987	213	11.3	87	64.51
4	941	387	10.7	88	61.50
5	983	210	10.5	94	64.25
6	607	227	8.7	70	39.67
7	776	195	8	97	50.72

Table 3

Table 4

Treat.	Average increase in bulbs			
	Diameter (cm)	SD	Weight (gr.)	SD
1	1.3	0.3	8.3	2.1
2	1.6	0.2	10.5	1.1
3	1.6	0.1	9.8	0.9
4	2.1	0.1	13.2	1.7
5	2.1	0.1	14.0	1.9
6	2.0	0.2	14.1	2.7

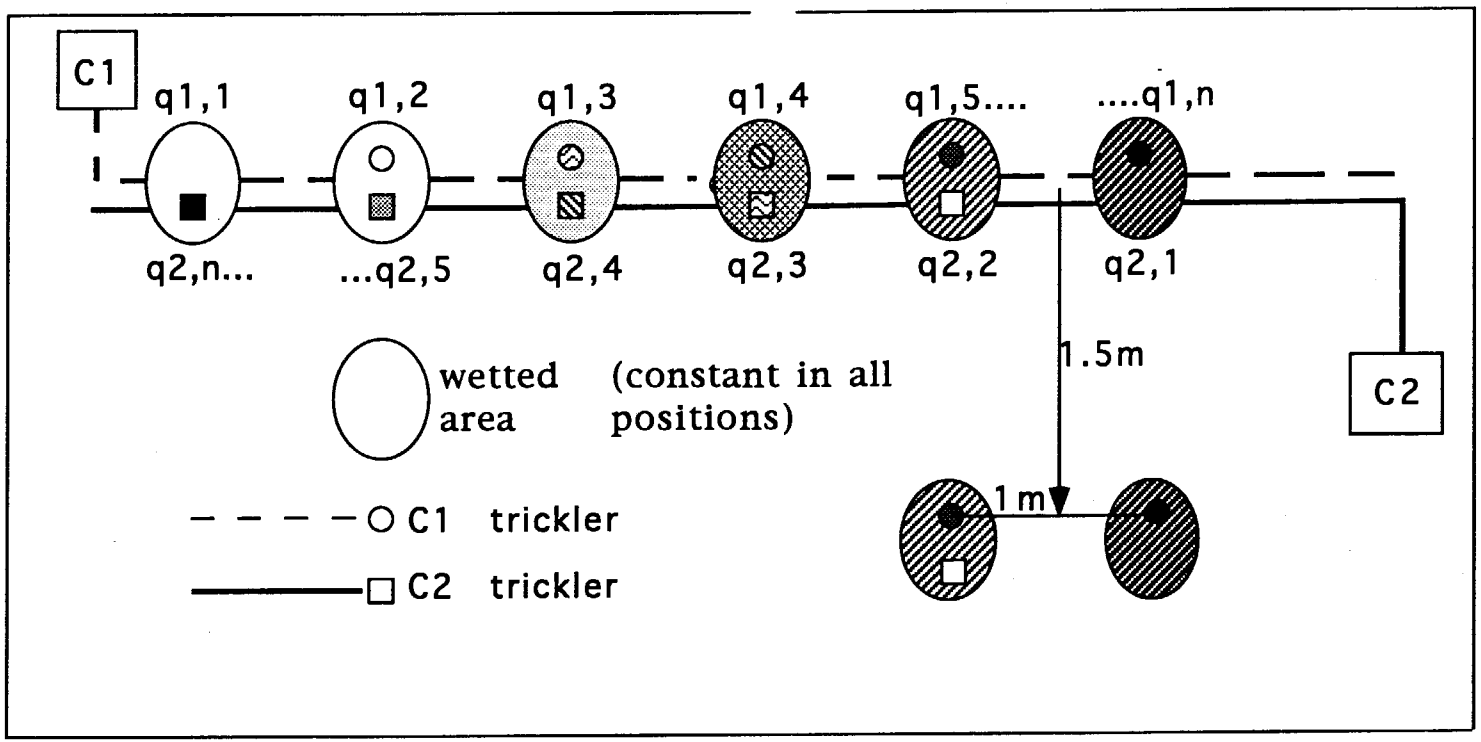
C1
q1,1
q1,2
q1,3
q1,4
q1,5....
....q1,n
q2,n...
...q2,5
q2,4
q2,3
q2,2
q2,1
1.5m
C2
1 m
wetted area
(constant in all positions)
C1 trickler
C2 trickler

Fig 1

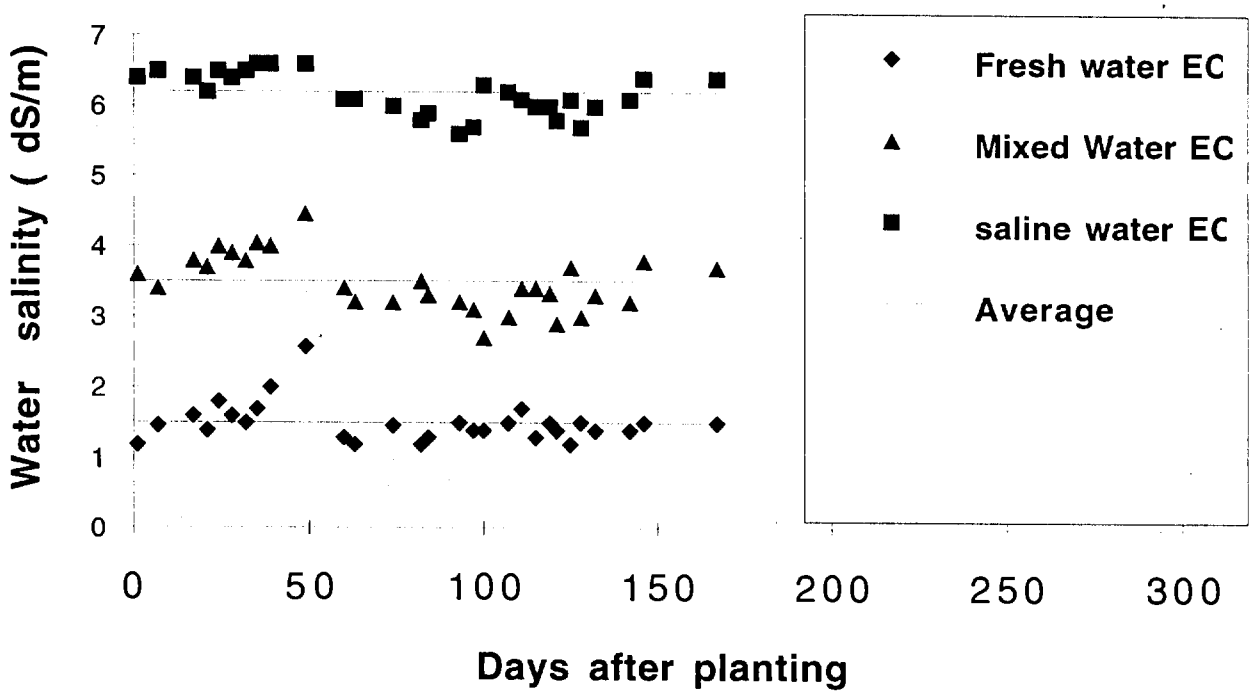
Water salinity (dS/m)
7
6
5
4
3
2
1
0
0
50
100
150
200
250
300
Days after planting
Fresh water EC
Mixed Water EC
saline water EC
Average

Fig 2

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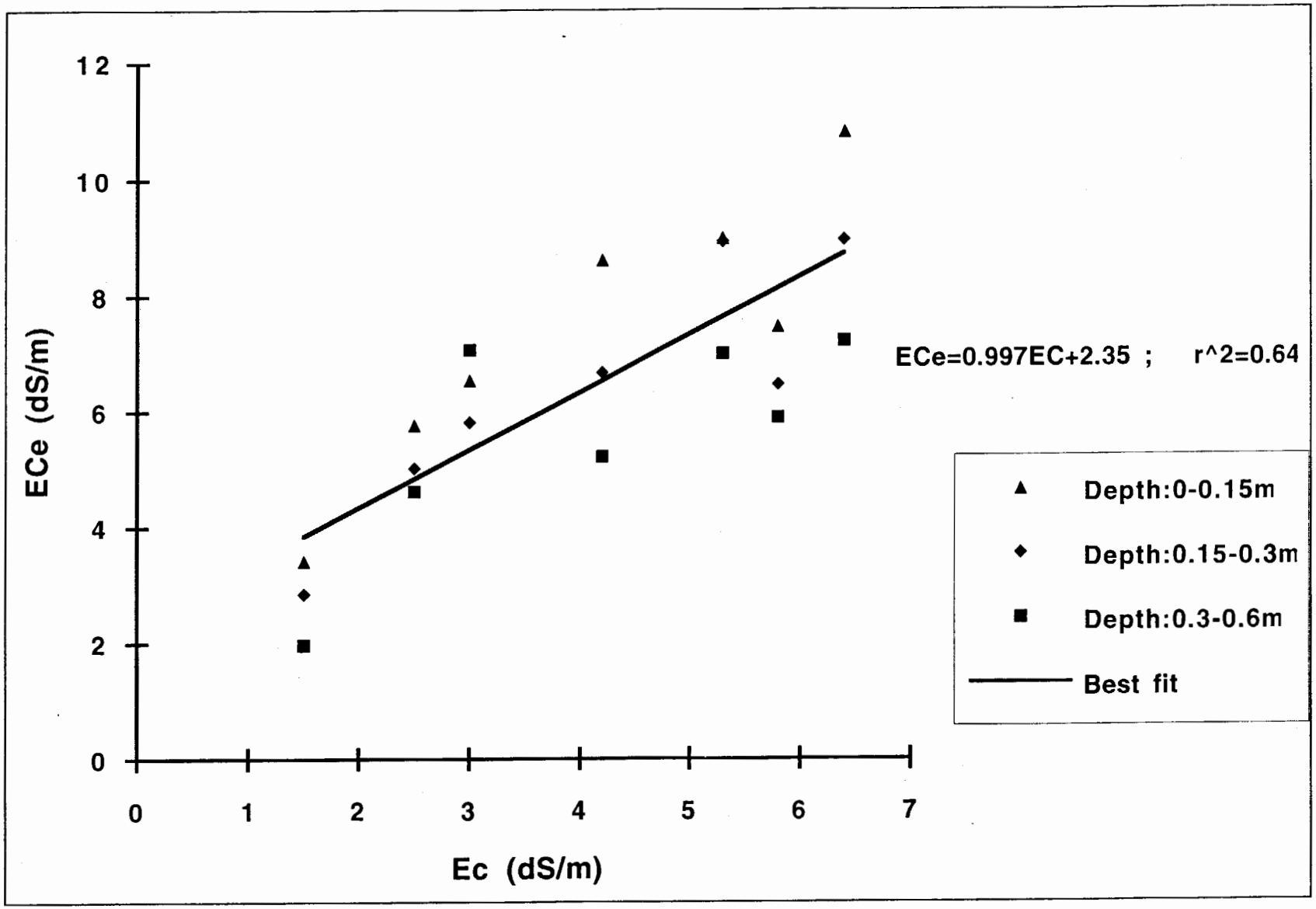
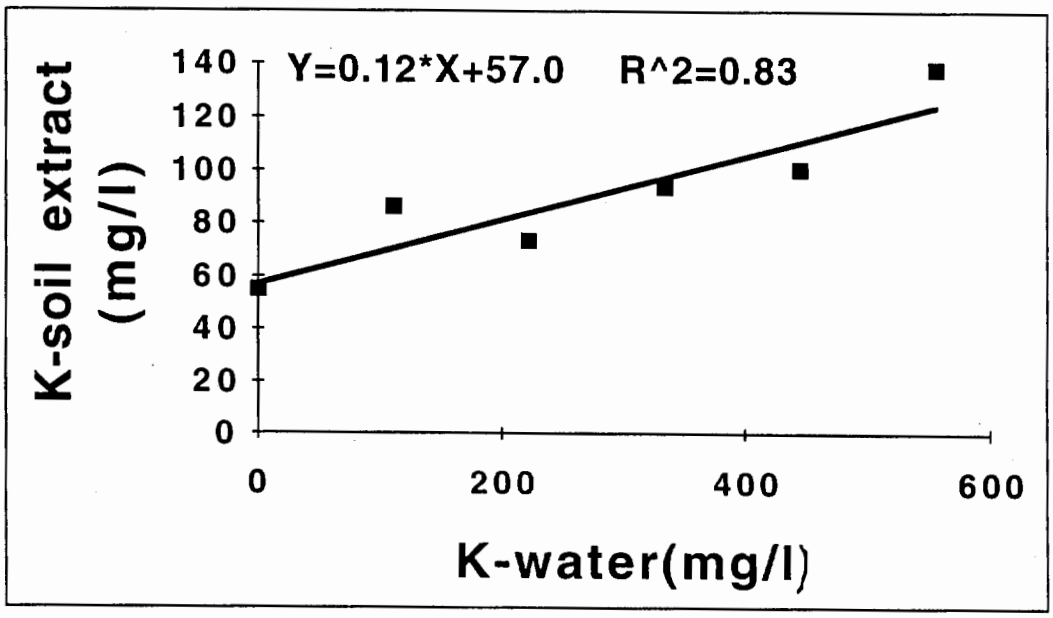
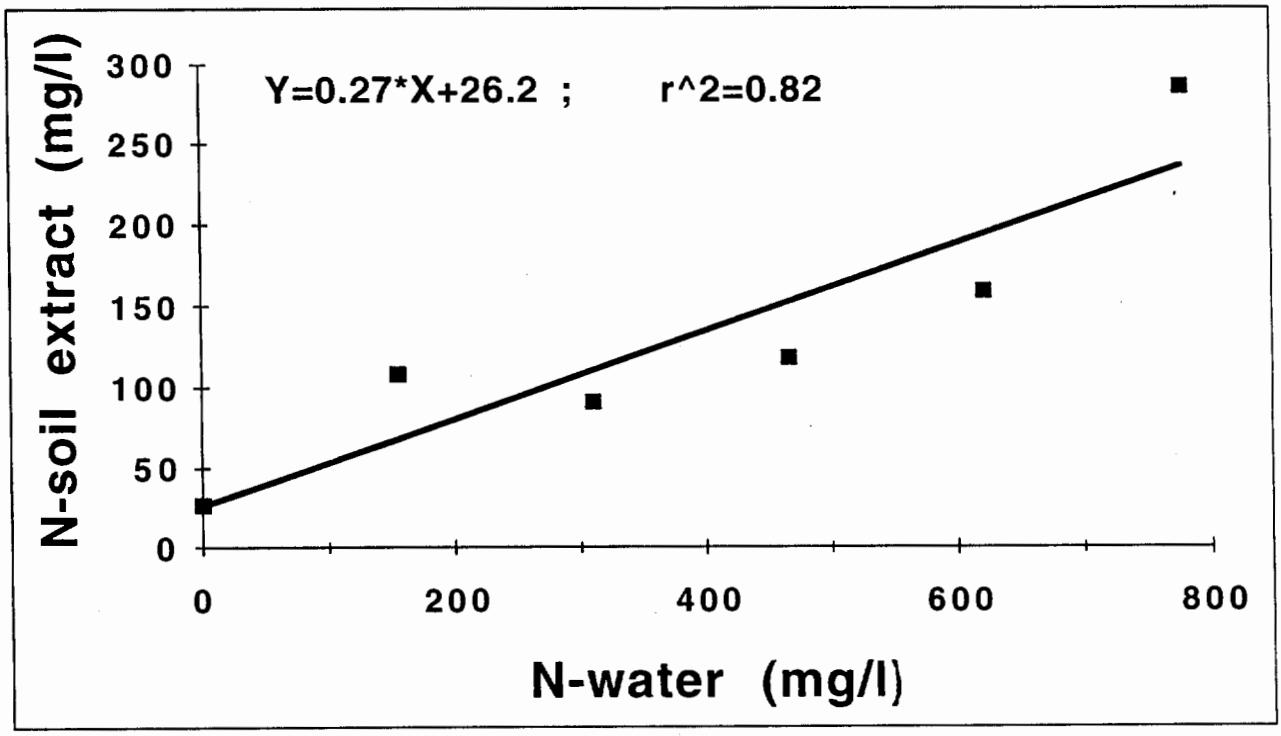

12
10
8
6
4
2
0
ECe (dS/m)
0
1
2
3
4
5
6
7
Ec (dS/m)
ECe=0.997EC+2.35 ; r^2=0.64
Depth:0-0.15m
Depth:0.15-0.3m
Depth:0.3-0.6m
Best fit

Fig 3


Y=0.12*X+57.0 R^2=0.83
K-soil extract (mg/l)
140
120
100
80
60
40
20
0
0
200
400
600
K-water(mg/l)

20


Y=0.27*X+26.2 ; r^2=0.82
N-soil extract (mg/l)
300
250
200
150
100
50
0
0
200
400
600
800
N-water (mg/l)

tg 5

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Ben-Gurion University of the Negev
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Ion Uptake by Peanut Gynophores Grown in Saline Solution

A project report

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Under the supervision of Prof. S.H. Lips and Dr. M. Silberbush

Introduction

Previous studies on peanut (*Arachis hypogaea* L.) growth under salinity, either in the greenhouse or in the field, resulted in that the vegetative growth in rather salt-tolerant (Silberbush et al. 1985, Silberbush and lips, 1988); The sensitive growth phase is the reproductive one, i.e. the gynophores. The penetration of these organs and the development of the pods in saline soils seems to be the critical stage in peanut cultivation when irrigated with saline water. The aim of is project was to study the uptake of different ions by the gynophores, and the effect of combinations of ion species and concentrations on influx and efflux of ions by the gynophores.

Material and methods

Peanut (*Arachis hypogaea* L. cv.Shulamit) seeds were germinated in moist vermiculite on April 17 1990. The plants were transfered to 20 liters hydroponic containers on April 29 1990, 4 plants in each container. Two days later (i.e. May 1 1990) the growth nutrient solutions were added. The basic growth solution contained 1.2 mM NaH_2PO_4, 2 mM$(NH_4)_2SO_4$, 1 mM $Ca(NO_3)_2$, 1.5mM $MgSO_4$, 1.8 mM K_2SO_4, 1.1 mM Fe-EDDHA and micronutrients according to Hoagland and Arnon (1950).

Three salinity treatments were applied: 0, 40 and 80 mM NaCl, in 7 replications (7 containers). The tap-roots of the seedlings were trimmed prior to the transfer, leaving 6 cm, to avoid elongation of the tap root and to stimulate growth of the secondary roots. Sodium chloride was added to the different salinity treatments in two steps to avoid a shock to the young seedlings. The nutrient solutions were changed every week. Water was added every day, to replace the evaporated water.

