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Salinité - Gypse

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Damas

LE CENTRE ARABE
POUR LES ETUDES DES ZONES ARIDES ET DES TERRES SÉCHES
(ACSAD)

La Centre Arabe
Pour les Etudes des Zones Arides & des Terres Sèches

ACSAD

No. 2801 (2^{ème} édition)

Salinité - Gypse

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Foreword

The compilation of these abstracts has been carried out by the staff of soil laboratory using its own bibliography. Revision and up-dating shall be made whenever enough material is collected to justify a new edition. Furthermore, these abstracts are limited to common methods of analysis usually performed in laboratories of soil survey, soil conservation and general agriculture with special emphasis on soils of arid zones. Specific research topics have been excluded, though some papers dealing with interpretation of results or theoretical aspects of methods have been also reviewed.

Until now, three abstracts have been published: (Sulfate, Cation Exchange Capacity, Exchangeable Cation & this one), some others are being prepared and they will be sent to all applicants. For each abstract a number is coded in a machine readable form for fast retrieval and we hope to publish them by computer printing in a near future.

Our main objective is to help the soil analyst in finding the publication which could be useful to him. To fulfill this expectation: the number of papers reviewed must be as high as possible. We would appreciate to receive from the readers reprints of their own which are available to us.

The KEYWORDS, CODE & ORDR references are used for bibliographic classification and automatic retrieval.

مقدمة

جمعت ملخصات هذه البحوث العلمية من قبل العاملين في مختبر الاراضي فسي المركز العربي ومن مكتبهم الخاصة . وتتناول هذه الملخصات بالبحث بصورة خاصة طرق التحليل الفيزيائية والكيميائية للتربة والمياه والنبات المتبعة عادة في مختبرات Soil Survey و Soil Conservation Service ومعظم النشرات العلمية التي تتعلق بالمناطق القاحلة . وقد تم استبعاد بعض المواضيع من جهة ، الا أنه قد تم التركيز على المواضيع المتعلقة بتفسير النتائج والقسم العملي للطرق التحليلية بشكل خاص .

تم حتى الان اصدار ثلاث من ملخصات البحوث هذه ، تتعلق بالكبريت والكبريتات ، التبادل الكاتيوني والسعة التبادلية للتربة ، الكالسيوم - المغنيزيوم - البوتاسيوم والنسب يوم واللواتي تحمطن على التوالي الارقام - ٢٤٠٠ ، ٣٤٠٠ ، ٤٠٠ - وتضم ايضا تحضير مجموعة اخرى من هذه الملخصات ستصدر على التوالي وترسل الى الراغبين في الحصول عليها . وتحمل كل واحدة من هذه المختصرات رقما معيناً يمكن قراءته آليا ، وتطلع في القريب العاجل على استخدام الحقل الالكتروني في تصنيفها . ان الهدف الرئيسي لهذا العمل هو مساعدة العاملين في المختبرات في الحصول على طرق التحليل الفيزيائية والكيميائية التي يمكن ان تكون مفيدة لهم بصورة سهلة واختيار المناسب منها حسب طبيعة العمل التحليلي الذين يقومون به .

اننا نرجب بجميع الاقتراحات والملاحظات على هذا العمل التي ستقدم لنا الفائدة في تحسين نوعيته ووضعه بالصورة الافضل .

ان الكلمات KEY WORDS - CODE - ORDR تستخدم من اجل التصنيف حسب الطريقة التي تم اعتمادها من قبل العاملين في مختبر الاراضي في المركز العربي .

Authors : ABROL (I.P) - DAHIYA (I.S) & BHUMBLA (D.R)
Title : On the method of determining gypsum requirement of soils.
Public : Soil Science 120-(1)-1975.
Pages/ref: 30-36 / 7 ref.

Summary:

The classical method of determination of the gypsum requirement of saline soils consists in shaking a known quantity of soil with a saturated gypsum solution (soil/solution ratio 1/20 about) and to measure the decrease in calcium concentration of the solution.

When soils contain sodium carbonates (saline sodic soils), CaCO_3 precipitates during the analysis, and the excess of exchangeable sodium is overestimated. Experiments on a saline sodic soil (salonatric calciorthid) were made in leaching columns to determine the effect of the nature of the amendment (gypsum or calcium chloride) and the system of application on the precipitation of carbonates during leaching. The results were in favor of surface application in the field. In the laboratory; it is suggested to eliminate soluble carbonates by washing it with 60% ethanol used under similar conditions, gypsum produced a lower carbonate precipitation than calcium chloride.

Tables : - Characteristics of the soil sample.
- Effect of different treatments on carbonate precipitation, on exchangeable calcium and on hydraulic conductivity of soils.
- Changes in hydraulic conductivity in respect to different soil treatments (in laboratory).
- Gypsum requirement of soils containing varying quantities of soluble carbonates.

Chemicals: Gypsum - Ethanol.

Key Words: SALI / GYPS / Na-EXCHAN / Ca-EXCHAN /

Author :: ALLISON (L.E)
Title : Oversaturation method for preparing saturation extract for salinity purposes.
Public : Soil Science 116, 2, 1973.
Pages/ref: 65-69 / 5 ref.

Summary:

This paper presents a procedure for preparing saturation extracts and an effective test to determine the point of saturation. An excess of water is added and mixed with the soil sample and after settling the excess water is adsorbed by addition of dry soil. The procedure is said to be more rapid than conventional mixing. In addition it prevents the puddling effect when working with fine-textured soils.

Figures : - Approximate quantity of water to add to 300 gr of soil according to its texture to reach nearby saturation.
- Illustration of streak test for saturation.
- Comparison of standard procedure and oversaturation method apparatus for vacuum extraction of saturated soils.

Precision: - Oversaturation method gives results slightly lower than conventional method (3 to 8% less for 11 samples ranging from sand-loam to clay)..

Material : Vacuum pump.

Key Words: SALI / COND /

Auteur : XXX/ARIANA
Titre : Dosage du Gypse. Méthode Cinétique, Méthode Conductimétrique.
Public : Laboratoire de la D.R.E.S., TUNIS.
Pages/ref: 5 pages / 3 ref.

Résumé:

Trois méthodes sont utilisées pour la détermination du gypse dans le sol.

1. Méthode conductimétrique: (USSL, 1956). 20 ml d'acetone pur sont ajoutés à 20ml d'extrait aqueux 1/20 de sol. Le précipité est séparé par centrifugation, dissous dans 40ml d'eau distillée et sa conductivité électrique est mesurée et comparée à une gamme étalon. Cette méthode permet un dosage du gypse jusqu'à 5.2% avec un extrait 1/20 et 26% avec un extrait 1/100.

2. Une méthode de mesure du gypse à partir de la décomposition avec du carbonate d'ammonium (ou de sodium) 5%. L'ion sulfate libéré est précipité au chlorure de barium 20% à chaud. La mesure gravimétrique de l'ion sulfate donne la teneur en gypse. Cette méthode est applicable à toutes les teneurs en gypse.

3. Une méthode dite cinétique qui consiste à décomposer le gypse à température constante pendant des temps t_1 , t_2 , t_3 sur les parties aliquotes de l'échantillon de sol et à enregistrer les résultats obtenus en fonction du temps. A l'intérieur d'une même profil la plus ou moins grande cohérence des cristaux de gypse peut-être ainsi mise en évidence par une méthode chimique.

Matériel : Conductimètre.

Produits : Acetone, Carbonate d'ammonium, Chlorure de barium, Acide chlorhydrique, Rouge de méthyle.

Mots Clés: GYPS / COND /

Authors : AVNIMELECH (Y) & EDEN (I)
 Title : The effect of soil:water ratios on the agronomic significance of the electrical conductivity of saturated paste extracts¹.
 Public : Soil Science & Plant Analysis 1-(4)-1970.
 Pages/ref: 221-226 / 4 ref.

Summary:

It is proposed to use the electrical conductivity of soil at field capacity (EC_f) to judge soil plant inter-relationship. A corrected equation which relates EC_f to the electrical conductivity of saturated extract EC_e is proposed. The original equation was $EC_f = EC_e \theta_s / \theta_f$ where θ_s and θ_f are the moisture contents of soil at saturation and field capacity respectively. To establish the corrected equation, a pot experiment was conducted in which wheat seeds were sown in a soil being at field capacity (θ_{fo}). The plants were then collected after six days and the moisture content of soil determined (θ_{f1}). Different soils (saturation percentage θ_s 31 to 75) were used. It is demonstrated that when the value $(\theta_{fo} + \theta_{f1})/2$ is used in equation (1) instead of θ_f to calculate EC_f a better correlation is obtained between the yield (fresh weight) and the salinity (EC_f).

Figures : Schematic presentation of the dependance of critical electrical conductivity values of saturated paste extracts on the ratio θ_f / θ_s :

- Water contents of soils (θ_s , θ_{f1} , θ_{fo} , ...)
- Fresh weight of 6 days old wheat seedlings as affected by salinity when expressed: a) as EC_e and b) as EC_f .

Equipment: Conductivity bridge.

Key Words: COND / SALI /

Author : AYERS (R.S)
 Title : Tentative Guidelines: Interpretation of quality of waters for irrigation.
 Public : In: Prognosis of Salinity & Alkalinity; FAO Soil Bulletin No. 31, 1976.
 Pages/ref: 221-240 / 13 ref.

Summary:

The problems related to the quality of water of irrigation were reviewed and guidelines have been prepared as far as salinity, permeability and toxicity are concerned. Crop tolerance table are given as well as leaching requirement (LR) for various crops and specific qualities of water. Recommended analysis for water evaluation include EC, Mg+Ca, CO_3+HCO_3 , Cl, SO_4 , B, NO_3 , pH. Permeability problems due to unbalanced sodium/calcium ratio of concentrations are evaluated by an adjusted Sodium Adsorption Ratio:

$$\text{Adj. SAR} = \text{SAR} (1 + (8.4 - \text{pHc}))$$

pHc being a value related to the total salinity as measured by (Na+Ca+Mg), the Ca+Mg supply in the water, and the carbonate + bicarbonate present. Tables are given based on Ca+Mg values from 0.5 to 76.0 meq/l and CO_3+HCO_3 values varying from 0.05 to 19.8 meq/l. pHc values are indicative of the tendency of irrigation water to precipitate their own lime or to dissolve lime from soil.

Eleven analysis of waters are given showing boron concentration, SAR and adj. SAR with comments on potential quality for irrigation.

- Tables :
1. Guidelines for interpretation of quality of water for irrigation.
 2. Crop tolerance and leaching requirement tables (Fruit, vegetable, forage and field crops).
 3. Tables for calculating pHc values of waters.
 4. Relative tolerance of plants to Boron.
 5. Typical water analysis (Ec, Ca+Mg, Na, CO_3+HCO_3 , Cl, B, NO_3-N).

Key Word : SALI /

Author : BOCK (E)
Title : On the solubility of anhydrous calcium sulfate and of gypsum in concentrated solutions of NaCl at 25°C, 30°C, 40°C and 50°C.
Public : Canadian Journal of Chemistry 39, 1961.
Pages/ref: 1746-1751 / 4 ref.

Summary:

The depression of the gypsum anhydrite transition point by addition of NaCl was studied. Two saturated solutions of gypsum and anhydrous calcium sulfate were obtained by addition of an excess of each salt to a solubility cell containing a known composition of sodium chloride solution. The cell and its contents were immersed in a water bath with a temperature controlling system and stirred for 48-72-96 h.s. The result showed no variation in solubility at different shaking time. Plotting the solubility of CaSO_4 and $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ versus sodium chloride was then possible to determine the transition point-temperature of the two salts. The variation of the transition point of the system with the temperature was experimentally found by this way and compared with theoretical value calculated from thermodynamic equations. The nature of the precipitate which occurs by evaporation of a solution of CaSO_4 in sodium chloride solution can be predicted from this curve.

Tables-Figures:

- Solubility of CaSO_4 and $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ in sodium chloride solutions (1N to 5N).
- Variation of transition point with temperature (25 to 50°C).
- Solubility in pure water for CaSO_4 and $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$.
- Isotherms: a) 25°C, b) 30°C, c) 40°C, d) 50°C for CaSO_4 anhydrous and $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$.

Material : Solubility cell ; Water bath with temperature controlling system.

Chemicals: CaSO_4 - $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$; those necessary for Ca titration, AgNO_3 , Potassium chromate.

Key Words: GYPS / SALI / LABIL /

Author : BCUMANS (J.H)
Title : Alkalinity aspects of Leaching of salts affected soils.
Public : In: Reclamation of salts affected soils in Iraq.
I.I.L.R.I., Wageningen 1963 (Dieleman Ed.).
Pages/ref: 48-56 / 49 ref.

Summary

South of Baghdad the soils of Tigris and Euphrates plains are saline (estimated average ESP 20 to 25). Gypsum is present in most sub-soils and 20 to 30% of lime are found commonly. The behavior of these soils during leaching was studied in field experiments. Relationship were developed: -(a) between soil salinity as measured in 1/2 extract, pH and exchangeable sodium at different levels of ESP (from 0 to above 30). -(b) between ESP and EC of 1/1 extract at constant pH. On the soil submitted to experiment, the alkalinity may be predicted by performing two simple tests (i.e PH and EC) and using the relation developed in the paper.

Tables : - Composition of Tigris water (Baghdad 1949)
- Average infiltration rate for 10 soils (0-250 cm depth).
- Soil analysis after leaching tests.
- Decrease of Exchangeable Sodium and salt during leaching.
- Relationship between ESP, pH and salinity.
- Relationship between soil salinity and Exchangeable Na (pH 7.3) .