Uptake by gynophores:

Gynophores were inserted into vials with 16 ml solution, covered with parafilm, so that 3-5 cm were within the solution, one gynophore in each vial. Eight different solution compositions were tested:

1. Control (deionized water)
2. 50 mM KNO_3
3. 25 mM $Ca(NO_3)_2$
4. 25 mM $Ca(NO_3)_2$ + 100 mM KCl
5. 100 mM NaCl
6. 50 mM KNO_3 + 100 mM NaCl
7. 25 mM $Ca(NO_3)_2$ + 100 mM NaCl
8. 50 mM KNO_3 + 25 mM $CaSO_4$ + 100 mM NaCl

The control treatment were tested on July 24 to August 26 1990;
The 40 mM NaCl: August 6-27 1990.

Plants grown in the 80 mM NaCl treatments did not develop any gynophores.

The gynophores were selected randomly, and were exposed to the different treatment solution for 0, 0.5, 1, 3 ,5, 8 and 24 hours.

Plants grown in the control treatment produced more gynophores than in the other treatments, so uptake was measured in this treatment also along 3,5 and 8 hours during night time.

The plants were harvested on August 28 1990 (126 days after germination). The different parts were separated, dried at 65°C for 4 days and weighed for their dry weight. Plant parts were ground, combusted in H_2SO_4+H_2O_2 and analyzed for PO_4-P (Murphy and Riley 1962), NH_4-N (Nessler reagent), Ca and Mg (atomic absorption spectroscopy). Leaf area was measured on fresh leaves with leaf area meter. Root length was measured by the line-intersect method (Tennant 1975).

-The solutions of the uptake test by the gynophores were stored in a refrigerator and analyzed for sodium concentration by flame-photometer, and for potassium by atomic absorption spectroscopy (flame-emission). Nitrate was analyzed by the NAS reagent and the absorbance was read at 570 nm with spectrophotometer.

Results and Discussion

Figs. 1 and 2 present dry weight of plant's parts grown in 0, 40 and 80 mM NaCl. Fig. 3 presents leaf area and root length of these plants. Plant dry weight, shoot dry matter, leaf area and root length decreased by increasing NaCl concentration in the growth nutrient solution.

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The results presented in Table 1 are mineral concentrations in each part. Nitrogen decreased in shoots, leaves, roots and gynophores of peanut plants by increasing NaCl concentration in the growth nutrient solution. Both N and P decreased in gynophores which were grown in 40 mM NaCl compared to the control. Magnesium in roots grown in 40 and 80 mM NaCl was half of the control. Accumulation of Na in plant tissues was associated with a decrease in uptake of nutrients from the solution by the plants.

Fig. (4a) and (4b) present the change in the amount of K in the solution (16 ml) around the gynophore as affected by different ions, in peanut plants grown either in 0 or 40 mM NaCl, respectively. K was released by the gynophore during day time, but was re-absorbed during night time when it was accompanied by NO_3^-, but not with other anions. The rate of release of K from the gynophore to deionized water was greater in plants grown in 0 NaCl compared to 40 mM NaCl.

As presented in Fig. (5b), Na ions were excluded by peanut gynophores which grew in 40 mM NaCl. In plants grown with 40 mM NaCl, Na ions' release from the gynophores was increased during day time, but not during night time. In the control treatment (Fig. (5a), Na was absorbed from the solution by the gynophores during day time, but was released again during night time.

Fig. 6 shows NO_3^- uptake by the gynophores during day and night time, when supplies as KNO_3. In all the other combinations, NO_3^- was released during day time, but re-absorbed during night time. There is a general agreement between K uptake and NO_3^- uptake during day and night, but not in all cases. It also agrees with findings by others of K and NO_3^- uptake by roots during illumination and photosynthetic activity, but efflux of these ions in darkness.

In Fig. (6b), NO_3^- was absorbed faster from the solution contained KNO_3+$CaSO_4$+NaCl than in the control treatment. In Fig. (6a) NO_3^- was absorbed in $Ca(NO_3)_2$+KCl and from the three-salt solution. In KNO_3+NaCl, NO_3^- was released from the plant. NO_3^- and K ions showed a similar pattern of release ions during day time and absorption during night time, which indicates the linkage between their mutual uptakes, which are affected by the photosynthetic activity.

References

Hoagland, D.R. and D.I. Arnon.1950. The Water Culture Method for Growing plants without Soil. Univ. California Berkeley, Circ. 347.

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Murphy, J. and J.P. Riley. 1962. A modified single solution method for the determination of P in natural waters. Anal. Chim. Acta 27:31-36.

NAS (Szechrom-NAS reagent, R&D Authority, Ben-Gurion University of the Negev, Beer Sheva, Israel).

Silberbush, M., J. Ben-Asher, U. Kafkafi and S.H. Lips. 1985. Fertigation of peanuts grown in sandy dunes and irrigated by trickling with saline water. Drip/Trickle Irrigation in Action. Proc. 3rd Intl. Drip/Trickle Irrig.. Congr. ASAE, Vol. 2, P. 652-658. Fresno, California.

Silberbush, M. and S.H. Lips. 1988. Nitrogen concentration, ammonium/nitrate ratio, and NaCl interaction in peanut vegetative and reproductive growth. Physiol. Plant. 74:493-498.

Tennant, D.1975. A test of a modified line intersect method of estimating root length. J. Ecol. 63:995-1001.

Table1: Mineral contents in different parts of peanut plants

NITROGEN

mM NaCl	mmol N/kg DW							
	Stem	SD	Leaf	SD	Root	SD	Gynophore	SD
0	3.73	0.72	7.36	1.11	4.57	0.69	2.83	1.01
40	3.57	0.58	6.51	0.42	4.51	0.45	2.22	0.05
80	3.41	0.69	6.3	1.05	3.85	0.42		

PHOSPHORUS

mM NaCl	mmol P/kg DW							
	Stem	SD	Leaf	SD	Root	SD	Gynophore	SD
0	106.52	10.5	204.52	14.5	1635.4	169	146.96	9.83
40	129.99	2.57	198.57	30.2	795.06	98.4	111.19	26.2
80	118.49	17.9	139.33	38.7	920.51	28.9		

CALCIUM

mM NaCl	mmol Ca/kg DW							
	Stem	SD	Leaf	SD	Root	SD	Gynophore	SD
0	181.81	19.5	447.94	39.7	1655.21	252		
40	167.04	8.8	353.88	15.7	775.33	156		
80	180.17	24.4	320.94	29.7	759.03	14.9		

MANGNISIUM

mM NaCl	mmol Mg/kg DW							
	Stem	SD	Leaf	SD	Root	SD	Gynophore	SD
0	155.29	12.1	316.27	20.4	287.42	31.4		
40	115.65	10.8	308.66	10.7	145.97	15.6		
80	121.37	6.74	277.42	14.7	116.27	7.1		

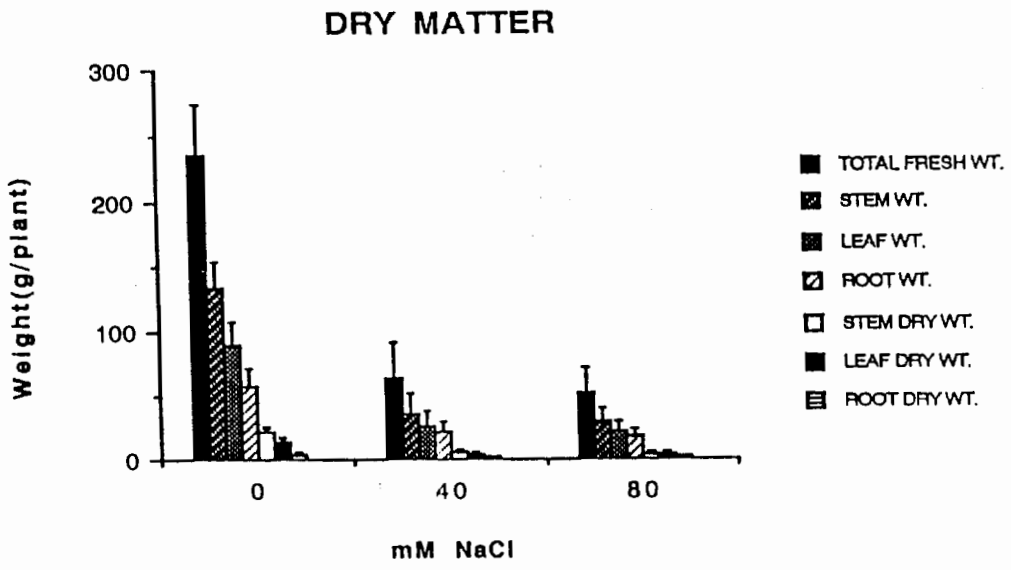


Fig.1: Dry matter in different parts of peanut plants grow in three NaCl concentrations.

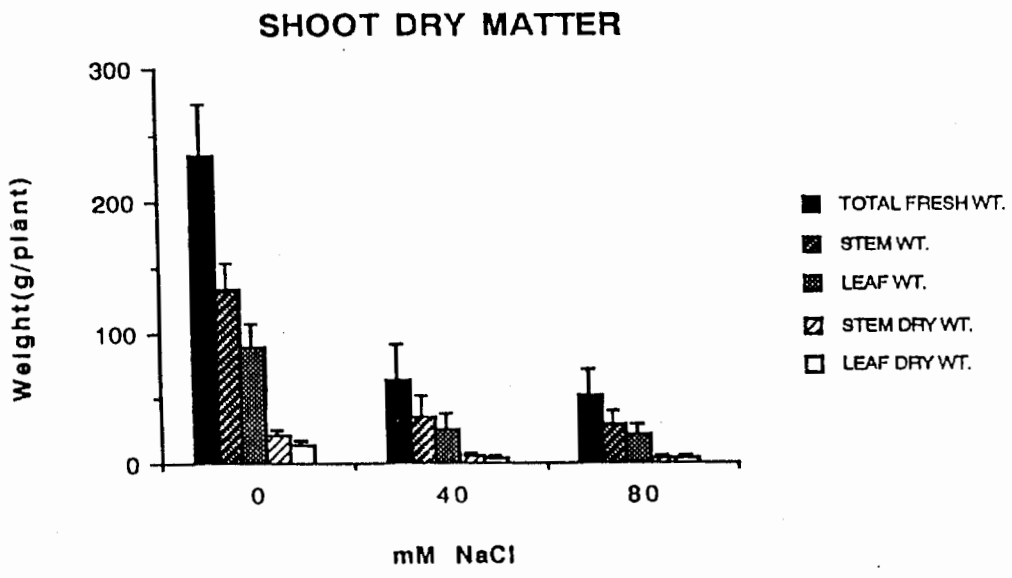


Fig.2: Dry matter in shoot of peanut plants grow in three NaCl concentrations.

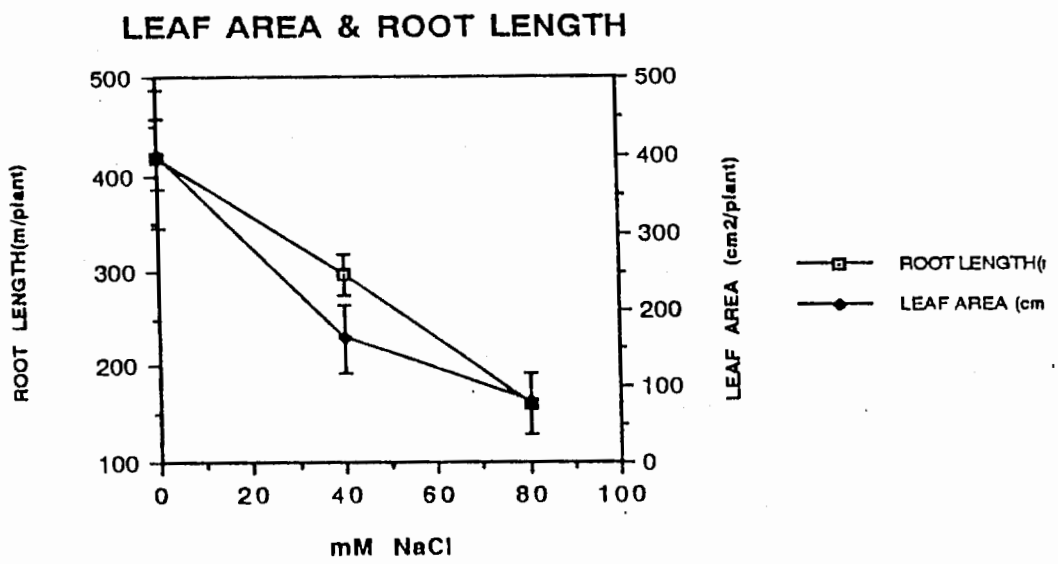


Fig.3: Leaf area and Root length of peanut plants grow in three NaCl concentrations.

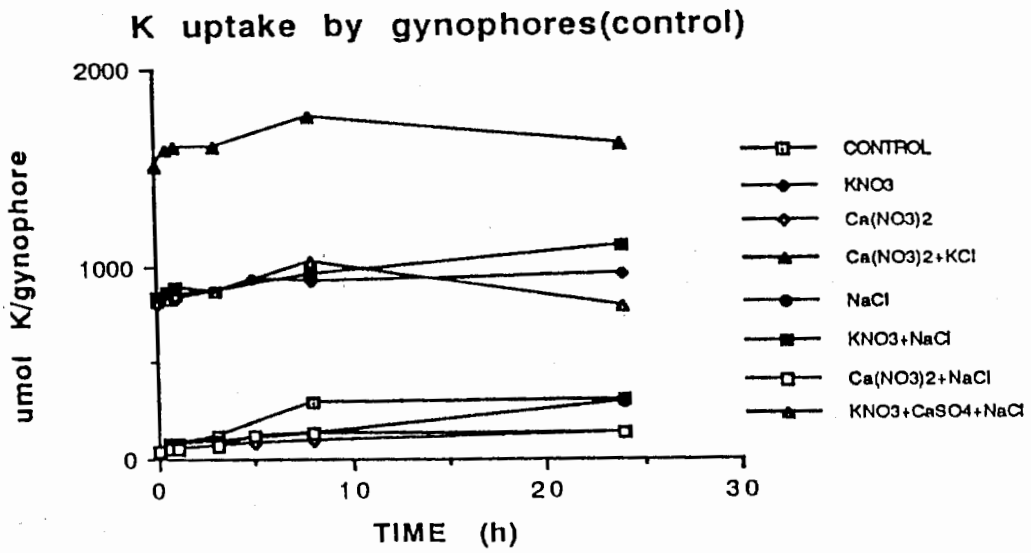
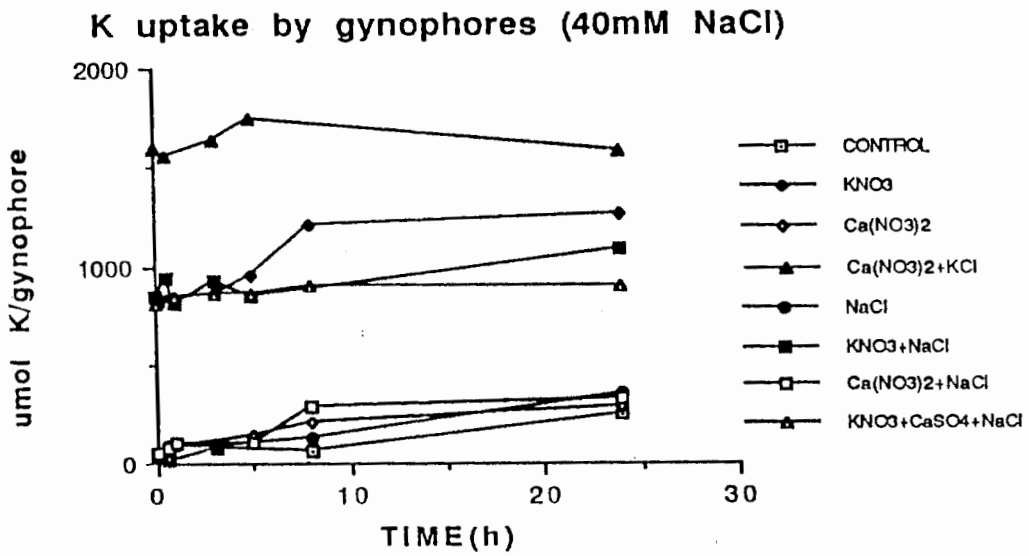


Fig.4: K change with time around gynophore of peanut plants grow in nutrient solutions with (a) 0 mMNaCl (b) 40 mMNaCl, as affected by different ions in the solution.



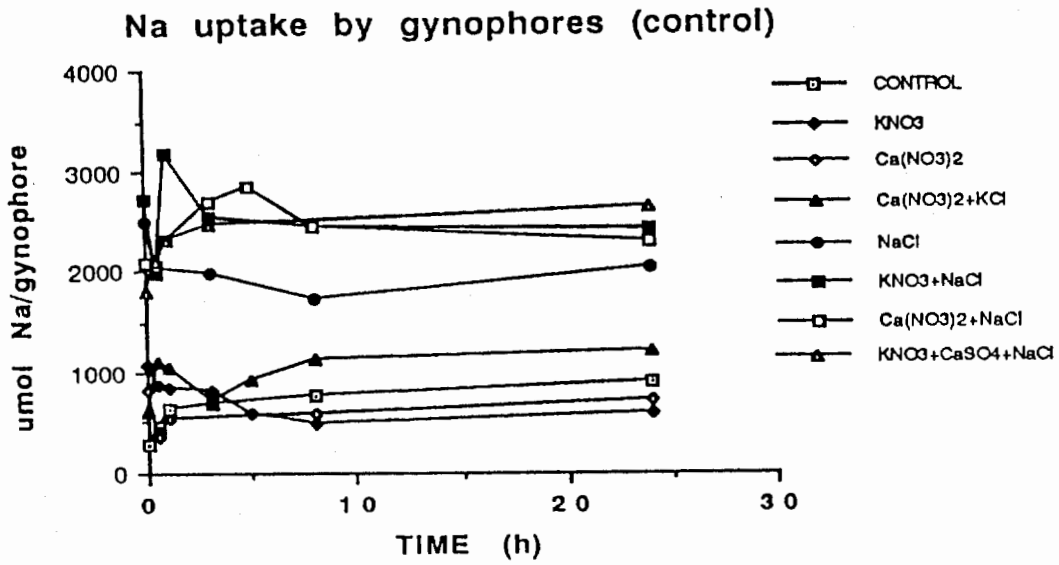
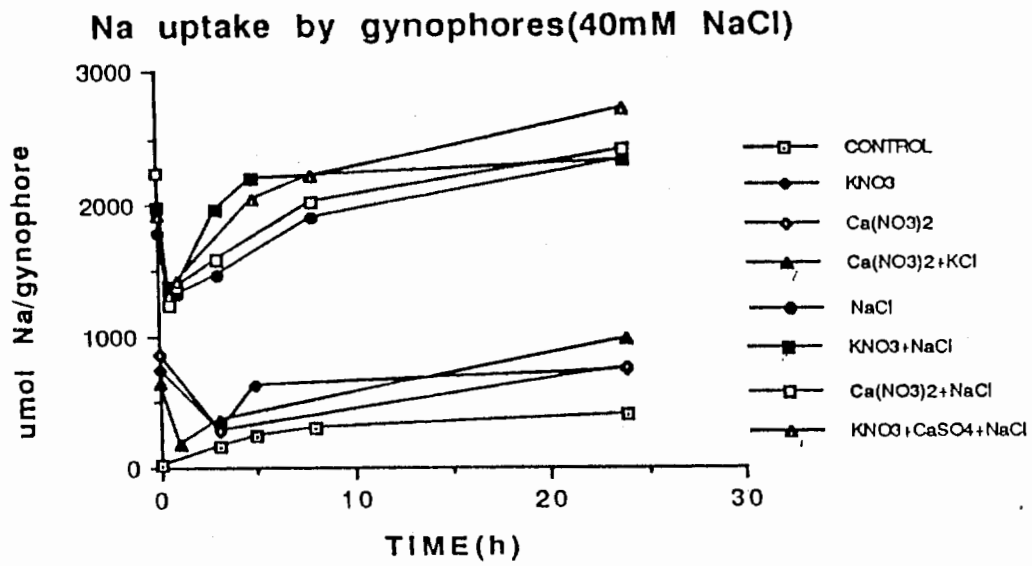


Fig.5: Na change with time around gynophore of peanut plants grow in nutrient solutions with (a) 0 mMNaCl (b) 40 mMNaCl, as affected by different ions in the solution.



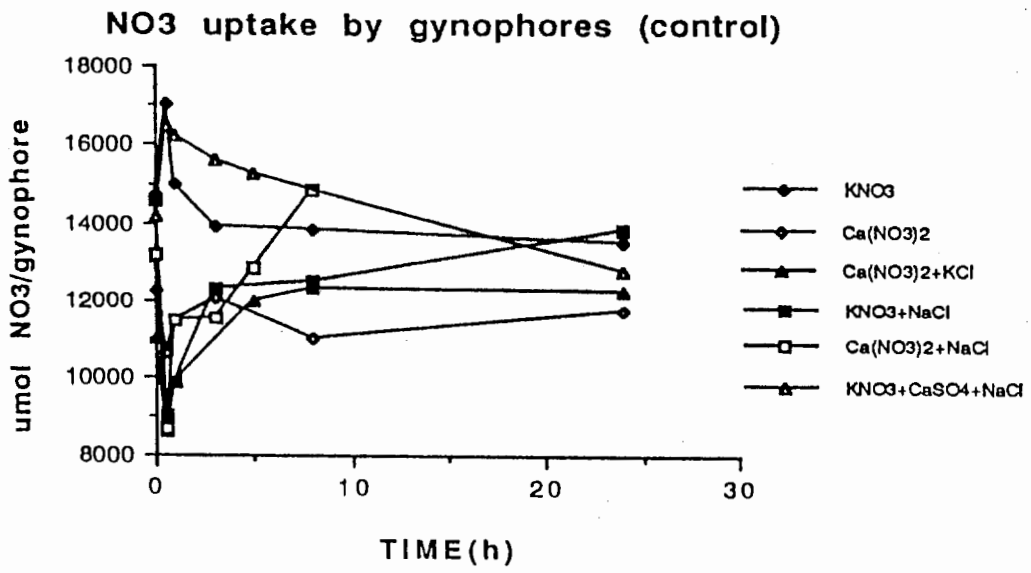
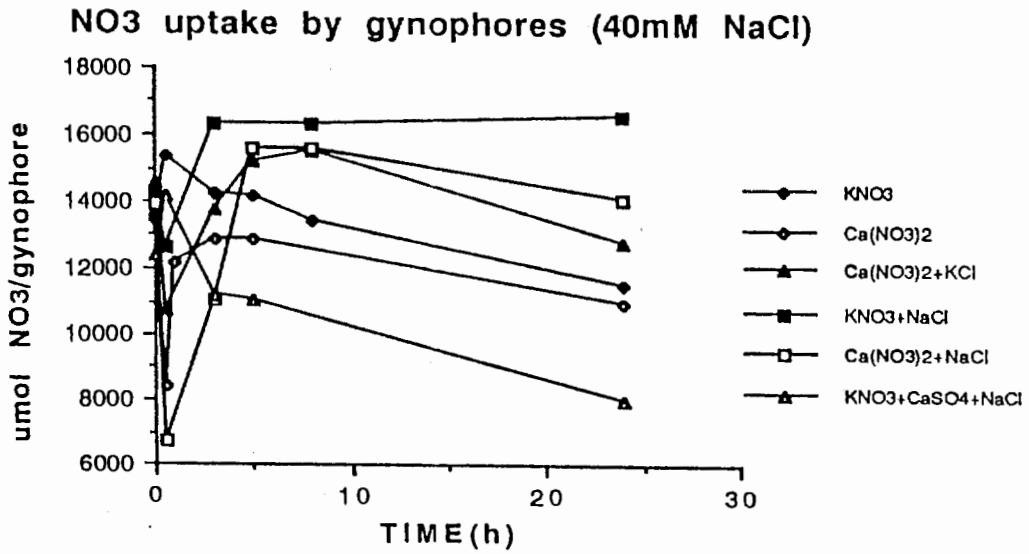


Fig.6: NO_3 change with time around gynophore of peanut plants grow in nutrient solutions with (a) 0 mMNaCl (b) 40 mMNaCl, as affected by different ions in the solution.



SECTION 5

The Effect of Prolonged Irrigation with Saline Water on the Soil of the Pear Orchard – *R.A.N.D.A.C By Raia Vulkan and Chaim Fraenkel*

5.0 INTRODUCTION

The effect of prolonged irrigation with saline irrigation on the soil is of paramount importance for the longevity of the orchard and cannot be underestimated. Even if leaching was assured and a regular and continuous monitoring of the soil was carried out it was important to know the configuration of the salinity in the different profiles of the soil. To this purpose it was necessary to follow the salinity deeper than the roots layer.

5.2 Methods

A deeper soil borer capable of drilling down up to 6 m. down, mounted on a small lorry, was brought into the orchard. The drillings were performed in the fresh (EC = 1.2 dS/m.) and in the brackish (EC = 4.2 dS/m.) irrigated plots at different distances (70, 130, 250 cm.) from the water emitters and at 14 different soil depths: 30, 60, 90, 120, 150, 180, 230, 280, 330, 380, 430, 480, 530, 580 cm.

The parameters measured were: moisture, saturation percentage, ion components of the soil solution and total salinity. The salinity and the ion composition were measured from the saturated soil paste extract. As a control, the same parameters were also measured from a non-irrigated soil.

5.3. Results

All the results are presented in 19 graphs found in pp. 71 - 79.

The upper layer (1 m.) is sandy loam. Between the first and the second m. the soil starts to be more silty and between 2 and 6 m. the soil turns progressively to clay loam.

The Ca^{++} content in the control is high at the two m. depth showing a derivation from a very calcareous parent material. The highest salinity (20 dS/m.) and the highest SAR value (25) were found in the upper layer of the saline irrigated plots, owing to the high water conductivity of this soil, the capillary rise of the soil solution and the following evaporation from the surface.

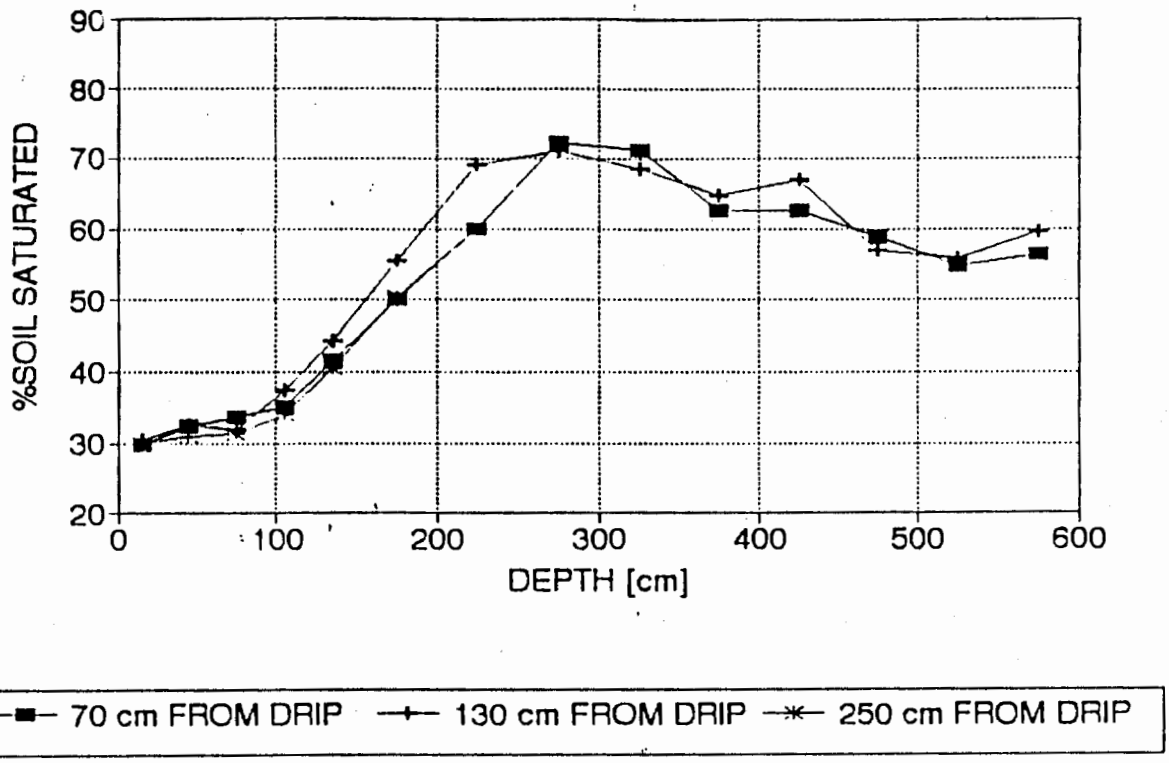
The SAR decreased considerably under the 3 m. layer. The salinity gradually decreased from top to bottom, and at 3 m. depth it was equal to the salinity of the non-irrigated plots.

Irrigation with brackish water considerably increased the Ca^{++}, Mg^{++}, and Na^{+} content, especially at the center of the rows, i.e., at an equal distance between the two lateral pipe emitters.

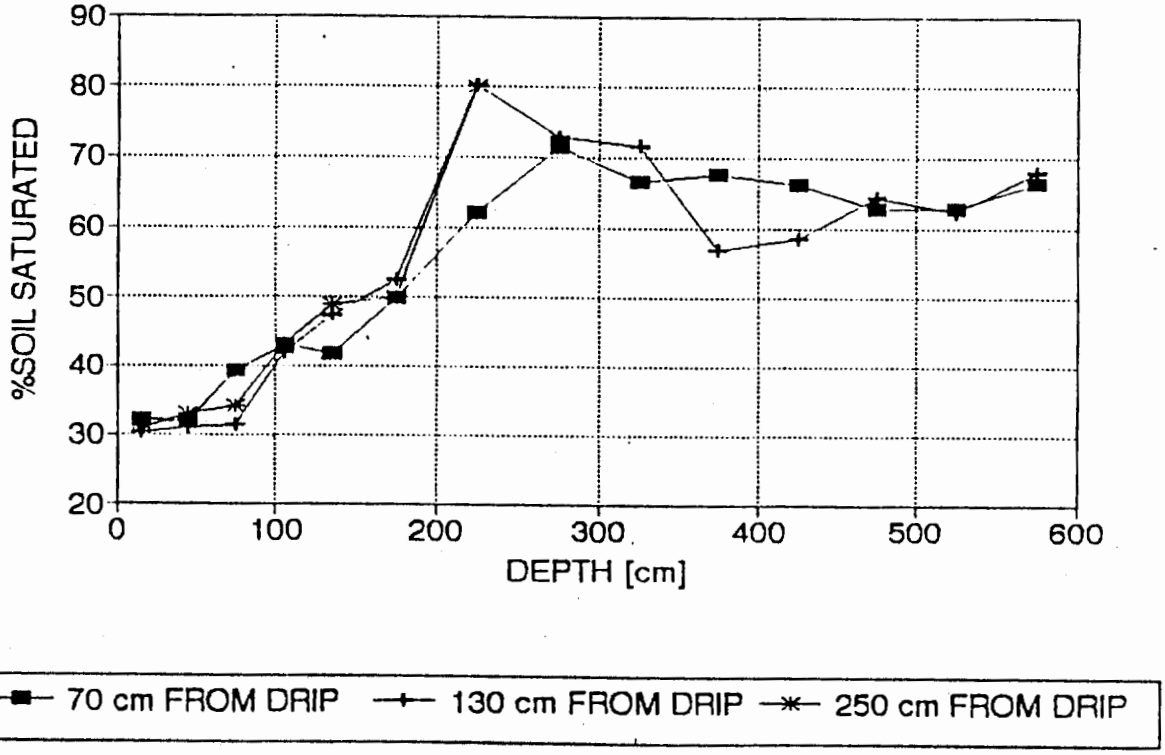
5.4 Conclusion

As a consequence of this work, the soil of the brackish irrigated plots down to 3 m. depth may be considered as a medium saline and alkaline soil.

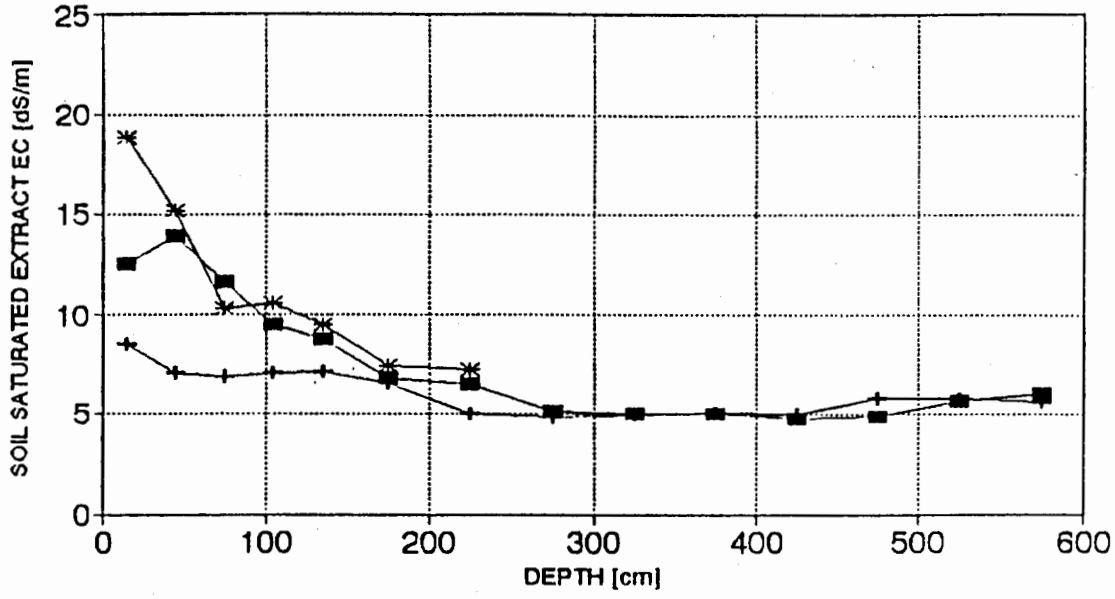
SOIL SATURATION PERCENT SALINE
VS. SOIL DEPTH AND DIS. FROM DRIPPER



SOIL SATURATION PERCENT - UNSALINE
VS. SOIL DEPTH AND DIS. FROM DRIPPER

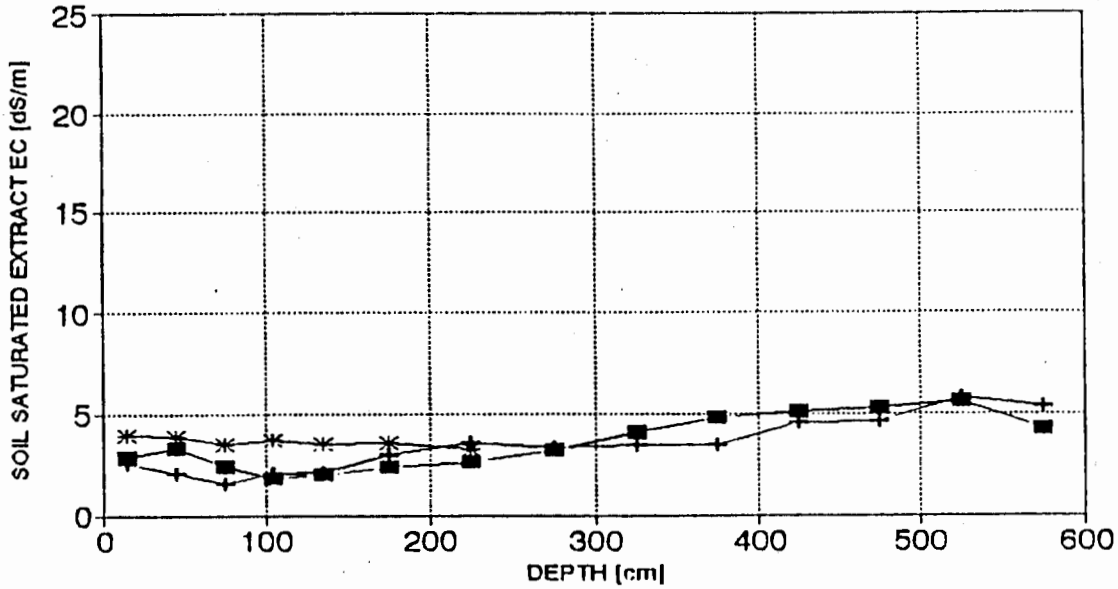


SOIL SATURATED EXTRACT EC - SALINE
VS. SOIL DEPTH AND DIS. FROM DRIPPER



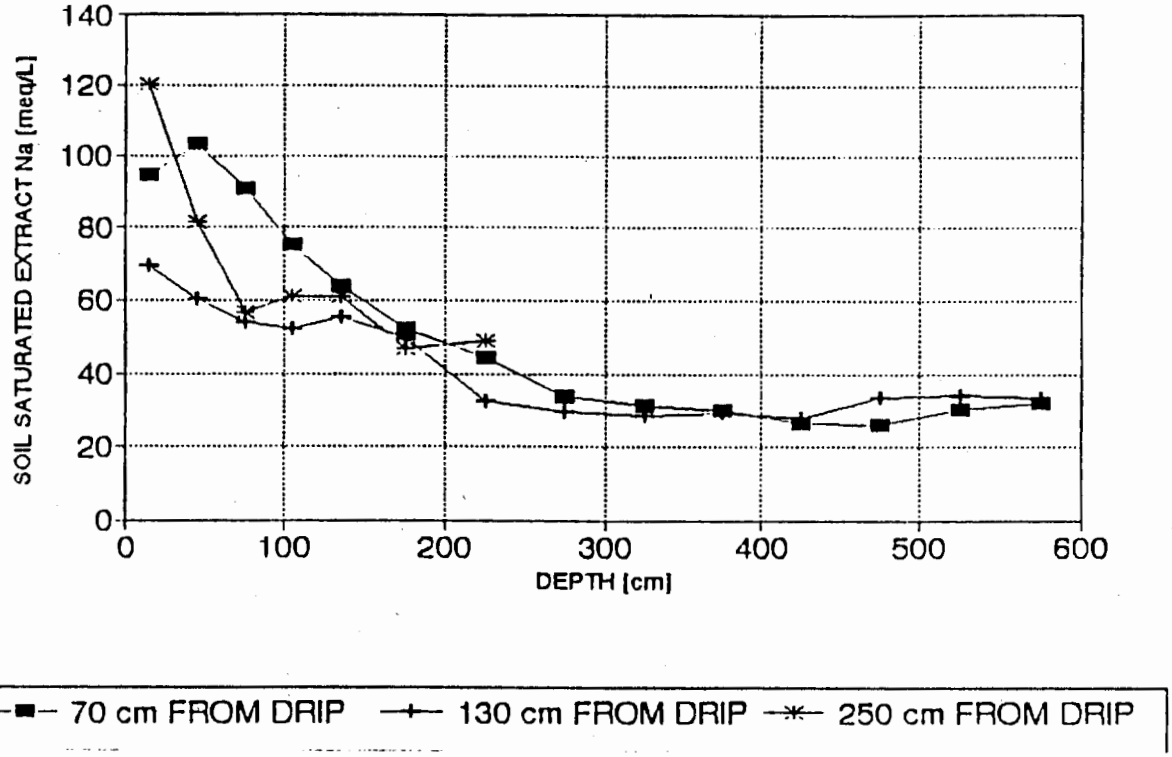
70 cm FROM DRIP — 130 cm FROM DRIP — 250 cm FROM DRIP