Key Words: SALI / SODIUM-ECHAN /

Authors : BOWER (C.A), REITEMETER (R.F) & FIREMAN (M)
 Title : Exchangeable cation analysis of saline and alkali soils
 Public : Soil Science 73-4-1952
 Pages/ref: 251-261 / 16 ref.

Summary:

The determination of exchangeable cations (EC), and cation exchange capacity (CEC) is considered with the evaluation of soluble salts (SS) in saturation extract.

EC are determined on 5 gr of soil by three times 33ml of 1N PH7 amonium acetate. Soluble cations in a saturated paste from 200gr of soil. For CEC, 5gr of soil is saturated by four 33 ml portions of 1N PH8.2 sodium acetate, washed with 95% ethanol. Efficiency of washing is controlled by electric conductivity (less than 40 micro S/cm). Displacement step is done by neutral amonium acetate. CEC is proportional to sodium extracted in this last solution.

The paper details experimental conditions, for instance the optimum number of acetate extractions to remove (EC+SS) on saline, calcareous and non saline soil samples. Data indicate that three extractions are sufficient to remove all soluble and exchangeable cations. Four treatments with sodium acetate are sufficient to saturate exchangeable sites with sodium.

Hydrolysis of exchangeable sodium upon washing treatment is investigated.

- Tables :
- Amounts of various cations removed by successive amonium acetate extractions of soils.
 - Amounts of Ca plus Mg removed by sodium acetate extraction of soil.
 - PH value of successive acetate extracts of soils.
 - Removal of excess salts hydrolysis of exchangeable Na upon washing sodium-treated soil with ethanol.
 - CEC of soils by Na at various PH values.
 - Influence of CaCO_3 upon values obtained for the CEC by saturation with normal sodium acetate solution of PH 8.2 .

Material : Flame Photometer - PH-meter .

Chemicals: Amonium acetate, Sodium acetate, Ethanol.

Key Words: ECEC / SALL /

Authors : CHANG (P.C) & VAN SCHAIK (J.C)
Title : Automated Method for Soil Salinity Studies.
Public : Technicon Symposium " Automation in Analytical Chemistry "
Pages/ref: 94-95 / 3 ref.

Summary:

Soil salinity is estimated by calculating exchangeable sodium percentage (ESP) from the values of Ca, Mg, Na concentrations in the saturation extract of the soil sample. The paper presents simultaneous determination of Na^+ and $(\text{Ca}^{++} + \text{Mg}^{++})$ in an autoanalyser assembly including a colorimeter, a flame photometer and a double-pen recorder. The results obtained are compared with a direct flame photometric method for Na and with volumetric titration with Eriochrome Black T for the sum $(\text{Ca}^{++} + \text{Mg}^{++})$.

Figures : Flow diagram (16 tubes).
Concentrations of Na and (Ca+Mg) in soil extracts as found by different methods:
- (a) for EC less than 1.3 mS,
- (b) for EC greater than 1.3 mS.

Precision: Max. concentration of the sum calcium plus magnesium is 100 meq/l with the flow system adopted.

Equipment: Continuous flow colorimeter, peristaltic pump (16 positions), dialyzer, " in-line colorimeter ", two-channels flame photometer, two-ways recorder.

Chemicals: Lithium nitrate, Na_2Mg EDTA, Ammonium chloride, Calgamite, Indicator, NaCl, MgCl_2 .

Key Words: SALI / COLOR /

Auteur : COUTINET (Sylvie)
 Titre : Méthodes d'analyses utilisables pour les sols salés, calcaires et gypseux.
 Public : Agron. Tropicale 12-1965.
 Pages/ref: 1242-1253 / 7 ref.

Résumé:

Pour l'analyse physique, si le sol est salé, il est lavé avec de l'eau distillée jusqu'à disparition des ions chlorures. Si le sol est gypseux (teneur inférieure à 25%), il est traité avec de l'oxalate d'ammonium de 1 à 5gr/l à l'ébullition pendant une heure. Le traitement est répété jusqu'à disparition du gypse. Pour des teneurs supérieures, il faut traiter le sol avec une solution de NaCl à 132gr/l à froid; on répète l'opération si nécessaire.

Analyse Chimique: Le gypse est dissous par le carbonate d'ammonium et précipité à l'état de sulfate de barium mesuré gravimétriquement. Ca et Mg sont dosés par complexométrie à la calceïne + thymolphthaleïne pour Ca seul et au noir d'eriochrome avec EDTA (Mg) pour la somme: calcium plus magnesium. Na et K sont dosés par photométrie de flamme.

- L'extraction de Na et K échangeables est faite par NH_4Cl avec correction pour Na et K solubles dans l'eau. L'extraction du Ca et Mg est faite en deux temps par NaCl avec correction pour Ca et Mg solubles dans la deuxième fraction de NaCl. (On suppose que la cinétique de dilution est linéaire par rapport au temps et aux volumes).
- Sols gypseux: La même méthode est utilisée mais un gros excès de gypse est ajouté à l'échantillon, une correction est faite pour le gypse solubilisé dans chaque fraction.

Capacité d'échange:

1. Sols Salés: lessivage des sels solubles par acetate d'ammonium (pH=7) puis saturation par une solution CaCl_2 (pH=7); ensuite déplacement avec une solution KNO_3 . On dose Ca et Cl, la différence étant proportionnelle à la CEC.
2. Sols calcaires: la même méthode est utilisée mais en retranchant la quantité de Ca correspondant à la dissolution des carbonates (dosés par acidimétrie).
3. Sols gypseux: On utilise encore la même méthode en corrigeant pour la quantité de Ca correspondant à CaSO_4 (par dosage du SO_4^{--}).

Tableau : Calcul des constantes de cellules et correction des conductivités suivant la température.

Mots Clés: SALI / GYPS / ECEC / GRAN /

Auteur : DABIN (B)
Titre : Méthodologie de détermination des sels et des éléments fertilisants dans les sols calcaires gypseux et salés avec application des méthodes automatiques.
Public : Workshop on Soil, Water & Plant Analysis, ACSAD-AWRC Riyadh, Octobre 1977.
Pages/ref: 121-134 / 10 ref.

Résumé:

Les problèmes posés par l'automatisation des analyses de sol sont passées en revue pour les méthodes d'extraction des éléments totaux, des éléments assimilables et solubles, ainsi que des cations échangeables et capacité d'échange. Les méthodes par fusion au métaborate de strontium dans un four à induction pour les éléments totaux des roches et les sols, les méthodes par combustion pour les plantes dont les éléments sont ensuite dosés par colorimétrie en flux continu; l'analyse du carbone et du soufre par combustion et coulométrie. Une méthode originale d'estimation du phosphore assimilable en sols calcaires et gypseux utilisés dans les laboratoires de l'CRSTOM depuis de longues années est présentée; l'automatisation de la mesure des sels solubles est discutée en détail, un extrait systématique soi/eau en 1/2 semblant être la meilleure solution, cet extrait ne provoquant pas l'hydrolyse du Na fixé sur le complexe absorbant.