SOIL SATURATED EXTRACT EC - UNSALINE
VS. SOIL DEPTH AND DIS. FROM DRIPPER

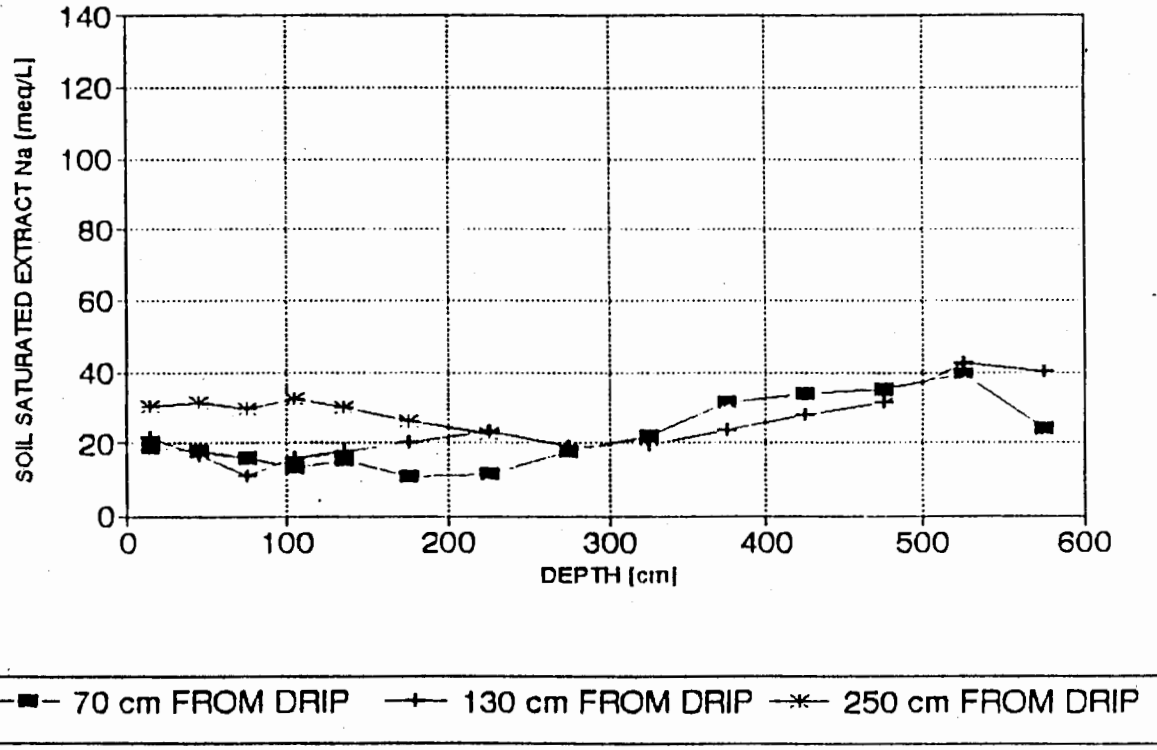


70 cm FROM DRIP — 130 cm FROM DRIP — 250 cm FROM DRIP

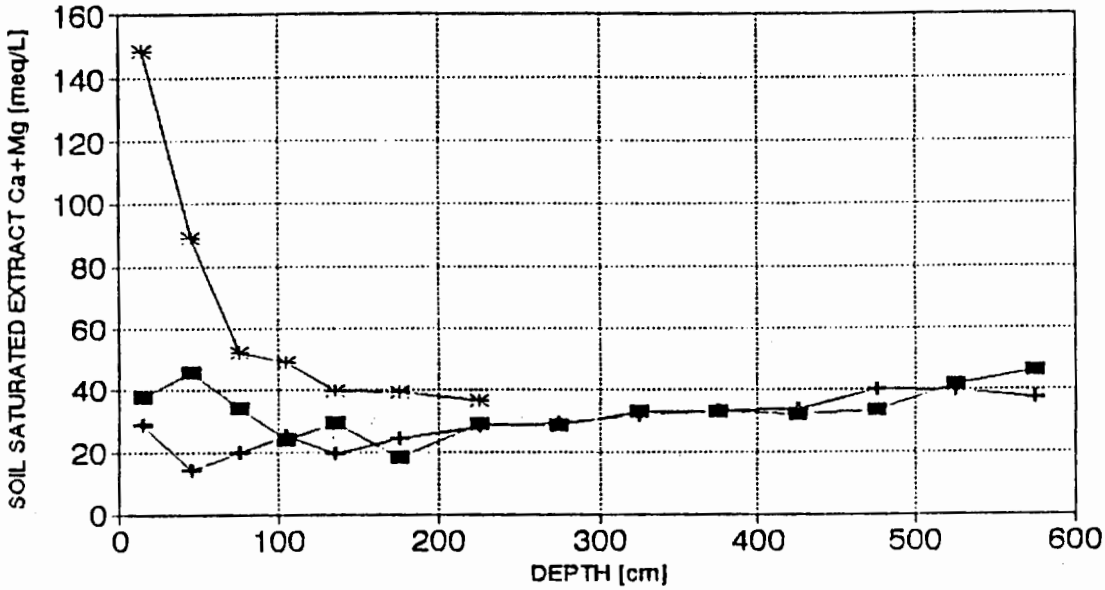
SOIL SATURATED EXTRACT Na - SALINE
VS. SOIL DEPTH AND DIS. FROM DRIPPER



SOIL SATURATED EXTRACT Na - UNSALINE
VS. SOIL DEPTH AND DIS. FROM DRIPPER

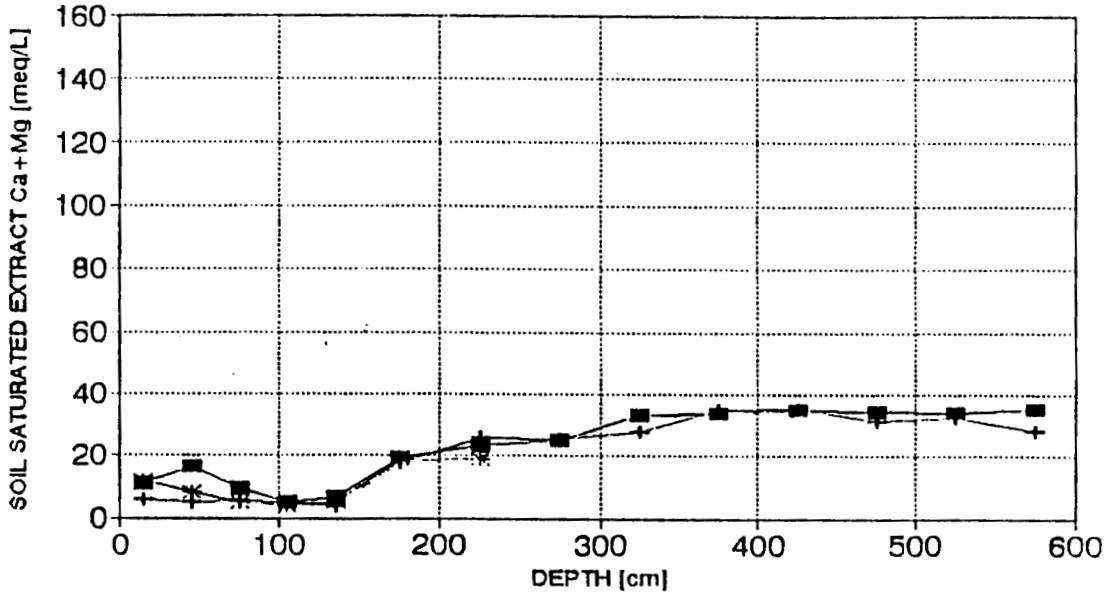


SOIL SATURATED EXTRACT Ca+Mg - SALINE
VS. SOIL DEPTH AND DIS. FROM DRIPPER



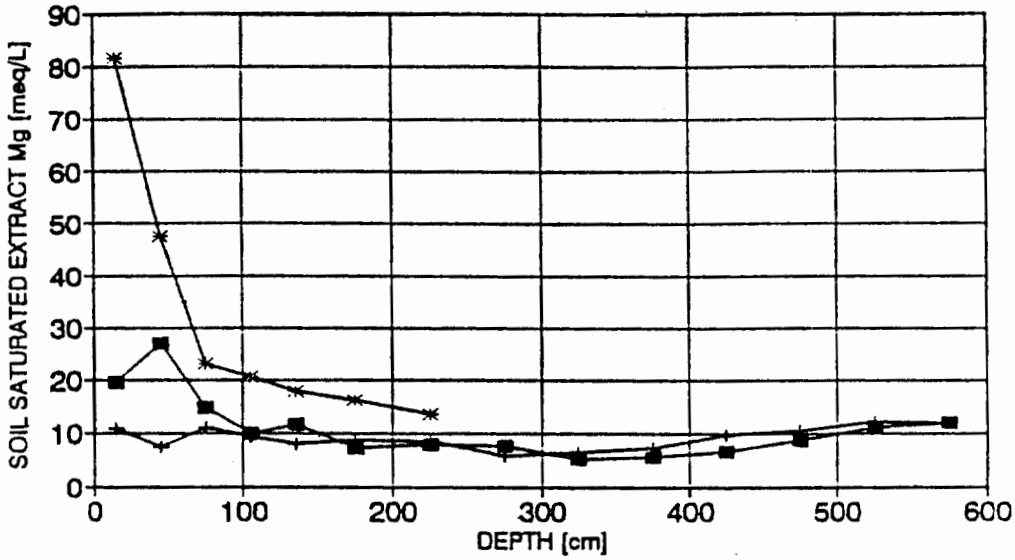
70 cm FROM DRIP — 130 cm FROM DRIP — 250 cm FROM DRIP

SOIL SATURATED EXTRACT Ca+Mg - UNSALINE
VS. SOIL DEPTH AND DIS. FROM DRIPPER



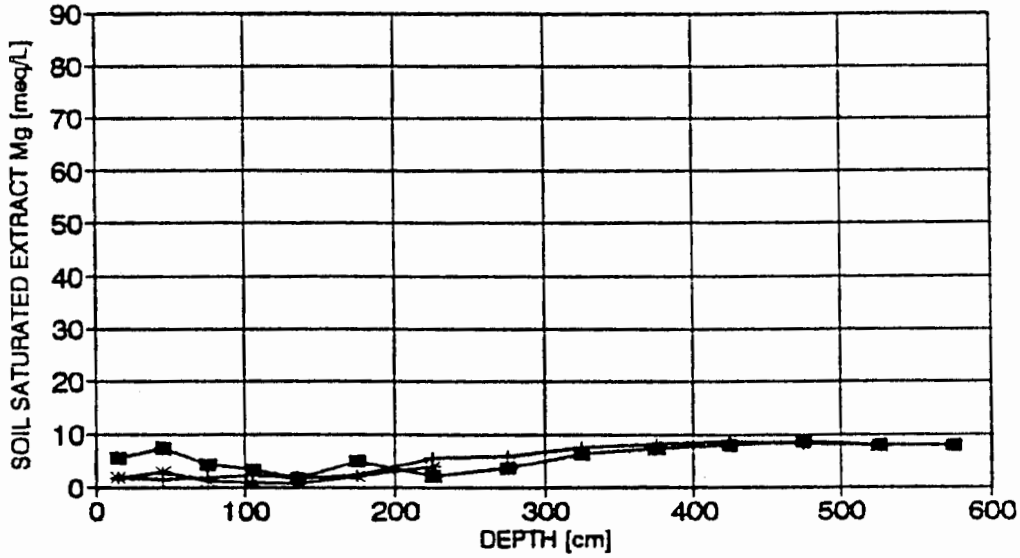
70 cm FROM DRIP — 130 cm FROM DRIP — 250 cm FROM DRIP

SOIL SATURATED EXTRACT Mg - SALINE
VS. SOIL DEPTH AND DIS. FROM DRIPPER



70 cm FROM DRIPP — 130 cm FROM DRIP — 250 cm FROM DRIP

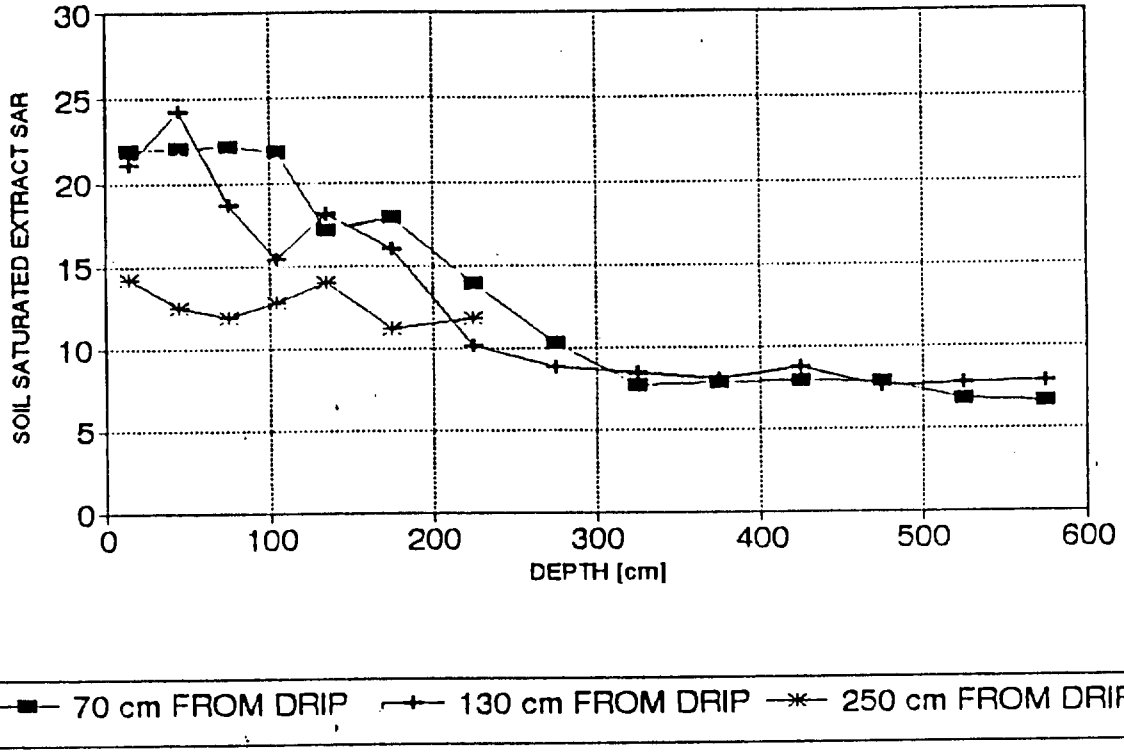
SOIL SATURATED EXTRACT Mg - UNSALINE
VS. SOIL DEPTH AND DIS. FROM DRIPPER



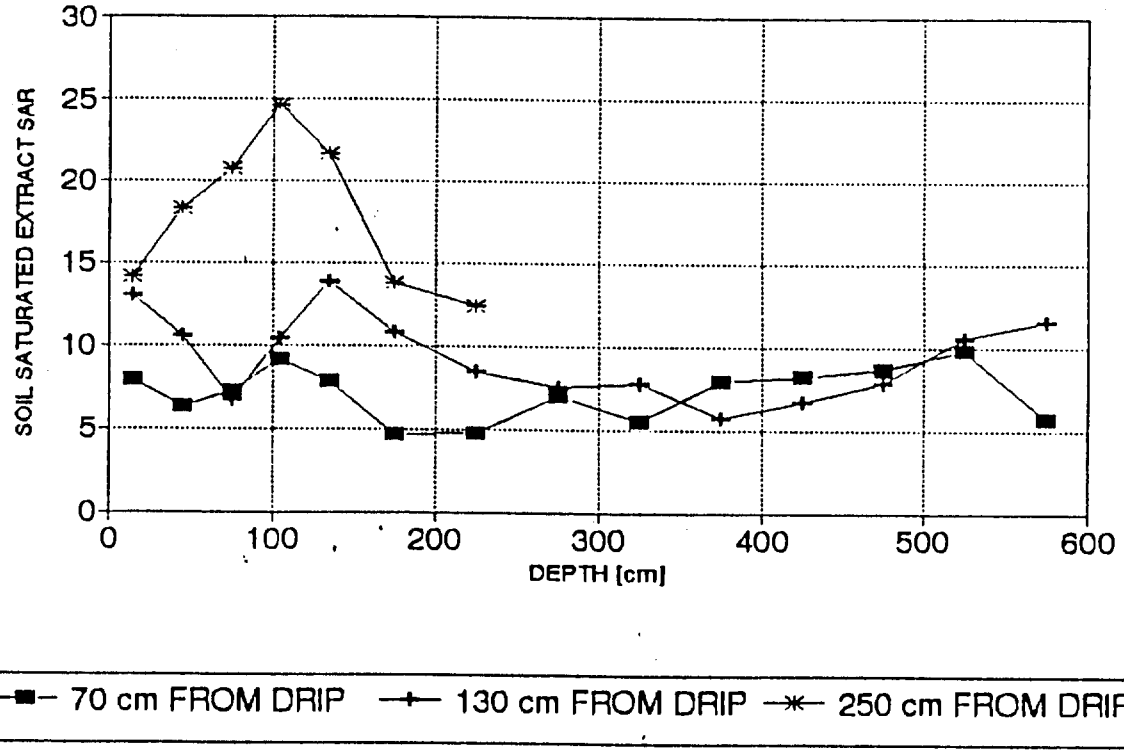
70 cm FROM DRIPPER — 130 cm FROM DRIP — 250 cm FROM DRIP

38

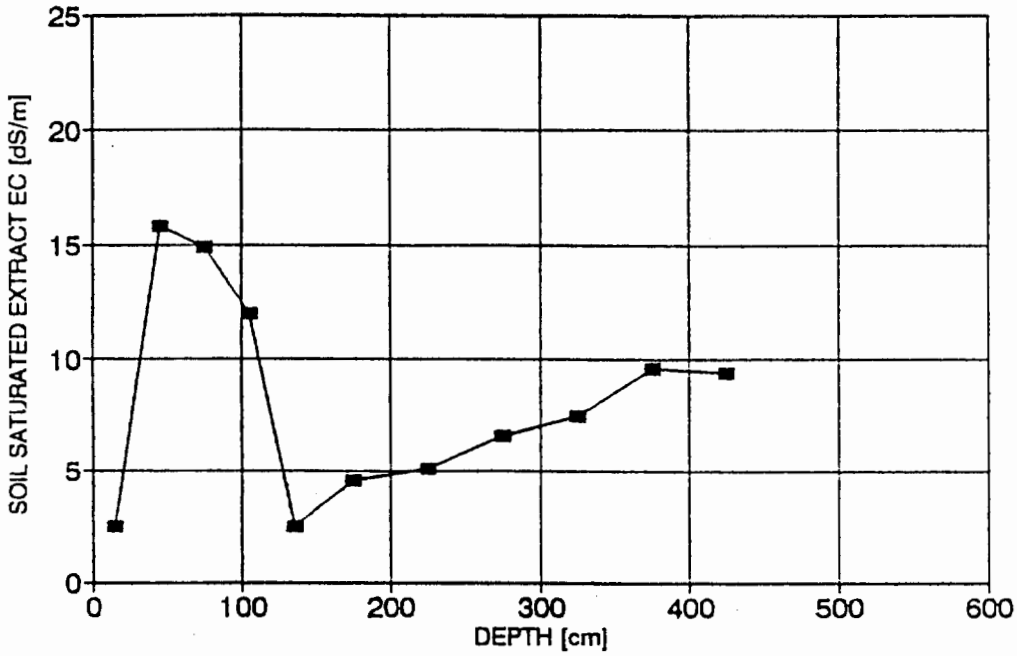
SOIL SATURATED EXTRACT SAR - SALINE
VS. SOIL DEPTH AND DIS. FROM DRIPPER



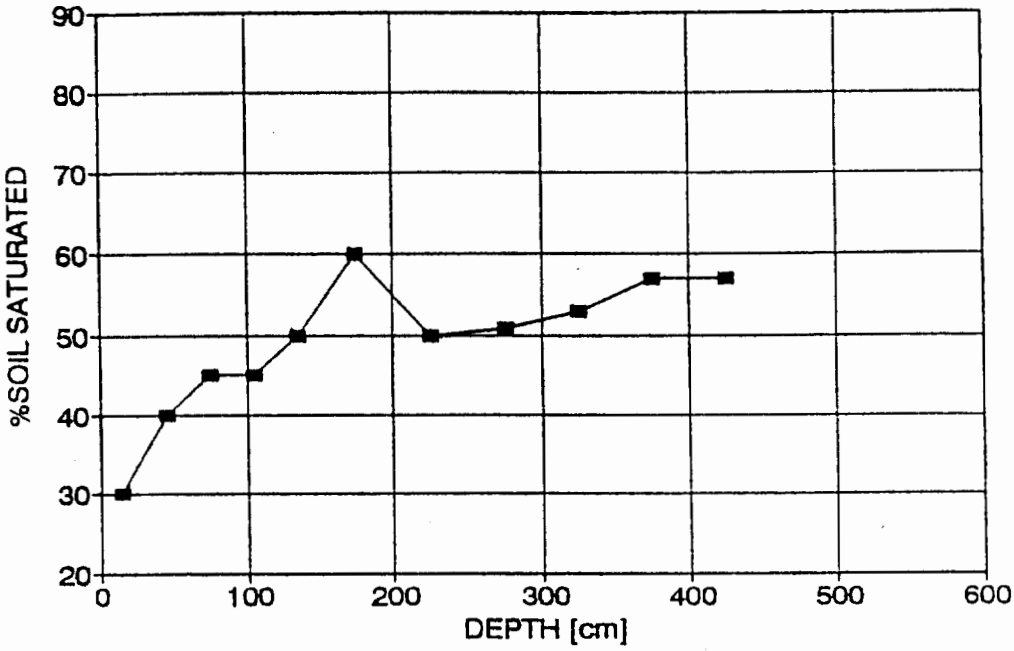
SOIL SATURATED EXTRACT SAR - UNSALINE
VS. SOIL DEPTH AND DIS. FROM DRIPPER

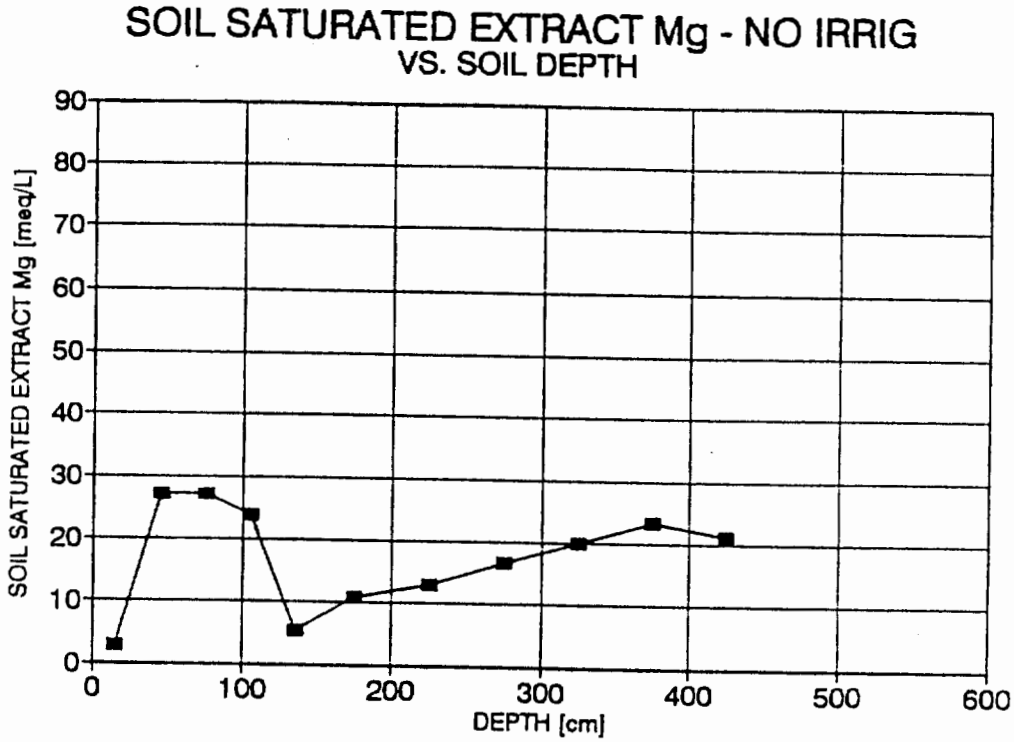


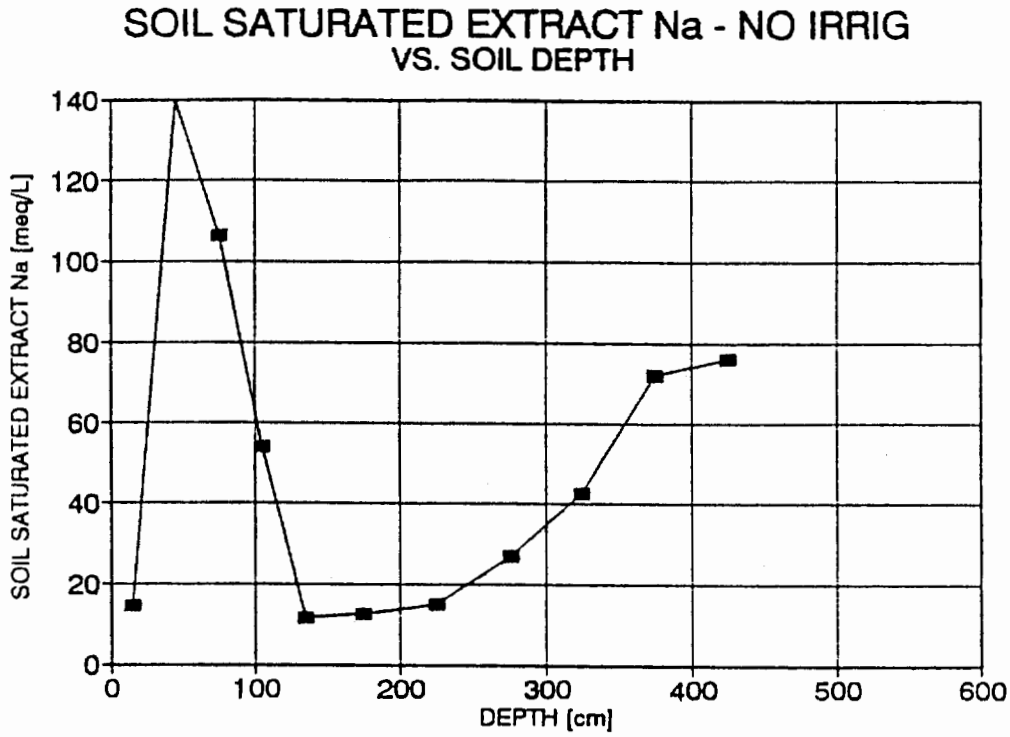
SOIL SATURATED EXTRACT EC - NO IRRIG
VS. SOIL DEPTH



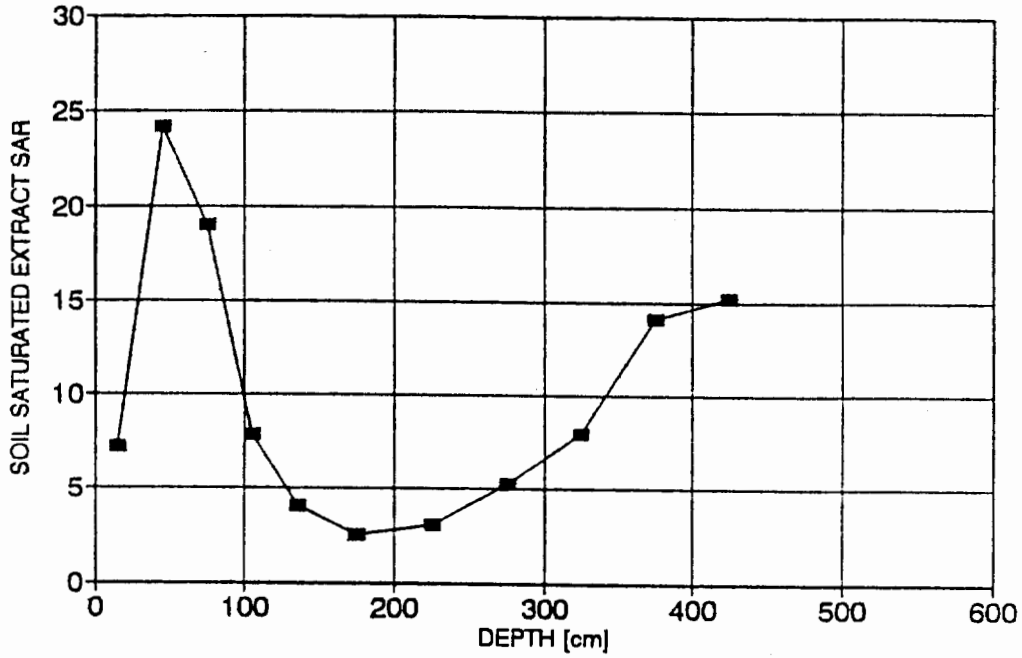
SOIL SATURATION PERCENT NO IRRIG
VS. SOIL DEPTH



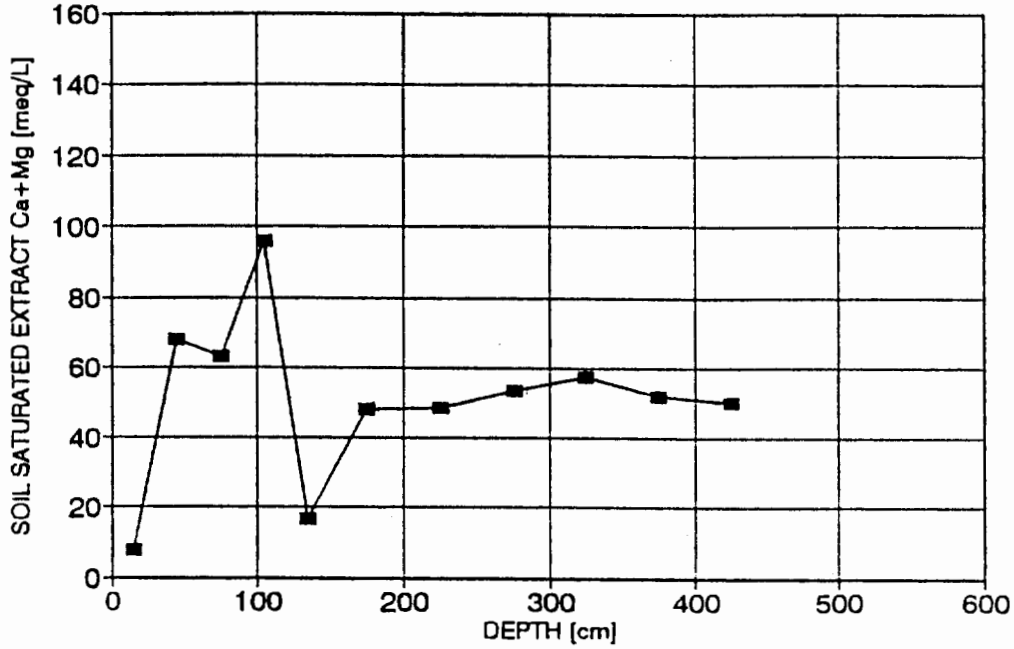

SOIL SATURATED EXTRACT Mg - NO IRRIG
VS. SOIL DEPTH
SOIL SATURATED EXTRACT Mg [meq/L]
DEPTH [cm]
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600


SOIL SATURATED EXTRACT Na - NO IRRIG
VS. SOIL DEPTH
SOIL SATURATED EXTRACT Na [meq/L]
DEPTH [cm]
0
20
40
60
80
100
120
140
0
100
200
300
400
500
600

SOIL SATURATED EXTRACT SAR - NO IRRIG
VS. SOIL DEPTH



SOIL SATURATED EXTRACT Ca+Mg - NO IRRIG
VS. SOIL DEPTH



Raw data from the Philippines

The data reported in this chapter was collected during the year of 1995. Yield and other growth parameters as well as concluding remarks will be reported as a section of the final report of this Project.

TABLE 1a. CONCENTRATION OF AVAILABLE CHLORIDE (ppm) IN SOIL BEFORE PLANTING CORN.

	AVAILABLE CHLORIDE (ppm)			
SAMPLE CODE	TRIAL I	TRIAL II	MEAN	
S1F0 I	35.42	35.43	35.43	± 0.00
S1F0 II	35.45	35.45	35.45	± 0.00
S1F0 III	44.30	44.29	44.30	± 0.00
S1F0 IV	26.56	22.14	24.35	± 2.21
S1F1 I	22.14	22.14	22.14	± 0.00
S1F1 II	88.57	88.60	88.59	± 0.01
S1F1 III	35.45	31.01	33.23	± 2.22
S1F1 IV	31.00	35.44	33.22	± 2.22
S1F2 I	4.43	4.43	4.43	± 0.00
S1F2 II	39.88	39.85	39.87	± 0.01
S1F2 III	ND	ND		ND
S1F2 IV	8.86	8.86	8.86	± 0.00
S1F3 II	48.74	53.15	50.95	± 2.21
S1F3 III	35.43	35.43	35.43	± 0.00
S1F3 IV	53.16	53.17	53.17	± 0.00
S2F0 I	44.29	44.29	44.29	± 0.00
S2F0 II	26.57	30.99	28.78	± 2.21
S2F0 III	4.43	4.43	4.43	± 0.00
S2F0 IV	106.28	106.29	106.29	± 0.00
S2F1 II	75.33	75.31	75.32	± 0.01
S2F1 III	22.15	26.57	24.36	± 2.21
S2F1 IV	70.89	70.85	70.87	± 0.02
S2F2 I	22.15	22.17	22.16	± 0.01
S2F2 II	101.88	101.87	101.88	± 0.00
S2F2 III	17.72	17.72	17.72	± 0.00
S2F2 IV	44.31	44.30	44.31	± 0.00

CONTINUATION...