Pour les bases échangeables, l'avantage considérable d'un sel non tamponné, comme le KNO_3 est qu'il permet d'affectuer une correction pour les carbonates dissous. La valeur de (Ca + Mg) échangeables et même de Ca échangeable peut-être calculée facilement avec dosage systématiques des carbonates et sulfate.

Figures : Graphique de comparaison entre les concentrations des extraits saturés et des extraits 1/2, 1/5, 1/10^e d'un même échantillon, par exemple de mesure de sels solubles et de cations échangeables avec correction.

Mots Clés: SALI /

CODE: 2804-01 / c-47-54-c / 80

GRNR: 0603

Author : DARAB (K)
Title : Laboratory analysis of soils related to the prognosis and monitoring of salinity and alkalinity.
Public& : In: Prognosis of Salinity & Alkalinity, FAO Soil Bulletin No. 31, 1976 (English version).
Pages/ref: 147-157 / no ref.

Summary:

Determination of physical and hydrophysical characteristics of soils, chemical characterization and fertility parameters are reviewed. Their use in estimating and monitoring soil salinity is evaluated. The electrical conductivities of 1/5 extract and saturation extract are compared and discussed in the case of chloride salinization, NaCl, MgCl₂ and soda salinization. The accuracy of the determination of exchangeable cations and CEC is reviewed in relation to the soil properties and the method used.

Key Words: SALI / GENER /

DARA

Authors : ELSEEWI (A.A) - ELATTAR (H.A) & DAQUD (A.M)
Title : Relationship between soluble and exchangeable sodium in some
soils in the Nile Delta: An examination of the SAR concept.
Public : Soil Science 124, 4, 1977.
Pages/ref: 249-264 / 8 ref.

Summary:

The SAR parameter (sodium adsorption ratio, or $1.41\text{Na} / (\text{Ca} + \text{Mg})^{1/2}$ where concentrations are expressed in mg/l in the saturation extracts) is an indirect way to estimate ESP, (exchangeable sodium percentage) providing the relationship between ESP and SAR is general. This relationship is examined in 31 surface-soils from the Nile Delta and compared with data obtained earlier with different soils. Soluble plus exchangeable cations are measured in NH_4OAC pH7.0 for Na and K and NaOAC pH8.2 for Ca and Mg; results of exchangeable cations are given after subtracting the corresponding values found in saturation extract.

Regression equations are calculated first between SAR and ESR and then, between SAR and ESP ($\text{ESR} = \text{ES} / (\text{CEC} - (\text{ES} + \text{EK}))$) over a wide range of ESP values.

Observed values (from soil analysis) and calculated values are compared and discussed for 31 soils.

Tables : 1. Location of sampling sites in the Nile Delta.
2. Chemical and physical characteristics of the soils studied.
3. Relationship between SAR and ESR.
4. SAR in relation to calculated ESP and to observed ESP.

Precision: $\text{ESR} = 0.0273 + 0.01457 \text{ SAR}$ ($r = 0.934$) Author's
 $\text{ESR} = -0.0126 + 0.01475 \text{ SAR}$ ($r = 0.923$) U.S. Sal.
 $\text{ESR} = 0.0057 + 0.0173 \text{ SAR}$ Rower's

Chemicals: Those necessary for CEC and for Na, K, Ca, Mg analysis and extraction.

Key Words: SALI / ECEC / SODIUM-ECHAN / PRECS /

Auteurs : GARDET (J.J), GUILHOT (B), PIOT (J) & SOUSTELLE (M)
 Titre : Etude de la déshydratation dans l'air et sous vide du sulfate de calcium dihydraté.
 Public ; Bul. de la Société Chimique de France No.3, 1970.
 Pages/ref: 827-831 / 26 ref.

Résumé:

Du sulfate de calcium dihydraté pur, ne contenant pas de forme semi-hydratée est préparé en solution à partir de chlorure de calcium et de sulfate de potassium. Les auteurs calculent les paramètres de la maille cristalline (monoclinique) qui contient quatre groupements $\text{CaSO}_4, 2\text{H}_2\text{O}$:

$$\begin{aligned} a &= 5.677 \pm 0.002 \text{ \AA} & b &= 15.192 \pm 0.003 \text{ \AA} \\ c &= 6.534 \pm 0.002 \text{ \AA} & \beta &= 118^\circ 24' \pm 4' \end{aligned}$$

ainsi que son comportement entre 25 et 75°C. L'étude thermogravimétrique de la déshydratation fait apparaître une brusque perte de 1.8 molécules d'eau entre 86° et 100°C (pour une vitesse de montée en température de 8°C/h) à l'air, et entre 31 et 51°C sous vide de 10^{-3} torr (vitesse 8°C/h). L'analyse thermique différentielle sur 50mgr de produit donne un pic endothermique à 89°C ± 1.5 (extrapolation à vitesse de chauffage nulle) à l'air et à 44°C ± 1 à 10^{-2} torr. Les auteurs montrent que même à 100°C et 10^{-2} torr pendant 12 heures on obtient $\text{CaSO}_4, 0.15 \text{ H}_2\text{O}$ et non pas la forme anhydre. Le double pic endothermique obtenu dans certaines conditions d'expérience provient de l'atmosphère du porte échantillons enrichi en vapeur d'eau.

Figures : - Paramètres h, k, l de la maille monoclinique.
 - Dilatation des paramètres de $\text{CaSO}_4, 2\text{H}_2\text{O}$ entre 10 et 60°C et du sulfate de calcium pseudo-anhydre.
 - Déshydratation de $\text{CaSO}_4, 2\text{H}_2\text{O}$ sous air et sous vide dynamique en thermogravimétrie en A.T.D.
 - Variation de la température apparente de déshydratation de $\text{CaSO}_4, 2\text{H}_2\text{O}$ sous air en fonction de la vitesse de chauffage par A.T.D.

Matériel : Thermobalance à enregistreur ; Appareil ATD.

Mots Clés: GYPS / ATD /

Authors : GARMAN (M) & HESSE (P.R)
Title : Cation Exchange Capacity of Gypsic Soils.
Public : Plant & Soil 42 , 1975.
Pages/ref : 477-480 / 1 ref.

Summary:

The method relies on saturation of exchange sites by barium at pH 8.1 . Barium is exchanged with magnesium using a standard magnesium sulfate solution. The CEC is determined by calculating the loss of magnesium from the added standard solution of magnesium sulfate. The method is applicable to soils containing up to 70% of gypsum providing some precautions:

1. A great excess of barium ions is used in saturation step.
2. EDTA titration of magnesium is corrected for calcium.

It was demonstrated that 1) even an excess of barium chloride does not dissolve all gypsum when present in quantities superior to 3% (overnight treatment). 2) pH 5.5 $MgSO_4$ treatment removes barium sulfate coating and an appreciable amount of remaining gypsum is dissolved during the second step of the procedure.