AVAILABLE CHLORIDE (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN	
S2F3 I	57.59	57.59	57.59	± 0.00
S2F3 II	70.88	70.89	70.89	± 0.00
S2F3 III	62.02	62.03	62.03	± 0.00
S2F3 IV	57.58	57.60	57.59	± 0.01
S3F0 I	35.42	35.43	35.43	± 0.00
S3F0 II	31.00	31.01	31.01	± 0.00
S3F0 III	31.01	35.45	33.23	± 0.00
S3F0 IV	97.42	97.41	97.42	± 0.00
S3F1 I	62.01	62.02	62.02	± 0.01
S3F1 II	ND	ND		ND
S3F1 III	17.72	17.72	17.72	± 0.00
S3F1 IV	137.31	137.32	137.32	± 0.01
S3F2 I	35.45	35.44	35.45	± 0.01
S3F2 II	39.88	44.30	42.09	± 2.21
S3F2 III	66.46	66.46	66.46	± 0.00
S3F2 IV	66.43	62.01	64.22	± 2.21
S3F3 I	44.29	44.29	44.29	± 0.00
S3F3 II	13.29	13.29	13.29	± 0.00
S3F3 III	39.85	39.85	39.85	± 0.00
S3F3 IV	44.31	48.72	46.52	± 2.21

LEGEND:

S1 = 2 mmhos/cm NaCl
S2 = 4 mmhos/cm NaCl
S3 = 8 mmhos

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

ND =Not Detected

TABLE 1b. CONCENTRATION OF AVAILABLE CHLORIDE (ppm) IN SOIL AFTER PLANTING CORN.

	AVAILABLE CHLORIDE (ppm)			
SAMPLE CODE	TRIAL I	TRIAL II	MEAN	
S1F0 I	150.02	145.61	147.82	± 2.20
S1F0 II	163.28	163.25	163.27	± 0.01
S1F0 III	83.83	79.43	81.63	± 2.20
S1F0 IV	450.09	450.07	450.08	± 0.01
S1F1 I	145.53	145.57	145.55	± 0.02
S1F1 II	216.22	216.23	216.23	± 0.00
S1F1 III	83.85	88.24	86.05	± 2.19
S1F1 IV	286.87	286.87	286.87	± 0.00
S1F2 I	308.84	308.89	308.87	± 0.02
S1F2 II	216.21	216.17	216.19	± 0.02
S1F2 III	127.95	127.97	127.96	± 0.01
S1F2 IV	176.48	176.47	176.48	± 0.00
S1F3 I	233.89	233.83	233.86	± 0.03
S1F3 II	35.30	39.72	37.51	± 2.21
S1F3 III	101.50	101.47	101.49	± 0.01
S1F3 IV	220.64	220.66	220.65	± 0.01
S2F0 I	185.30	185.28	185.29	± 0.01
S2F0 II	145.58	145.62	145.60	± 0.02
S2F0 III	282.39	282.44	282.42	± 0.02
S2F0 IV	247.15	247.05	247.10	± 0.05
S2F1 I	242.66	238.28	240.47	± 2.19
S2F1 II	401.51	401.56	401.54	± 0.02
S2F1 III	158.82	158.82	158.82	± 0.00
S2F1 IV	203.02	203.02	203.02	± 0.00
S2F2 I	353.05	352.91	352.98	± 0.07
S2F2 II	216.22	216.20	216.21	± 0.01
S2F2 III	414.80	414.73	414.77	± 0.03
S2F2 IV	132.40	132.39	132.40	± 0.00

CONTINUATION...

AVAILABLE CHLORIDE (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN	
S2F3 I	405.89	405.92	405.91	± 0.01
S2F3 II	388.32	383.97	386.15	± 2.17
S2F3 III	273.60	273.61	273.61	± 0.01
S2F3 IV	132.34	132.38	132.36	± 0.02
S3F0 I	44.12	44.13	44.13	± 0.01
S3F0 II	467.51	467.66	467.59	± 0.07
S3F0 III	529.51	529.38	529.45	± 0.06
S3F0 IV	322.08	322.15	322.12	± 0.03
S3F1 I	229.42	229.40	229.41	± 0.01
S3F1 II	247.13	247.12	247.13	± 0.01
S3F1 III	370.64	370.71	370.68	± 0.03
S3F1 IV	441.19	441.24	441.22	± 0.02
S3F2 I	185.33	185.30	185.32	± 0.01
S3F2 II	489.83	489.74	489.79	± 0.04
S3F2 III	375.05	375.08	375.07	± 0.02
S3F2 IV	436.79	436.85	436.82	± 0.03
S3F3 I	825.14	824.91	825.03	± 0.12
S3F3 II	383.91	383.86	383.89	± 0.02
S3F3 III	692.59	692.81	692.70	± 0.11
S3F3 IV	595.63	595.69	595.66	± 0.03

LEGEND:

S1 = 2 mmhos NaCl
S3 = 8 mmhos NaCl

F0 = 0 kg NO3/3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 1c. CHLORIDE CONTENT (%) OF CORN SAMPLES.

	CHLORIDE CONTENT (%)			
SAMPLE CODE	TRIAL I	TRIAL II	MEAN	
S1F0 I	0.52	0.52	0.52	± 0.00
S1F0 II	0.78	0.76	0.77	± 0.01
S1F0 III	0.68	0.63	0.66	± 0.02
S1F0 IV	0.85	0.85	0.85	± 0.00
S1F1 I	0.58	0.58	0.58	± 0.00
S1F1 II	0.55	0.61	0.58	± 0.03
S1F1 III	0.99	0.92	0.96	± 0.03
S1F1 IV	0.61	0.65	0.63	± 0.02
S1F2 I	0.41	0.40	0.41	± 0.00
S1F2 II	0.84	0.79	0.82	± 0.02
S1F2 III	0.93	0.92	0.93	± 0.01
S1F2 IV	0.86	0.86	0.86	± 0.00
S1F3 I	0.72	0.74	0.73	± 0.01
S1F3 II	0.50	0.47	0.49	± 0.02
S1F3 III	1.13	1.10	1.12	± 0.01
S1F3 IV	0.83	0.75	0.79	± 0.04
S2F0 I	0.80	0.83	0.82	± 0.01
S2F0 II	0.74	0.79	0.77	± 0.02
S2F0 III	0.89	0.91	0.90	± 0.01
S2F0 IV	0.85	0.85	0.85	± 0.00
S2F1 I	0.81	0.86	0.84	± 0.02
S2F1 II	0.70	0.75	0.73	± 0.03
S2F1 III	0.63	0.63	0.63	± 0.00
S2F1 IV	0.99	0.99	0.99	± 0.00
S2F2 I	1.12	1.09	1.11	± 0.01
S2F2 II	1.37	1.37	1.37	± 0.00
S2F2 III	1.37	1.28	1.33	± 0.04
S2F2 IV	1.41	1.46	1.44	± 0.02

CONTINUATION...

SAMPLE CODE	CHLORIDE CONTENT (%) TRIAL I	TRIAL II	MEAN		
S2F3 I	0.54	0.57	0.56	±	0.01
S2F3 II	1.05	1.09	1.07	±	0.02
S2F3 III	0.75	0.77	0.76	±	0.01
S2F3 IV	1.06	1.14	1.10	±	0.04
S3F0 I	1.01	1.01	1.01	±	0.00
S3F0 II	0.54	0.49	0.52	±	0.03
S3F0 III	0.90	0.84	0.87	±	0.03
S3F0 IV	1.01	0.98	1.00	±	0.01
S3F1 I	0.76	0.83	0.80	±	0.03
S3F1 II	0.92	1.00	0.96	±	0.04
S3F1 III	1.11	1.15	1.13	±	0.02
S3F1 IV	1.04	1.03	1.04	±	0.00
S3F2 I	0.41	0.40	0.41	±	0.00
S3F2 II	1.04	1.05	1.05	±	0.00
S3F2 III	1.17	1.11	1.14	±	0.03
S3F2 IV	1.11	1.12	1.12	±	0.00
S3F3 I	0.88	0.97	0.93	±	0.04
S3F3 II	0.71	0.71	0.71	±	0.00
S3F3 III	1.86	1.80	1.83	±	0.03
S3F3 IV	1.14	1.20	1.17	±	0.03

LEGEND:

S1 = 2 mmhos NaCl
S2 = 4 mmhos NaCl
S3 = 8 mmhos NaCl

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 2a. CONCENTRATION OF AVAILABLE CHLORIDE (ppm) IN SOIL BEFORE PLANTING PEANUT.

	AVAILABLE CHLORIDE (ppm)		
SAMPLE CODE	TRIALI	TRIAL II	MEAN
S1F0 I	ND	ND	ND
S1F0 II	ND	ND	ND
S1F0 III	ND	ND	ND
S1F0 IV	ND	ND	ND
S1F0 V	ND	ND	ND
S1F1 I	ND	ND	ND
S1F1 II	ND	ND	ND
S1F1 III	ND	ND	ND
S1F1 IV	ND	ND	ND
S1F1 V	ND	ND	ND
S1F2 I	ND	ND	ND
S1F2 II	ND	ND	ND
S1F2 III	ND	ND	ND
S1F2 IV	ND	ND	ND
S1F2 V	ND	ND	ND
S1F3 I	ND	ND	ND
S1F3 II	ND	ND	ND
S1F3 III	ND	ND	ND
S1F3 IV	ND	ND	ND
S1F3 V	ND	ND	ND
S3F0 I	ND	ND	ND
S3F0 II	ND	ND	ND
S3F0 III	ND	ND	ND
S3F0 IV	ND	ND	ND
S3F0 V	ND	ND	ND

CONTINUATION...

SAMPLE CODE	AVAILABLE CHLORIDE (ppm) TRIALI	TRIAL II	MEAN
S3F1 I	ND	ND	ND
S3F1 II	ND	ND	ND
S3F1 III	ND	ND	ND
S3F1 IV	ND	ND	ND
S3F1 V	ND	ND	ND
S3F2 I	ND	ND	ND
S3F2 II	ND	ND	ND
S3F2 III	ND	ND	ND
S3F2 IV	ND	ND	ND
S3F2 V	ND	ND	ND
S3F3 I	ND	ND	ND
S3F3 II	ND	ND	ND
S3F3 III	ND	ND	ND
S3F3 IV	ND	ND	ND
S3F3 V	ND	ND	ND

LEGEND:

S1 = 2 mmhos NaCl
S3 = 8 mmhos NaCl

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

ND = Not detected

TABLE 2b. CONCENTRATION OF AVAILABLE CHLORIDE (ppm) IN SOIL AFTER PLANTING PEANUT.

	AVAILABLE CHLORIDE (ppm)			
SAMPLE CODE	TRIAL I	TRIAL II	MEAN	
S1F0 I	48.70	48.72	48.71	± 0.01
S1F0 II	26.57	26.57	26.57	± 0.00
S1F0 III	39.84	39.84	39.84	± 0.00
S1F0 IV	39.84	39.84	39.84	± 0.00
S1F0 V	35.43	35.43	35.43	± 0.00
S1F1 I	39.78	39.77	39.78	± 0.00
S1F1 II	17.71	17.71	17.71	± 0.00
S1F1 III	57.45	57.46	57.46	± 0.00
S1F1 IV	39.82	39.82	39.82	± 0.00
S1F1 V	22.13	17.70	19.92	± 2.21
S1F2 I	57.43	57.45	57.44	± 0.01
S1F2 II	53.14	53.14	53.14	± 0.00
S1F2 III	48.70	48.70	48.70	± 0.00
S1F2 IV	39.81	39.80	39.80	± 0.00
S1F2 V	44.28	44.28	44.28	± 0.00
S1F3 I	43.90	48.32	46.11	± 2.21
S1F3 II	22.07	22.07	22.07	± 0.00
S1F3 III	39.55	39.54	39.55	± 0.01
S1F3 IV	22.04	22.03	22.04	± 0.00
S1F3 V	26.40	26.41	26.40	± 0.00
S3F0 I	190.39	190.38	190.38	± 0.00
S3F0 II	88.37	92.78	90.57	± 2.21
S3F0 III	115.14	115.14	115.14	± 0.00
S3F0 IV	163.39	163.43	163.41	± 0.02
S3F0 V	141.39	141.42	141.41	± 0.01

CONTINUATION...

AVAILABLE CHLORIDE (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN	
S3F1 I	84.06	84.05	84.06	± 0.01
S3F1 II	101.66	101.64	101.65	± 0.01
S3F1 III	185.51	185.50	185.50	± 0.01
S3F1 IV	70.74	70.73	70.74	± 0.00
S3F1 V	132.70	137.16	134.93	± 2.23
S3F2 I	141.68	146.09	143.88	± 2.21
S3F2 II	114.72	114.74	114.73	± 0.01
S3F2 III	163.13	163.10	163.12	± 0.01
S3F2 IV	105.65	101.25	103.45	± 2.20
S3F2 V	61.89	61.89	61.89	± 0.00
S3F3 I	185.61	185.59	185.60	± 0.01
S3F3 II	132.78	132.76	132.77	± 0.01
S3F3 III	61.82	57.40	59.61	± 2.21
S3F3 IV	97.37	97.37	97.37	± 0.00
S3F3 V	66.30	66.30	66.30	± 0.00

LEGEND:

S1 = 2 mmhos/cm NaCl
S3 = 8 mmhos/cm NaCl

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 2c. CHLORIDE CONTENT (%) OF PEANUT SAMPLES.

	CHLORIDE CONTENT (%)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S1F0 I	1.14	1.14	1.14	±	0.00
S1F0 II	0.80	0.79	0.80	±	0.01
S1F0 III	1.19	1.18	1.19	±	0.00
S1F0 IV	0.67	0.69	0.68	±	0.01
S1F0 V	0.81	0.81	0.81	±	0.00
S1F1 I	0.63	0.64	0.64	±	0.00
S1F1 II	0.53	0.53	0.53	±	0.00
S1F1 III	0.87	0.89	0.88	±	0.01
S1F1 IV	1.00	0.95	0.98	±	0.02
S1F1 V	0.75	0.74	0.75	±	0.01
S1F2 I	0.78	0.78	0.78	±	0.00
S1F2 II	1.15	1.19	1.17	±	0.02
S1F2 III	0.68	0.73	0.71	±	0.02
S1F2 IV	0.77	0.78	0.78	±	0.00
S1F2 V	0.90	0.89	0.90	±	0.01
S1F3 I	1.01	1.02	1.02	±	0.00
S1F3 II	1.16	1.16	1.16	±	0.00
S1F3 III	0.70	0.70	0.70	±	0.00
S1F3 IV	1.33	1.28	1.31	±	0.02
S1F3 V	0.82	0.82	0.82	±	0.00
S3F0 I	1.07	1.08	1.08	±	0.00
S3F0 II	0.55	0.57	0.56	±	0.01
S3F0 III	0.76	0.78	0.77	±	0.01
S3F0 IV	0.89	0.92	0.91	±	0.01
S3F0 V	0.64	0.69	0.67	±	0.02

CONTINUATION...

SAMPLE CODE	CHLORIDE CONTENT (%) TRIAL I	TRIAL II	MEAN
S3F1 I	0.65	0.67	0.66 ± 0.01
S3F1 II	1.00	1.07	1.04 ± 0.03
S3F1 III	0.84	0.79	0.82 ± 0.02
S3F1 IV	0.90	0.95	0.93 ± 0.02
S3F1 V	1.32	1.25	1.29 ± 0.03
S3F2 I	1.11	1.05	1.08 ± 0.03
S3F2 II	0.92	0.86	0.89 ± 0.03
S3F2 III	1.11	1.14	1.13 ± 0.01
S3F2 IV	0.81	0.84	0.83 ± 0.01
S3F2 V	1.01	0.92	0.97 ± 0.04
S3F3 I	1.04	1.10	1.07 ± 0.03
S3F3 II	0.85	0.90	0.88 ± 0.02
S3F3 III	0.64	0.63	0.64 ± 0.00
S3F3 IV	1.16	1.12	1.14 ± 0.02
S3F3 V	0.84	0.80	0.82 ± 0.02

LEGEND:

S1 = 2 mmhos/cm NaCl
S3 = 8 mmhos/cm NaCl

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 3a. CONCENTRATION OF AVAILABLE SODIUM (ppm) IN SOIL BEFORE PLANTING CORN.

	AVAILABLE SODIUM (ppm)				
SAMPLE CODE	TRIAL I	TRIAL I	MEAN		
S1F0 I	196.07	187.70	191.89	±	4.19
S1F0 II	247.82	240.53	244.18	±	3.64
S1F0 III	83.43	79.09	81.26	±	2.17
S1F0 IV	357.38	328.50	342.94	±	14.44
S1F1 I	136.70	140.47	138.59	±	1.88
S1F1 II	245.94	245.54	245.74	±	0.20
S1F1 III	72.99	68.95	70.97	±	2.02
S1F1 IV	92.79	89.79	91.29	±	1.50
S1F2 I	256.57	249.22	252.90	±	3.67
S1F2 II	229.53	226.30	227.92	±	1.61
S1F2 III	105.61	114.41	110.01	±	4.40
S1F2 IV	223.27	224.03	223.65	±	0.38
S1F3 II	327.56	301.75	314.66	±	12.90
S1F3 III	135.44	139.02	137.23	±	1.79
S1F3 IV	275.26	271.07	273.17	±	2.09
S2F0 I	251.69	250.58	251.14	±	0.55
S2F0 II	201.62	205.37	203.50	±	1.87
S2F0 III	75.05	79.38	77.21	±	2.16
S2F0 IV	364.36	373.42	368.89	±	4.53
S2F1 II	283.72	275.82	279.77	±	3.95
S2F1 III	354.94	337.34	346.14	±	8.80
S2F1 IV	272.36	177.39	224.88	±	47.49
S2F2 I	170.43	164.06	167.25	±	3.18
S2F2 II	443.25	434.80	439.03	±	4.22
S2F2 III	135.25	134.61	134.93	±	0.32
S2F2 IV	208.36	203.01	205.69	±	2.67

CONTINUATION...

AVAILABLE SODIUM (ppm)					
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S2F3 I	475.49	456.16	465.83	±	9.66
S2F3 II	325.94	322.97	324.46	±	1.48
S2F3 III	105.44	105.63	105.54	±	0.10
S2F3 IV	166.87	158.69	162.78	±	4.09
S3F0 I	325.84	326.49	326.17	±	0.32
S3F0 II	183.15	179.38	181.27	±	1.88
S3F0 III	98.30	96.06	97.18	±	1.12
S3F0 IV	152.33	152.11	152.22	±	0.11
S3F1 I	381.81	393.19	387.50	±	5.69
S3F1 II	183.88	175.31	179.60	±	4.28
S3F1 III	237.76	249.75	243.76	±	5.99
S3F1 IV	415.37	407.15	411.26	±	4.11
S3F2 I	377.91	376.09	377.00	±	0.91
S3F2 II	1592.90	1576.20	1584.55	±	8.35
S3F2 III	277.00	279.13	278.07	±	1.06
S3F2 IV	261.54	259.09	260.32	±	1.23
S3F3 I	117.46	120.27	118.87	±	1.40
S3F3 II	228.41	222.23	225.32	±	3.09
S3F3 III	230.82	233.45	232.14	±	1.31
S3F3 IV	190.25	191.37	190.81	±	0.56

LEGEND:

S1 = 2 mmhos NaCl
S3 = 8 mmhos NaCl

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 3b. CONCENTRATION OF AVAILABLE SODIUM (ppm) IN SOIL AFTER PLANTING CORN.