Tables : - CEC (meq/100g soil) of gypsic soil using the original and a modified version of the Bascomb's method.
- Calcium content of final magnesium sulfate extract of soils during determination of CEC by Bascomb's method.

Chemicals : Barium chloride , Magnesium sulfate , Solochrome dark blue.

Key Words : GYPSUM / ECEC / CARB /

Author : GILLMAN (G.P)
Title : A centrifuge method for obtaining soil solution.
Public : C.S.I.R.O Division of Soils Divisional Report No. 16, 1976.
Pages/ref: 1-6 / 11 ref.

Summary:

Soil solution is extracted from moist (PF 2.0) soil by centrifuging in a 700ml centrifuge cup prepared to receive 250gr of soil. A relative centrifugal force of 900gr is applied, the solution is collected at the bottom of the centrifuge cup. (The centrifuge tube is especially designed to ease this operation). The extract is then passed through a 0.2 microns filter paper.

Results: The change in centrifuge speed and time apparently does not affect the composition of the extract and successive increments of soil solution (5 to 8 ml) had the same electrical conductivity.

The method is applied to 18 soils having different clay composition (10 to 78%) to test the recovery of the moisture at PF2 (12 to 40%). Water recovery is dependant on clay percentage.

Figures : Centrifuge assembly design.

Tables : - Effect of time and speed of centrifugation on the volume of extracted solution.
- Composition of successive increments of soil solution from 500gr aliquots of two surface soils.
- Results of applying the centrifuge method to 18 samples.

Material : Centrifuge with 700ml cups.

Key Words: SALI / COND /

Author : HARDIE (L.A)
Title : The gypsum anhydrite equilibrium at one atmospheric pressure.
Public : The American Mineralogist 52, Jan.-Feb. 1967.
Pages/ref: 171-200 / 62 ref.

Summary:

An extensive study of the system gypsum / calcium sulfate (anhydrite) / $2\text{H}_2\text{O}$ is presented. The temperature of equilibrium is calculated as a function of the activity of H_2O . It leads to the values: 55° for a $\text{H}_2\text{O} = 0.960$

39° for a $\text{H}_2\text{O} = 0.845$

23° for a $\text{H}_2\text{O} = 0.770$

(the extrapolation for a $\text{H}_2\text{O} = 1.000$ leads to $58^\circ \pm 2^\circ\text{C}$). The activity of water in the system was varied by addition of Na_2SO_4 for low concentrations. It was found that static experiments were unsuitable and that agitation was necessary to promote the reactions leading to the equilibrium. The rate of reaction is followed by X-Ray diffraction patterns and microscope examination of small aliquots of the suspension. Three mechanisms of dehydration of gypsum to anhydrite are proposed.

The study relies on the supposition that the transition point of gypsum-anhydrite is independent of reaction products (i.e the reaction products are supposed to be pure in pure liquid water). Geological implications of this work cover a full chapter (page 189 to 194). A survey of thermodynamics results available to date is summarized in an appendix (and H_2SO_4 for higher concentrations)^x.

- Tables :
- Activities of H_2O in aqueous sulfuric acid solutions.
 - Activities of H_2O in the system (from 6 to 359 days at different temperatures (20 to 70°C)).
 - Solubility relations of gypsum and anhydrite in the system $\text{CaSO}_4\text{-H}_2\text{O}$ as function of P and T (compilation of previous works).
 - Microphotograph.
 - Thermodynamic values in appendix.

Key Words: GYPS / SALI / X-RAY /

Author : HESSE (P.R)
 Title : Some studies on gypsum and gypsic soils. Appendix 6: Some factors affecting solubility of gypsum.
 Public : FAO/Euphrate pilot irrigation project AGON/SF/SYR-522/ Nov. 1974.
 Pages/ref: 72-79 / no ref.

Summary:

Different factors affecting solubility of gypsum are reviewed and tested experimentally:

- a) Effect of particle size: The maximum solubility value of 2.61gr/l is obtained after 2 min. for particle less than 0.05m/m and 3.5 min. for particle between 0.5 and 1m/m diam. (0.1gr gypsum is 10ml water). The calculation of the solubility product of gypsum when it takes into account ion pair formation, leads to the value $2.44 \times 10^{-5} (m/l)^2$.
- b) The solubility of gypsum from rocks under standing water leads to the same value after 500 hours of contact while if gypsum particle are packet in leaching columns (0.6 x 6.0 cm), the leachate water is saturated with gypsum without respect to the particle size (from 0.05 m/m to 2 m/m) of gypsum.

An experiment in the field was made to evaluate the effects of irrigation water on gypsic soils. Increase in bulk density and quasi saturation (2.40 gr/l) of irrigation water in the top 15cm of soil was demonstrated.

The effect of the cristalline form of gypsum in soil, of temperature, pH and salt is also investigated. Analytical implication of all these experiments are detailed.

- Tables: :
1. Solubility of gypsum in water at 25°C as affected by particle size.
 2. Solution of gypsum rock during 30 hours under standing water.
 3. Analysis of a gypsic soil before and after leaching for 500 hours.
 4. Gypsum content of water dripping from large fragments of different form of gypsum.
 5. Effect of temperature on solubility of gypsum.
 6. Solubility of gypsum in various salt solutions.
 7. Effect of insoluble carbonates in a soil on solubility of gypsum.
 8. Extraction of gypsum from soil with water and with 0.5M NaCl.
 9. Effect of soil and gypsum particle size upon reproducibility of analytical results.
 10. Effect of calcium carbonate removal on the determination of gypsum.

Key Words: SALI / GYPS /

Author : HESS (P.R)
Title : Some Studies on Gypsum and Gypsic Soils.
Appendix 8: A contribution to the mechanical analysis of
gypsic soils.
Public : FAO AGON/SF/SYR-522/Nov. 1974.
Pages/ref: 100-106 / No ref.

Summary:

The effect of gypsum in a soil sample is investigated as far as soil dispersion is concerned. It is shown that even 1% of fine gypsum added may partially coagulate clay and give erroneous results for clay even when no visible flocculation occurs. Complexation of Ca by EDTA, precipitation by ammonium oxalate or replacing Na-hexametaphosphate by sodium carbonate or NH_4OH to disperse the soil did not solve the problem. But coagulation due to gypsum may be impeded by formation of a thin coating of barium sulfate, formed by treating the sample with an alkaline barium chloride solution.

Method: To 10gr of soil add 40ml BaCl_2 , shake one hour, centrifuge and wash until supernatant is free of barium. Add 15ml Na-hexametaphosphate 40gr/l, eliminate sand by wet sieving collect silt plus clay in a sedimentation cylinder and proceed as for classical pipet method.