	AVAILABLE SODIUM (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S1F0 I	392.84	373.67	383.26	±	9.59
S1F0 II	466.43	489.72	478.08	±	11.64
S1F0 III	428.92	411.24	420.08	±	8.84
S1F0 IV	588.82	618.85	603.84	±	15.02
S1F1 I	373.32	317.72	345.52	±	27.80
S1F1 II	582.82	539.10	560.96	±	21.86
S1F1 III	499.72	569.47	534.60	±	34.87
S1F1 IV	627.05	741.66	684.36	±	57.30
S1F2 I	352.59	303.52	328.06	±	24.53
S1F2 II	353.82	405.09	379.46	±	25.63
S1F2 III	855.86	916.21	886.04	±	30.17
S1F2 IV	467.28	478.15	472.72	±	5.43
S1F3 I	148.24	149.11	148.68	±	0.44
S1F3 II	114.15	113.42	113.79	±	0.36
S1F3 III	875.02	760.25	817.64	±	57.39
S1F3 IV	873.37	818.02	845.70	±	27.67
S2F0 I	1445.10	1409.70	1427.40	±	17.70
S2F0 II	1226.50	1278.50	1252.50	±	26.00
S2F0 III	978.56	865.89	922.23	±	56.33
S2F0 IV	894.91	993.53	944.22	±	49.31
S2F1 I	1300.30	1298.50	1299.40	±	0.90
S2F1 II	1080.10	1056.30	1068.20	±	11.90
S2F1 III	1238.90	1288.40	1263.65	±	24.75
S2F1 IV	881.96	822.40	852.18	±	29.78
S2F2 I	1373.30	1321.80	1347.55	±	25.75
S2F2 II	593.46	552.64	573.05	±	20.41
S2F2 III	1093.40	1240.20	1166.80	±	73.40
S2F2 IV	976.38	1006.30	991.34	±	14.96

TABLE 3c. SODIUM CONTENT (ppm) OF CORN SAMPLES.

	SODIUM CONTENT (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S1F0 I	20.45	29.11	24.78	±	4.33
S1F0 II	32.94	27.02	29.98	±	2.96
S1F0 III	19.20	20.01	19.60	±	0.41
S1F0 IV	43.28	40.42	41.85	±	1.43
S1F1 I	36.69	32.97	34.83	±	1.86
S1F1 II	60.24	66.10	63.17	±	2.93
S1F1 III	146.01	141.69	143.85	±	2.16
S1F1 IV	200.38	236.35	218.37	±	17.98
S1F2 I	9.08	9.69	9.39	±	0.31
S1F2 II	136.05	130.18	133.12	±	2.94
S1F2 III	8.91	9.70	9.30	±	0.40
S1F2 IV	10.71	12.49	11.60	±	0.89
S1F3 I	50.84	57.96	54.40	±	3.56
S1F3 II	56.53	50.55	53.54	±	2.99
S1F3 III	34.34	31.39	32.87	±	1.47
S1F3 IV	27.21	27.69	27.45	±	0.24
S2F0 I	28.49	31.57	30.03	±	1.54
S2F0 II	321.13	361.67	341.40	±	20.27
S2F0 III	48.48	44.63	46.56	±	1.92
S2F0 IV	50.67	49.01	49.84	±	0.83
S2F1 I	256.69	266.06	261.38	±	4.69
S2F1 II	156.41	135.28	145.85	±	10.56
S2F1 III	68.01	60.83	64.42	±	3.59
S2F1 IV	47.04	43.12	45.08	±	1.96
S2F2 I	801.48	883.89	842.69	±	41.20
S2F2 II	390.90	364.22	377.56	±	13.34
S2F2 III	180.56	168.46	174.51	±	6.05
S2F2 IV	43.64	39.68	41.66	±	1.98

CONTINUATION...

SODIUM CONTENT (ppm)					
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S2F3 I	304.75	321.82	313.29	±	8.53
S2F3 II	88.01	82.26	85.14	±	2.88
S2F3 III	21.64	20.78	21.21	±	0.43
S2F3 IV	116.47	121.27	118.87	±	2.40
S3F0 I	201.99	214.96	208.48	±	6.48
S3F0 II	60.82	67.32	64.07	±	3.25
S3F0 III	205.92	231.43	218.68	±	12.75
S3F0 IV	41.03	48.96	45.00	±	3.96
S3F1 I	212.17	225.24	218.71	±	6.53
S3F1 II	50.79	56.96	53.87	±	3.08
S3F1 III	100.15	112.13	106.14	±	5.99
S3F1 IV	429.92	452.89	441.41	±	11.48
S3F2 I	68.15	74.96	71.56	±	3.40
S3F2 II	100.43	120.62	110.53	±	10.09
S3F2 III	151.54	127.66	139.60	±	11.94
S3F2 IV	125.28	110.68	117.98	±	7.30
S3F3 I	245.34	267.21	256.28	±	10.94
S3F3 II	890.47	897.80	894.14	±	3.67
S3F3 III	25.29	29.45	27.37	±	2.08
S3F3 IV	180.79	176.17	178.48	±	2.31

LEGEND:

S1 = 2 mmhos NaCl
S2 = 4 mmhos NaCl
S3 = 8 mmhos NaCl

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 4A. CONCENTRATION OF AVAILABLE SODIUM (ppm) IN SOIL BEFORE PLANTING PEANUT.

	AVAILABLE SODIUM (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S1F0 I	51.15	56.98	54.07	±	2.91
S1F0 II	50.00	49.51	49.75	±	0.25
S1F0 III	54.42	50.76	52.59	±	1.83
S1F0 IV	59.77	61.69	60.73	±	0.96
S1F0 V	80.66	75.27	77.96	±	2.70
S1F1 I	41.09	37.98	39.54	±	1.56
S1F1 II	45.64	51.75	48.70	±	3.06
S1F1 III	52.87	50.40	51.64	±	1.23
S1F1 IV	70.10	67.98	69.04	±	1.06
S1F1 V	56.79	66.06	61.42	±	4.63
S1F2 I	30.25	29.44	29.84	±	0.40
S1F2 II	38.30	37.26	37.78	±	0.52
S1F2 III	49.39	47.95	48.67	±	0.72
S1F2 IV	51.26	47.64	49.45	±	1.81
S1F2 V	71.32	89.36	80.34	±	9.02
S1F3 I	36.46	34.84	35.65	±	0.81
S1F3 II	40.73	38.52	39.63	±	1.10
S1F3 III	47.68	55.80	51.74	±	4.06
S1F3 IV	44.35	46.71	45.53	±	1.18
S1F3 V	54.16	70.62	62.39	±	8.23
S3F0 I	45.00	40.85	42.92	±	2.07
S3F0 II	56.84	54.79	55.82	±	1.02
S3F0 III	48.19	53.34	50.76	±	2.58
S3F0 IV	59.04	50.64	54.84	±	4.20
S3F0 V	67.37	59.78	63.58	±	3.79

CONTINUATION...

AVAILABLE SODIUM (ppm)					
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S3F1 I	43.79	39.92	41.86	±	1.93
S3F1 II	53.38	48.51	50.95	±	2.44
S3F1 III	49.08	47.81	48.45	±	0.63
S3F1 IV	51.19	56.54	53.86	±	2.67
S3F1 V	77.93	77.92	77.93	±	0.00
S3F2 I	30.31	29.20	29.76	±	0.56
S3F2 II	41.11	44.38	42.74	±	1.64
S3F2 III	49.21	43.47	46.34	±	2.87
S3F2 IV	50.43	51.84	51.13	±	0.70
S3F2 V	59.22	55.85	57.54	±	1.68
S3F3 I	31.21	36.05	33.63	±	2.42
S3F3 II	56.62	59.86	58.24	±	1.62
S3F3 III	67.31	69.54	68.43	±	1.11
S3F3 IV	67.82	68.10	67.96	±	0.14
S3F3 V	71.46	66.84	69.15	±	2.31

LEGEND:

S1 = 2 mmhos/cm NaCl
S3 = 8 mmhos/cm NaCl

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 4b. CONCENTRATION OF AVAILABLE SODIUM (ppm) IN SOIL AFTER PLANTING PEANUT.

	AVAILABLE SODIUM (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S1F0 I	514.31	499.86	507.09	±	7.23
S1F0 II	164.59	159.10	161.85	±	2.74
S1F0 III	531.47	507.75	519.61	±	11.86
S1F0 IV	153.60	149.31	151.46	±	2.14
S1F0 V	208.68	208.56	208.62	±	0.06
S1F1 I	510.23	498.41	504.32	±	5.91
S1F1 II	105.89	97.36	101.63	±	4.26
S1F1 III	425.52	426.51	426.02	±	0.49
S1F1 IV	149.78	153.00	151.39	±	1.61
S1F1 V	429.19	465.66	447.43	±	18.23
S1F2 I	700.09	687.47	693.78	±	6.31
S1F2 II	170.15	149.31	159.73	±	10.42
S1F2 III	506.84	496.69	501.77	±	5.07
S1F2 IV	113.44	111.12	112.28	±	1.16
S1F2 V	326.73	308.27	317.50	±	9.23
S1F3 I	440.18	440.79	440.49	±	0.30
S1F3 II	109.68	114.68	112.18	±	2.50
S1F3 III	507.93	481.87	494.90	±	13.03
S1F3 IV	107.33	113.03	110.18	±	2.85
S1F3 V	443.96	447.84	445.90	±	1.94
S3F0 I	418.05	380.88	399.47	±	18.58
S3F0 II	539.27	553.70	546.49	±	7.21
S3F0 III	242.59	236.70	239.65	±	2.94
S3F0 IV	1023.40	1101.40	1062.40	±	39.00
S3F0 V	279.63	250.76	265.20	±	14.43

CONTINUATION...

AVAILABLE SODIUM (ppm)					
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S3F1 I	194.86	174.17	184.52	±	10.34
S3F1 II	808.17	848.88	828.53	±	20.36
S3F1 III	226.86	293.95	260.41	±	33.54
S3F1 IV	717.13	802.66	759.90	±	42.77
S3F1 V	183.44	175.06	179.25	±	4.19
S3F2 I	323.55	255.71	289.63	±	33.92
S3F2 II	592.68	659.98	626.33	±	33.65
S3F2 III	153.60	227.00	190.30	±	36.70
S3F2 IV	802.59	807.86	805.23	±	2.64
S3F2 V	173.99	168.17	171.08	±	2.91
S3F3 I	136.90	168.01	152.46	±	15.55
S3F3 II	398.27	385.20	391.74	±	6.53
S3F3 III	621.49	668.63	645.06	±	23.57
S3F3 IV	560.10	465.32	512.71	±	47.39
S3F3 V	173.11	142.69	157.90	±	15.21

LEGEND:

S1 = 2 mmhos/cm NaCl
S3 = 8 mmhos/cm NaCl

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 4c. SODIUM CONTENT (ppm) OF PEANUT SAMPLES.

	SODIUM CONTENT (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S1F0 I	131.84	131.88	131.86	±	0.02
S1F0 II	188.75	165.05	176.90	±	11.85
S1F0 III	47.94	48.72	48.33	±	0.39
S1F0 IV	109.65	106.64	108.15	±	1.50
S1F0 V	79.19	85.81	82.50	±	3.31
S1F1 I	50.33	54.67	52.50	±	2.17
S1F1 II	100.79	104.41	102.60	±	1.81
S1F1 III	76.90	74.16	75.53	±	1.37
S1F1 IV	105.45	110.65	108.05	±	2.60
S1F1 V	114.34	113.02	113.68	±	0.66
S1F2 I	69.18	75.38	72.28	±	3.10
S1F2 II	201.79	216.81	209.30	±	7.51
S1F2 III	50.87	55.77	53.32	±	2.45
S1F2 IV	21.43	26.37	23.90	±	2.47
S1F2 V	63.88	61.00	62.44	±	1.44
S1F3 I	36.40	33.68	35.04	±	1.36
S1F3 II	89.31	88.35	88.83	±	0.48
S1F3 III	47.83	45.73	46.78	±	1.05
S1F3 IV	106.64	104.06	105.35	±	1.29
S1F3 V	82.30	80.60	81.45	±	0.85
S3F0 I	62.82	68.69	65.76	±	2.94
S3F0 II	75.75	81.10	78.42	±	2.67
S3F0 III	146.75	151.48	149.12	±	2.37
S3F0 IV	101.50	105.63	103.57	±	2.06
S3F0 V	85.01	90.01	87.51	±	2.50

CONTINUATION...

SODIUM CONTENT (ppm)					
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S3F1 I	66.34	60.96	63.65	±	2.69
S3F1 II	90.97	94.12	92.55	±	1.58
S3F1 III	219.93	236.59	228.26	±	8.33
S3F1 IV	59.18	64.10	61.64	±	2.46
S3F1 V	120.71	131.03	125.87	±	5.16
S3F2 I	210.17	248.71	229.44	±	19.27
S3F2 II	87.09	91.15	89.12	±	2.03
S3F2 III	63.09	62.14	62.62	±	0.48
S3F2 IV	160.20	164.09	162.15	±	1.94
S3F2 V	217.90	200.70	209.30	±	8.60
S3F3 I	370.82	330.00	350.41	±	20.41
S3F3 II	174.72	167.62	171.17	±	3.55
S3F3 III	64.16	63.76	63.96	±	0.20
S3F3 IV	91.05	99.49	95.27	±	4.22
S3F3 V	72.84	72.78	72.81	±	0.03

LEGEND:

S1 = 2 mmhos/cm NaCl
S3 = 8 mmhos/cm NaCl

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 5a. CONCENTRATION OF AVAILABLE POTASSIUM (ppm) IN SOIL BEFORE PLANTING CORN.

	AVAILABLE POTASSIUM (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S1F0 I	447.63	450.09	448.86	±	1.23
S1F0 II	204.97	197.59	201.28	±	3.69
S1F0 III	445.72	444.73	445.23	±	0.49
S1F0 IV	435.30	450.77	443.04	±	7.73
S1F1 I	405.95	419.43	412.69	±	6.74
S1F1 II	300.03	282.87	291.45	±	8.58
S1F1 III	543.81	504.95	524.38	±	19.43
S1F1 IV	389.03	397.39	393.21	±	4.18
S1F2 I	428.90	391.82	410.36	±	18.54
S1F2 II	376.69	329.08	352.89	±	23.81
S1F2 III	543.05	534.94	539.00	±	4.05
S1F2 IV	462.31	438.36	450.34	±	11.97
S1F3 II	193.59	203.90	198.75	±	5.15
S1F3 III	560.15	544.91	552.53	±	7.62
S1F3 IV	411.77	390.41	401.09	±	10.68
S2F0 I	300.45	305.96	303.21	±	2.76
S2F0 II	287.92	271.24	279.58	±	8.34
S2F0 III	369.40	398.48	383.94	±	14.54
S2F0 IV	346.87	342.46	344.67	±	2.20
S2F1 II	190.28	190.29	190.29	±	0.00
S2F1 III	312.83	253.24	283.04	±	29.79
S2F1 IV	446.51	438.98	442.75	±	3.77
S2F2 I	394.61	371.68	383.15	±	11.46
S2F2 II	323.56	315.83	319.70	±	3.87
S2F2 III	453.33	470.13	461.73	±	8.40
S2F2 IV	662.95	652.14	657.55	±	5.40

CONTINUATION...

AVAILABLE POTASSIUM (ppm)					
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S2F3 I	272.47	281.28	276.88	±	4.40
S2F3 II	358.01	361.05	359.53	±	1.52
S2F3 III	465.94	470.13	468.04	±	2.09
S2F3 IV	496.83	484.44	490.64	±	6.19
S3F0 I	299.60	288.03	293.82	±	5.79
S3F0 II	351.17	350.62	350.90	±	0.27
S3F0 III	447.52	455.11	451.32	±	3.80
S3F0 IV	482.82	461.18	472.00	±	10.82
S3F1 I	220.30	224.29	222.30	±	1.99
S3F1 II	281.81	277.66	279.74	±	2.07
S3F1 III	328.58	341.18	334.88	±	6.30
S3F1 IV	390.15	377.33	383.74	±	6.41
S3F2 I	197.12	193.10	195.11	±	2.01
S3F2 II	416.81	412.17	414.49	±	2.32
S3F2 III	428.79	453.49	441.14	±	12.35
S3F2 IV	489.22	468.14	478.68	±	10.54
S3F3 I	324.59	310.53	317.56	±	7.03
S3F3 II	263.39	258.18	260.79	±	2.60
S3F3 III	470.36	491.23	480.80	±	10.43
S3F3 IV	508.34	506.31	507.33	±	1.01

LEGEND:

S1 = 2 mmhos NaCl
S3 = 8 mmhos NaCl

F0 = 0 kg NO3/3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 5b. CONCENTRATION OF AVAILABLE POTASSIUM (ppm) IN SOIL AFTER PLANTING CORN.

	AVAILABLE POTASSIUM (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S1F0 I	463.54	467.77	465.66	±	2.11
S1F0 II	328.43	359.34	343.89	±	15.46
S1F0 III	476.70	457.32	467.01	±	9.69
S1F0 IV	347.68	317.60	332.64	±	15.04
S1F1 I	406.62	407.49	407.06	±	0.44
S1F1 II	379.64	378.75	379.20	±	0.45
S1F1 III	477.78	539.05	508.41	±	30.64
S1F1 IV	502.79	478.86	490.83	±	11.96
S1F2 I	430.66	423.08	426.87	±	3.79
S1F2 II	339.86	342.96	341.41	±	1.55
S1F2 III	496.04	521.99	509.02	±	12.97
S1F2 IV	483.82	511.88	497.85	±	14.03
S1F3 I	404.24	383.68	393.96	±	10.28
S1F3 II	339.19	357.65	348.42	±	9.23
S1F3 III	592.96	619.34	606.15	±	13.19
S1F3 IV	547.84	615.29	581.57	±	33.72
S2F0 I	346.82	282.42	314.62	±	32.20
S2F0 II	336.91	340.78	338.85	±	1.93
S2F0 III	364.52	342.68	353.60	±	10.92
S2F0 IV	304.64	326.41	315.53	±	10.88
S2F1 I	346.04	336.85	341.45	±	4.59
S2F1 II	325.46	263.23	294.35	±	31.11
S2F1 III	460.71	392.25	426.48	±	34.23
S2F1 IV	460.84	460.04	460.44	±	0.40
S2F2 I	316.99	363.61	340.30	±	23.31
S2F2 II	273.35	263.79	268.57	±	4.78
S2F2 III	487.90	499.87	493.89	±	5.98
S2F2 IV	541.16	417.78	479.47	±	61.69

CONTINUATION...