Tables : Mechanical analysis of soil containing increasing quantities of gypsum, (a) Coarse gypsum, (b) Medium gypsum, (c) Fine gypsum, (c) silt-clay sized gypsum.
&
Mechanical analysis of synthetic gypsic soils (gypsum added 0 to 90%).
Mechanical analysis of some naturally occurring gypsic soils of the Wadi Al-Fayd (Syria).
Particle size distribution of two gypsic soils by the classical and the new procedures.

Chemicals: Barium chloride, Triethanolamine, Sodium hexametaphosphate, Sodium carbonate, Potassium chromate.

Key Words: GYPS / GRAN / SALI /

Authors : HIRA (G.S) & SINGH (N.T)
Title : Irrigation water requirement for dissolution of gypsum in sodic soils.
Public : Soil Science Society of America Journal 44-(5)-1980.
Pages/ref: 930-933 / 8 ref.

Summary:

The dissolution of gypsum artificially added to a sodic soil as amendment depends on the gypsum fineness and on the exchangeable sodium percentage (ESP) of the soil. Experiments were made on 7 soils of dry area (ESP superior to 40%, PH 10 or more). An increase in ESP of the soil was found to be related to an increase in the solubility of added gypsum (dissolved gypsum = $0.186 \text{ ESP} + 1.8$ $r = 0.98$). On the other hand the composition of the water used to dissolve the gypsum had only a small effect on the speed of dissolution. The effect of particle size of gypsum is investigated experimentally while assuming that the rate of dissolution is proportionnal to the total instantaneous surface area of gypsum spheres. This was verified by experience for particles $< 0.1 \text{ mm}$ mean diameter. As a conclusion, the equal reduction hypothesis may be used to estimate the quantity of irrigation water necessary to dissolve the gypsum added to reclaim sodic soil.

Tables : - Description of sodic soils used in the experiment and analytical properties of these soils.
- Effect of Exchangeable Na, particle size and gypsum requirement on the solubility of gypsum (calculated as SO_4 concentration in the effluent).
- Dissolution of gypsum for different sizes of particles.

Key Words: SALI / GYPS / Na-ECHAN /

Author : ILAIWI (M)
Title : Elimination and determination of gypsum in highly gypsiferous soils.
Public : Mast. Dg. Thesis, State University of Ghent 1977.
Pages/ref: 1-17 / 5 ref.

Summary:

$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ was eliminated from soils by treatment with ammonium-hydrogen-carbonate at 70°C during 50 min. prior to particle size determination. The amount of NH_4HCO_3 necessary may be limited to 2 equivalents for 1 equivalent of gypsum.

In a second experiment, gypsum was transformed into H_2SO_4 by equilibrating the soil with a strong cationic-resin (H^+). The amount of H_2SO_4 produced is titrated by standard NaOH. Other sources of calcium as well as Mg and monovalent cations contribute also to the production of sulfuric acid and titration include them all. Cation resin provide a way to eliminate gypsum. In the proposed method 0.5gr of gypsum are treated with 12gr of H^+ resin (during 30 minutes). All gypsum passes into solution and is titrated by NaOH 0.2N.

Tables : - Treatment of a soil containing 70% gypsum with NH_4HCO_3 at 70°C .
- Treatment of 0.5gr of pure gypsum with different cation exchange resin.

Chemicals: 1. Elimination of gypsum : Amonium-hydrogen carbonate.
2. Determination of gypsum: Acidic resin amberlite 1R-120 (H^+).

Key Word : GYPS /

Authors : KHAN (S.U) & WEBSTER (G.R)
Title : Determination of gypsum in solonchic soils by an X-Ray Technique.
Public : Analyst 93, June 1968.
Pages/ref: 400-402 / 7 ref.

Summary:

The paper presents a method for the quantitative determination of gypsum in solonchic soils that contain sulfate, and for which the classical method of extraction by water is not satisfactory. In the experiment, soils were spiked with gypsum and KCl (2%) was added as internal standard. The X-ray diffraction peaks of gypsum ($11^{\circ}.77^{\circ}$) and potassium chloride ($29^{\circ}.41^{\circ}$) were not superimposed on other peaks of salts or clay mineral in soil samples. Standard samples were made and a calibration graph from 0 to 10% gypsum was drawn by plotting concentration of gypsum against the ratio of counts per min. for gypsum and KCl.

Figures : - Diffraction pattern of the black chernozem.
- Calibration graph for gypsum determination in soil.
- Concentration of gypsum in four horizons.

Precision: Four different powder preparations for each sample averaged a recovery of 91% (W/W) of added gypsum at concentration levels of 0.2 to 3.4%.

Material : X-Ray diffractometer with Cu source.

Key Words: GYPS / X-RAY /

Authors : KHOSLA (B.K) & ABROL (I.P)
Title : Effect of gypsum fineness on the composition of saturation
extract of a saline sodic soil.
Public : Soil Science 113, 3, 1972.
Pages/ref: 204-206 / 2 ref.

Summary:

The effect of gypsum fineness used in amendment of sodic soils was investigated as far as inactivation of free carbonates and bicarbonates is concerned. The study was made on a sandy-loam soil (saturation percentage 45.3% , gypsum requirement by Schoonover's method 14.2 meq/100 gr, pH 10.3). Data on the composition of saturation extract at different levels and fineness of added gypsum are presented and commented.

Results: 1) It is shown that the reactivity of gypsum is maximum at 0.25 mm fineness and for an added quantity 100 to 200% of the gypsum requirement (GR). 2) If only 25% of the GR is added, the whole gypsum is consumed in neutralizing the soluble carbonates; it is therefore recommended to use an excess of fine grade gypsum in reclamation of saline sodic soils high in carbonates.

Tables-Figures:

- Soil characteristics.
- Anions and Cations in the saturation extract at different levels of gypsum fineness and added quantities.

Key Words: GYPS / SALI /

Author : KITTERICK (J.M)
 Title : The separation factor applied to some soil ion exchange equilibria.
 Public : Soil Science Society of America Journal 49-1976.
 Pages/ref: 147-148 / 6 ref.

Summary:

The use of the separation factor $\alpha = \frac{C_A c_b}{C_B c_a}$ (1) where c and C are concentrations in soil solution (ml^{-1}) and in soil ($\text{eq}^{\text{K}^{-1}}$) respectively is investigated. For montmorillonite data from others authors (cf table 1) agreed well with equation (1). Data for 198 samples of arid zones calculated for Na and Ca (c = concentrations in saturation extracts and C values of exchangeable Na and (Ca + Mg) respectively, exchangeable Ca being calculated as CEC - exchangeable sodium - exchangeable potassium) resulted in equation (2).

$$\log \frac{C_{\text{Na}}}{C_{\text{Ca}}} = 0.79 \log \frac{a_{\text{Na}}}{a_{\text{Ca}}} - 1.41 \quad (2)$$

where a stands for activities in saturation extract. Author notes that there is some questions as to whether the ionic activities in the saturation extract are in equilibrium with exchangeable ions. The intercept - 1.41 cannot be considered to be the logarithm of the separation factor because the slope of eq. (2) is not equal to 1.