AVAILABLE POTASSIUM (ppm)					
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S2F3 I	182.25	240.95	211.60	±	29.35
S2F3 II	246.73	281.44	264.09	±	17.36
S2F3 III	473.29	385.19	429.24	±	44.05
S2F3 IV	382.64	391.40	387.02	±	4.38
S3F0 I	287.19	287.04	287.12	±	0.07
S3F0 II	231.22	225.12	228.17	±	3.05
S3F0 III	313.54	205.05	259.30	±	54.25
S3F0 IV	443.10	303.65	373.38	±	69.72
S3F1 I	336.44	309.77	323.11	±	13.33
S3F1 II	260.92	316.07	288.50	±	27.57
S3F1 III	466.27	411.75	439.01	±	27.26
S3F1 IV	317.12	334.92	326.02	±	8.90
S3F2 I	142.09	154.67	148.38	±	6.29
S3F2 II	341.07	335.21	338.14	±	2.93
S3F2 III	513.80	505.60	509.70	±	4.10
S3F2 IV	337.52	364.09	350.81	±	13.28
S3F3 I	262.38	273.13	267.76	±	5.37
S3F3 II	327.34	352.84	340.09	±	12.75
S3F3 III	363.96	346.28	355.12	±	8.84
S3F3 IV	555.80	552.79	554.30	±	1.51

LEGEND:

S1 = 2 mmhos NaCl
S3 = 8 mmhos NaCl

F0 = 0 kg NO3/3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 5c. POTASSIUM CONTENT (ppm) OF CORN SAMPLES.

	POTASSIUM CONTENT (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S1F0 I	3529.15	3717.83	3623.49	±	94.34
S1F0 II	3431.71	3346.81	3389.26	±	42.45
S1F0 III	3707.98	3488.82	3598.40	±	109.58
S1F0 IV	3597.81	3864.45	3731.13	±	133.32
S1F1 I	3125.94	3322.99	3224.46	±	98.53
S1F1 II	2942.49	2949.35	2945.92	±	3.43
S1F1 III	3907.17	3772.12	3839.64	±	67.52
S1F1 IV	3687.91	3984.50	3836.21	±	148.29
S1F2 I	2646.55	2811.85	2729.20	±	82.65
S1F2 II	3614.31	3334.99	3474.65	±	139.66
S1F2 III	3652.16	3930.66	3791.41	±	139.25
S1F2 IV	3151.24	2967.95	3059.60	±	91.64
S1F3 I	3920.10	4160.23	4040.17	±	120.07
S1F3 II	3470.16	3694.57	3582.36	±	112.21
S1F3 III	3952.49	4032.74	3992.61	±	40.12
S1F3 IV	3688.65	3360.64	3524.64	±	164.00
S2F0 I	2966.86	3030.00	2998.43	±	31.57
S2F0 II	2713.45	2746.82	2730.13	±	16.68
S2F0 III	3027.31	3123.14	3075.22	±	47.92
S2F0 IV	3114.18	2927.90	3021.04	±	93.14
S2F1 I	2691.89	2789.61	2740.75	±	48.86
S2F1 II	2373.35	2593.26	2483.30	±	109.96
S2F1 III	3233.33	3419.89	3326.61	±	93.28
S2F1 IV	3887.42	3922.04	3904.73	±	17.31
S2F2 I	2910.16	2830.80	2870.48	±	39.68
S2F2 II	3455.35	3520.98	3488.16	±	32.81
S2F2 III	3656.59	3541.54	3599.07	±	57.52
S2F2 IV	3356.88	3608.76	3482.82	±	125.94

CONTINUATION...

POTASSIUM CONTENT (ppm)					
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S2F3 I	1968.33	2035.06	2001.69	±	33.37
S2F3 II	3902.22	3762.57	3832.40	±	69.82
S2F3 III	3119.07	2999.30	3059.19	±	59.89
S2F3 IV	3242.69	3373.24	3307.96	±	65.27
S3F0 I	2936.59	2731.06	2833.82	±	102.77
S3F0 II	2337.32	2445.51	2391.41	±	54.09
S3F0 III	2643.75	2828.78	2736.26	±	92.51
S3F0 IV	3247.76	3001.50	3124.63	±	123.13
S3F1 I	2517.43	2785.81	2651.62	±	134.19
S3F1 II	1898.60	2012.09	1955.34	±	56.75
S3F1 III	2708.45	2697.47	2702.96	±	5.49
S3F1 IV	2799.76	2815.40	2807.58	±	7.82
S3F2 I	3037.27	3206.52	3121.89	±	84.63
S3F2 II	3650.87	3474.78	3562.83	±	88.05
S3F2 III	3771.70	3853.45	3812.58	±	40.87
S3F2 IV	3771.10	3702.23	3736.66	±	34.44
S3F3 I	3019.87	3081.99	3050.93	±	31.06
S3F3 II	3859.01	3716.08	3787.55	±	71.46
S3F3 III	3254.79	3275.79	3265.29	±	10.50
S3F3 IV	3311.36	3265.10	3288.23	±	23.13

LEGEND:

S1 = 2 mmhos NaCl
S2 = 4 mmhos NaCl
S3 = 8 mmhos NaCl

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 6A. CONCENTRATION OF AVAILABLE POTASSIUM (ppm) IN SOIL AFTER PLANTING PEANUT.

SAMPLE CODE	AVAILABLE POTASSIUM (ppm) TRIAL I	TRIAL II	MEAN		
S1F0 I	230.77	235.37	233.07	±	2.30
S1F0 II	246.67	237.37	242.02	±	4.65
S1F0 III	253.90	238.92	246.41	±	7.49
S1F0 IV	249.34	236.89	243.12	±	6.22
S1F0 V	215.34	208.79	212.07	±	3.28
S1F1 I	285.12	274.12	279.62	±	5.50
S1F1 II	223.55	230.29	226.92	±	3.37
S1F1 III	240.24	234.99	237.62	±	2.62
S1F1 IV	235.38	238.65	237.02	±	1.63
S1F1 V	219.13	235.46	227.30	±	8.16
S1F2 I	307.49	300.23	303.86	±	3.63
S1F2 II	277.22	274.87	276.05	±	1.18
S1F2 III	237.11	246.86	241.99	±	4.88
S1F2 IV	310.52	304.75	307.64	±	2.89
S1F2 V	299.90	288.09	294.00	±	5.90
S1F3 I	294.71	316.80	305.76	±	11.04
S1F3 II	273.95	271.42	272.69	±	1.26
S1F3 III	240.96	289.37	265.17	±	24.20
S1F3 IV	243.44	279.02	261.23	±	17.79
S1F3 V	342.22	351.91	347.07	±	4.84
S3F0 I	275.44	295.90	285.67	±	10.23
S3F0 II	251.19	234.24	242.72	±	8.48
S3F0 III	245.90	234.13	240.02	±	5.88
S3F0 IV	263.02	271.58	267.30	±	4.28
S3F0 V	282.66	260.96	271.81	±	10.85

CONTINUATION...

AVAILABLE POTASSIUM (ppm)					
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S3F1 I	288.29	277.68	282.99	±	5.30
S3F1 II	289.59	288.54	289.07	±	0.53
S3F1 III	288.64	289.75	289.20	±	0.56
S3F1 IV	252.78	266.02	259.40	±	6.62
S3F1 V	263.61	258.37	260.99	±	2.62
S3F2 I	354.87	353.93	354.40	±	0.47
S3F2 II	291.39	268.83	280.11	±	11.28
S3F2 III	294.11	320.44	307.28	±	13.16
S3F2 IV	234.92	238.19	236.56	±	1.63
S3F2 V	385.62	372.33	378.98	±	6.64
S3F3 I	338.89	403.85	371.37	±	32.48
S3F3 II	141.83	152.08	146.96	±	5.12
S3F3 III	213.32	221.14	217.23	±	3.91
S3F3 IV	199.47	199.18	199.33	±	0.14
S3F3 V	222.09	207.18	214.64	±	7.45

LEGEND:

S1 = 2 mmhos/cm NaCl
S3 = 8 mmhos/cm NaCl

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 6b. CONCENTRATION OF AVAILABLE POTASSIUM (ppm) IN SOIL BEFORE PLANTING PEANUT.

	AVAILABLE POTASSIUM (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S1F0 I	184.64	175.53	180.09	±	4.55
S1F0 II	168.10	170.19	169.15	±	1.04
S1F0 III	238.93	229.45	234.19	±	4.74
S1F0 IV	180.58	165.28	172.93	±	7.65
S1F0 V	140.47	141.89	141.18	±	0.71
S1F1 I	447.24	444.73	445.99	±	1.26
S1F1 II	174.85	168.01	171.43	±	3.42
S1F1 III	315.69	317.63	316.66	±	0.97
S1F1 IV	178.41	181.52	179.97	±	1.55
S1F1 V	278.64	287.10	282.87	±	4.23
S1F2 I	479.14	478.13	478.64	±	0.51
S1F2 II	181.05	177.62	179.34	±	1.71
S1F2 III	375.76	363.66	369.71	±	6.05
S1F2 IV	197.57	190.54	194.06	±	3.51
S1F2 V	452.95	452.28	452.62	±	0.33
S1F3 I	177.09	180.20	178.65	±	1.55
S1F3 II	372.31	364.53	368.42	±	3.89
S1F3 III	202.34	181.19	191.77	±	10.57
S1F3 IV	291.82	292.50	292.16	±	0.34
S1F3 V	333.35	304.53	318.94	±	14.41
S3F0 I	211.86	200.42	206.14	±	5.72
S3F0 II	176.32	165.73	171.03	±	5.29
S3F0 III	161.57	154.16	157.87	±	3.70
S3F0 IV	202.54	200.64	201.59	±	0.95
S3F0 V	160.81	156.40	158.61	±	2.20

TABLE 6A. CONCENTRATION OF AVAILABLE POTASSIUM (ppm) IN SOIL AFTER PLANTING PEANUT.

	AVAILABLE POTASSIUM (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S1F0 I	230.77	235.37	233.07	±	2.30
S1F0 II	246.67	237.37	242.02	±	4.65
S1F0 III	253.90	238.92	246.41	±	7.49
S1F0 IV	249.34	236.89	243.12	±	6.22
S1F0 V	215.34	208.79	212.07	±	3.28
S1F1 I	285.12	274.12	279.62	±	5.50
S1F1 II	223.55	230.29	226.92	±	3.37
S1F1 III	240.24	234.99	237.62	±	2.62
S1F1 IV	235.38	238.65	237.02	±	1.63
S1F1 V	219.13	235.46	227.30	±	8.16
S1F2 I	307.49	300.23	303.86	±	3.63
S1F2 II	277.22	274.87	276.05	±	1.18
S1F2 III	237.11	246.86	241.99	±	4.88
S1F2 IV	310.52	304.75	307.64	±	2.89
S1F2 V	299.90	288.09	294.00	±	5.90
S1F3 I	294.71	316.80	305.76	±	11.04
S1F3 II	273.95	271.42	272.69	±	1.26
S1F3 III	240.96	289.37	265.17	±	24.20
S1F3 IV	243.44	279.02	261.23	±	17.79
S1F3 V	342.22	351.91	347.07	±	4.84
S3F0 I	275.44	295.90	285.67	±	10.23
S3F0 II	251.19	234.24	242.72	±	8.48
S3F0 III	245.90	234.13	240.02	±	5.88
S3F0 IV	263.02	271.58	267.30	±	4.28
S3F0 V	282.66	260.96	271.81	±	10.85

CONTINUATION...

AVAILABLE POTASSIUM (ppm)					
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S3F1 I	288.29	277.68	282.99	±	5.30
S3F1 II	289.59	288.54	289.07	±	0.53
S3F1 III	288.64	289.75	289.20	±	0.56
S3F1 IV	252.78	266.02	259.40	±	6.62
S3F1 V	263.61	258.37	260.99	±	2.62
S3F2 I	354.87	353.93	354.40	±	0.47
S3F2 II	291.39	268.83	280.11	±	11.28
S3F2 III	294.11	320.44	307.28	±	13.16
S3F2 IV	234.92	238.19	236.56	±	1.63
S3F2 V	385.62	372.33	378.98	±	6.64
S3F3 I	338.89	403.85	371.37	±	32.48
S3F3 II	141.83	152.08	146.96	±	5.12
S3F3 III	213.32	221.14	217.23	±	3.91
S3F3 IV	199.47	199.18	199.33	±	0.14
S3F3 V	222.09	207.18	214.64	±	7.45

LEGEND:

S1 = 2 mmhos/cm NaCl
S3 = 8 mmhos/cm NaCl

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 6b. CONCENTRATION OF AVAILABLE POTASSIUM (ppm) IN SOIL BEFORE PLANTING PEANUT.

	AVAILABLE POTASSIUM (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S1F0 I	184.64	175.53	180.09	±	4.55
S1F0 II	168.10	170.19	169.15	±	1.04
S1F0 III	238.93	229.45	234.19	±	4.74
S1F0 IV	180.58	165.28	172.93	±	7.65
S1F0 V	140.47	141.89	141.18	±	0.71
S1F1 I	447.24	444.73	445.99	±	1.26
S1F1 II	174.85	168.01	171.43	±	3.42
S1F1 III	315.69	317.63	316.66	±	0.97
S1F1 IV	178.41	181.52	179.97	±	1.55
S1F1 V	278.64	287.10	282.87	±	4.23
S1F2 I	479.14	478.13	478.64	±	0.51
S1F2 II	181.05	177.62	179.34	±	1.71
S1F2 III	375.76	363.66	369.71	±	6.05
S1F2 IV	197.57	190.54	194.06	±	3.51
S1F2 V	452.95	452.28	452.62	±	0.33
S1F3 I	177.09	180.20	178.65	±	1.55
S1F3 II	372.31	364.53	368.42	±	3.89
S1F3 III	202.34	181.19	191.77	±	10.57
S1F3 IV	291.82	292.50	292.16	±	0.34
S1F3 V	333.35	304.53	318.94	±	14.41
S3F0 I	211.86	200.42	206.14	±	5.72
S3F0 II	176.32	165.73	171.03	±	5.29
S3F0 III	161.57	154.16	157.87	±	3.70
S3F0 IV	202.54	200.64	201.59	±	0.95
S3F0 V	160.81	156.40	158.61	±	2.20

CONTINUATION...

AVAILABLE POTASSIUM (ppm)					
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S3F1 I	195.09	187.26	191.18	±	3.91
S3F1 II	417.12	415.83	416.48	±	0.64
S3F1 III	178.62	193.89	186.26	±	7.63
S3F1 IV	452.50	441.98	447.24	±	5.26
S3F1 V	171.48	177.73	174.61	±	3.13
S3F2 I	259.22	256.26	257.74	±	1.48
S3F2 II	457.27	443.48	450.38	±	6.89
S3F2 III	174.38	170.23	172.31	±	2.07
S3F2 IV	499.55	505.42	502.49	±	2.93
S3F2 V	220.05	221.99	221.02	±	0.97
S3F3 I	230.14	281.56	255.85	±	25.71
S3F3 II	229.12	234.04	231.58	±	2.46
S3F3 III	482.61	473.36	477.99	±	4.63
S3F3 IV	390.92	405.96	398.44	±	7.52
S3F3 V	262.07	215.67	238.87	±	23.20

LEGEND:

S1 = 2 mmhos/cm NaCl
S3 = 8 mmhos/cm NaCl

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha

TABLE 6c. POTASSIUM CONTENT (ppm) OF PEANUT SAMPLES.

	POTASSIUM CONTENT (ppm)				
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S1F0 I	4036.43	3845.20	3940.81	±	95.62
S1F0 II	4030.57	4214.32	4122.45	±	91.87
S1F0 III	3839.46	4137.28	3988.37	±	148.91
S1F0 IV	3306.05	3515.00	3410.53	±	104.48
S1F0 V	3766.78	3672.46	3719.62	±	47.16
S1F1 I	4674.33	4666.53	4670.43	±	3.90
S1F1 II	3819.82	3810.70	3815.26	±	4.56
S1F1 III	4284.65	4224.30	4254.48	±	30.17
S1F1 IV	4615.99	4361.31	4488.65	±	127.34
S1F1 V	3805.64	3518.04	3661.84	±	143.80
S1F2 I	4154.23	4008.24	4081.24	±	73.00
S1F2 II	3896.91	4027.06	3961.99	±	65.07
S1F2 III	3902.12	3939.92	3921.02	±	18.90
S1F2 IV	4084.80	4039.25	4062.02	±	22.78
S1F2 V	4065.32	3859.91	3962.62	±	102.71
S1F3 I	4446.60	4259.13	4352.87	±	93.74
S1F3 II	3786.75	4031.22	3908.98	±	122.24
S1F3 III	4135.94	4376.31	4256.12	±	120.18
S1F3 IV	4040.71	3773.44	3907.08	±	133.63
S1F3 V	3942.79	3724.99	3833.89	±	108.90
S3F0 I	3976.88	4095.60	4036.24	±	59.36
S3F0 II	3560.06	3606.22	3583.14	±	23.08
S3F0 III	3533.01	3485.53	3509.27	±	23.74
S3F0 IV	3834.85	3895.07	3864.96	±	30.11
S3F0 V	3537.29	3456.50	3496.89	±	40.40

CONTINUATION...

POTASSIUM CONTENT (ppm)					
SAMPLE CODE	TRIAL I	TRIAL II	MEAN		
S3F1 I	4187.39	4139.40	4163.39	±	23.99
S3F1 II	4217.64	4128.08	4172.86	±	44.78
S3F1 III	4160.46	4133.07	4146.77	±	13.69
S3F1 IV	4081.63	4045.84	4063.74	±	17.90
S3F1 V	4150.68	4141.97	4146.33	±	4.36
S3F2 I	3407.17	3385.62	3396.40	±	10.77
S3F2 II	4543.87	4429.34	4486.60	±	57.27
S3F2 III	3469.94	3479.54	3474.74	±	4.80
S3F2 IV	3653.88	3663.86	3658.87	±	4.99
S3F2 V	3883.64	3808.18	3845.91	±	37.73
S3F3 I	3807.68	3468.24	3637.96	±	169.72
S3F3 II	3057.52	2994.22	3025.87	±	31.65
S3F3 III	4128.07	3948.42	4038.25	±	89.83
S3F3 IV	3618.85	3652.21	3635.53	±	16.68
S3F3 V	4400.87	4096.66	4248.76	±	152.10

LEGEND:

S1 = 2 mmhos/cm NaCl
S3 = 8 mmhos/cm NaCl

F0 = 0 kg NO3/ha
F1 = 75 kg NO3/ha
F2 = 150 kg NO3/ha
F3 = 300 kg NO3/ha