Tables : - Exchange data of Vanselow (1932) and Eliason (1966) for montmorillonite plotted according to eq. (1).

Precision: $r = 0.98$ between $\log \frac{a_{\text{Na}}}{a_{\text{Ca}}}$ in saturation extract and $\log \frac{C_{\text{Na}}}{C_{\text{Ca}}}$ of exchange sites (NH_4OAC extraction) for 198 soils of arid zones.

Key Words: CEC / Na-Labil / Ca-Labil / SALI /

Author : KOVALENKO (T.A)
Title : Determination of gypsum in soils.
Public : Poch. 5, 1972 (In: Soviet Soil Science 3-(373-376), 1972.
Pages/ref: 373-376 / 3 ref.

Summary:

Three methods of determining gypsum are examined.
Method a): Gypsic sample is mixed at 1/500 ratio with a solution saturated with calcium carbonate. Gypsum in the soil was calculated as the increase in Ca content of leaching solution.

Method b): In a flask 0.2 to 0.5gr of soil is poured into 250ml freshly boiled water, and left to stand 12 hours. The solution is heated to 80°C and calcium determined. The method does not apply to clay soils because of the fixation of Ca on the exchange complex.

A third rapid method is proposed. It involves (Mg+Ca) carbonates determination by measurement of CO_2 produced by reaction with HCL-0.2N: gypsum is determined by subtraction of total calcium from carbonates.

Tables : - Recovery of gypsum from samples by the leaching method.
- Comparative data of analysis performed by leaching with tap water and by dissolution in 0.2N HCL.

Chemicals: HCL - Trilon B - Eriochrome Black - NaOH - Amonium chloride - Amonia - Methyl Red - Potassium chromate.

Key Word : GYPS /

Authors : LAGERWERFF (J.V) - AKIN (G.W) & MOSES (S.W)
 Title : Detection and determination of gypsum in soils.
 Public : Soil Sc. Soc. of Am. Proc. 1965.
 Pages/ref: 535-540 / 6 ref.

Summary:

Two methods were used for detection and determination of gypsum in soils. The first method is an electroconductimetric technique: the electrical conductivity of saturation extract is measured before and after the addition of an excess of gypsum to the saturation extract. If the difference between the second value and the first one is more than 2.2mmS at (25°C), no gypsum is present in the soil; if this value is less than 2.2mmS, gypsum is present, and the saturation extract contains it all without reaching the point of saturation. In case where the two values are the same, the soil contains a significant amount a gypsum.

Second method is the conventional precipitation: to 5ml of each saturation extract and dilution extract, a mixture of 80% of acetone, 20% glacial acetic acid is added. The mixture is 0.05N with respect to $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$. After centrifuging and decanting for obtaining the precipitates add 10ml of 80% acetone in water and shake until the precipitate is dispersed. Titrate for Ca with EDTA using Eriochrome Black T as indicator and calculate SO_4 . After drying the precipitate (110°C), dissolve it in water and determine the electrical conductivity; read the corresponding gypsum concentration or calculate it using the equation:

$$C = [6.81 + (4.15 \sqrt{EC} / (1 - 0.084 \cdot \sqrt{EC})]$$

where EC = Electrical Conductivity in mS cm^{-1}

Tables : - Some characteristics of 13 gypsiferous soils and their aqueous extracts.
 - Recovery by 4 methods of known amounts of gypsum added to soils.
 - Native gypsum in soils determined by 4 methods.

Figures : Electrical Conductivity of CaSO_4 , MgSO_4 and Na_2SO_4 solutions.

Chemicals: Acetone.

Key Words: GYPS / SALI / COND /

Authors : LONGENECKER (D.E) & LYERLY (P.J)
Title : Making soil pastes for salinity analysis: A reproducible
capillary procedure.
Public : Soil Science 4, 97, 1964.
Pages/ref: 268-275 / 10 ref.

Summary:

The paper describes a capillary method of wetting soils which is meant to eliminate the variability due to personal estimation of saturation point.

Method: 200gr soil samples are placed in a paper cup on a sandbath holding distilled water during 18 hours. Different variables are studied: water level depth, comparison with direct mixing on a silt loam and a clay loam.

In a separate experiment the effect of exchangeable sodium on wetting is investigated. Additional wetting is necessary when ESP is greater than 30%. The fineness of grinding has a noticeable effect on moisture uptake by samples. Standardization of sieving is therefore necessary.

- Tables :
- Comparison of saturation paste and saturation extract data by five different laboratories.
 - Drawing showing construction of capillary saturation table.
 - Amounts of distilled water absorbed by five sieved, blended subsamples of four soils on capillary saturation table.
 - Comparison of saturation extract data from capillary saturation table and hand-mixed pastes, using equal amounts of water.
 - Effect of distillation water absorbed by two soils at different ESP.
 - Effect of particle-size fraction and fineness of crushing on amounts of water absorbed.
 - Comparison on hand-mixed and saturation-table data by five laboratories.

Key Word : SALI /

Author : LOVEDAY (J)
Title : Methods of analysis of irrigated soils. Chap: 16: Gypsum
Determination.
Public : CSIRO Tech. Comm. No. 54-1974.
Pages/ref: 135-137 / 7 ref.

Summary:

The method relies on separate determination of Ca and SO_4 in saturation extract and SO_4 in a more dilute extract. It is based on the fact that a solution saturated with gypsum as a conductivity of about 2.3mS/cm at 25°C, and a concentrations of 30 to 32meq/l of Ca and SO_4 respectively, (corresponding to a solubility of 2.61 gr/l for gypsum).

If E_c of saturation extract is smaller than 2.3mS/cm gypsum is given either by Ca or by SO_4 concentration (whichever is the lowest value). If E_c is greater than 2.3mS/cm a more dilute extract is made until all the gypsum passes into solution and calculation is made from SO_4 concentration to eliminate errors due to dissolution of calcium salts other than gypsum.

Material : Conductivity Bridge.

Chemicals: Those necessary for the determination of Ca and SO_4 .

Key Words: GYPS / SALI /

Authors : MARTIN (J.F) - RICHARDS (S.J) & PRATT (P.F)
Title : Relationship of exchangeable Na percentage at different soil pH levels to hydraulic conductivity.
Public : Soil Science Society of America Proceedings 28-(5)-1964.
Pages/ref: 620-622 / 5 ref.

Summary:

Studies were made for six soils to find the relation between exchangeable Na percentage at different soil pH levels, and the hydraulic conductivity. The ranges of pH were between 4.0 to 8.0 .

The soils were leached by 3 liters of 0.1N HCl until the leachate has a value of pH=2 then deionized water was used to wash out the soil to a Cl free state. After drying, the soils were extracted with neutral 1.0N ammonium-acetate, mixed with calculated amounts of CaCO_3 and NaHCO_3 . After 2 months the soils were analyzed to calculate EC value.

The observations show that for the same amount of Na, a greater decrease in hydraulic conductivity is observed in acid soil than in neutral or alkaline ones. The behavior of the different soils was studied by correlating hydraulic conductivity with exchangeable sodium percentage related to CEC at pH7, then to CEC at pH of the soil, then to the sum of exchangeable cations. The correlation was the best when the hydraulic conductivity was related to exchangeable Na percentage calculated on the CEC at the soil pH.

The hydraulic conductivity was measured in soil compacted in 5 x 5 (diam. x height) cms cylinders.

- Tables :
- Influence of exchangeable Na percentage at different levels of acidity on hydraulic conductivity and other properties of a clay loam.
 - Correlation coefficient between hydraulic conductivity and exchangeable Na expressed as percent of CEC at pH7, CEC at the pH of the soil, and as percent of the NH_4OAc - extractable Ca, Mg, K and Na.
 - Relation of exchangeable Na at different pH levels to hydraulic conductivity.

Key Words: SODIUM / ECEC /

MART

CODE: 2713-01 / c-47-54-c / 80
ORDER : 0269

Authors : MATAR (A) & DOULEIMY (T)
Title : Note on a proposed method for the mechanical analysis of
gypsiferous soils.
Public : ACSAD Publication.
Pages/ref: 9 pages/2 ref.

Summary:

The stability of gypsic soils suspension is improved by treating the soil with barium chloride. The barium sulfate coating around gypsum particles avoid to a certain extend their dissolution. Excess barium is removed by quick washing with ethanol. Drying the soil after leaching with ethanol was found helpful in ameliorating the stability of the suspension. Sampling the soil suspension for particle size determination is then made as usual by pipet or by hydrometer method.

Tables : Effect of proposed treatment on soil suspension stability.

Key Words: GYPS / GRAN / PHYS /

Author : MICAH (W.M)
Title : A new suction plate apparatus for extraction of soil solution
in conductivity determination.
Public : Soil Science 2, 95, 1963.
Pages/ref: 142-143 / 2 ref.

Summary:

An simple apparatus designed to extract soil solution is presented. It reduces the time required for extraction soil solution and simplifies the washing of equipment. The apparatus consists of a flat suction plate made from perforated steel sealed on the top of a conventional funnel. This devices is used in place of a Buchner funnel; it is placed on a 500 ml erlenmeyer vacuumfflask. Saturation extract is collected in a small plastic vial.

Figures : - Diagram of simple suction plate apparatus.
- Suction plate apparatus connected to vacuum rack and pipet-cell conductivity bridge.

Key Words: SALI / COND /

Authors : MOLODSTOV (V.A) & IGNATOVA (V.P)
Title : Determination of the composition of adsorbed bases in Saline Soils.
Public : Soviet Soil Science 3, 1976.
Pages/ref: 364-367 / 3 ref.

Summary:

It is proposed to determine exchangeable cations of saline soils, especially those with sulfate and chloride salinization after dissolving the salts in water (20 to 40% water/soil ratio) and washing them out by 70% ethanol; up to 10% by weight of soluble salts in soil may be eliminated. Data are presented on 15 samples with 0.6 to 3% water soluble salts, 0 to 30% gypsum and 5 to 12% carbonates.

Method:

Wet 5 gr of soil to field capacity, leave overnight. Add 10-15 ml 70% ethanol; mix, centrifuge. Repeat until no sulfate is detected in washings. Add 25 ml of 0.1N NH_4Cl in 70% alcohol, mix, allow to stand 1 hour, centrifuge. Repeat three times, collect supernatant in a porcelain dish, evaporate, dissolve in water. Determine Ca, Mg, K and Na.

The method is tested on a chloridic-sulfatic solonchack and a sierozem with sulfate salinization. In none of the soil samples soluble calcium was removed in the 70% alcohol extracts. Sulfate of sodium and magnesium were not removed by washing out with alcohol alone.

- Tables :
- Composition of adsorbed bases in meq/100gr after removal of soluble salts with water alone, with alcohol alone according to the proposed method.
 - Content of ions in 70% alcohol solutions and composition of exchangeable cations as a function of the degree of wetting before analysis (for 20% and 40% water/soil ratio).
 - Sodium content in various extracts and soil solutions.
 - Content of ions in extracts and soil solution (1/5 water extracts: 70% alcohol extract after wetting; soil solution).

Chemicals: Ethanol, Amonium chloride.

Key Words: ECEC / SALI / SODIUM /

Authors : MURARAK (A) & OLSEN (R.A)
Title : An improved technique for measuring soil pH.
Public : Soil Science Society of America Journal 40-(6)-1976.
Pages/ref: 880-882 / 17 ref.

Summary:

Method: The soil solution is removed by adding carbon tetrachloride to the soil and centrifuging at 48.300 g two hours in an air-tight tube: the combination electrode of a pH meter is then inserted directly in the tube. The system is claimed to eliminate the errors occurring in pH measurement in situ (junction error due to poor electrode - soil contact) and in laboratory (errors in extraction, contamination, effect of ambient CO₂...). The experiment is made on CaCO₃, H₂O, CO₂ artificial systems. The CO₂ content of the tube being adjusted by bubbling different Air-CO₂ mixtures. The CaCO₃-H₂O systems was treated by CCl₄ as described above and the pH of the supernatant measured. Agreement of exp-pH and theor-pH (calculated as: $6.03 - 0.67 \log pCO_2$) was less than 0.04 pH units. At pH levels of 6 to 7.70 it is shown an increase of as much as 0.3pH unit can be produced by the loss of CO₂ from the sample to the atmosphere. Two supplementary experiments gave for the junction potential error a value of -0.5pH unit and for dilution effect error a similar value.

Figures : - Details of the closed centrifuge tube.
- Variation of the pH of a clay and a sandy-loam with percent moisture (25 to 300%).

Tables : - Comparison of theoretical and experimental pH values.
- Changes in pH of soil solution induced by loss of CO₂.
- Deviations in pH of soil caused by junction error.

Material : pH-meter ; Centrifuge ; Sealed centrifuge tubes.

Key Words: PH / SALI /

Author : NAKAYAMA (F.S)
Title : Calcium complexing and the enhanced solubility of gypsum in concentrated salt solutions.
Public : Soil Sci. Soc. of Am. Proc. 35, 1971.
Pages/ref: 831-883 / 14 ref.

Summary:

The amount of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ dissolved in NaCl , NaNO_3 , NaClO_4 , NaOAC solutions of different concentrations (0.025 to 1M) was measured after equilibration of these salts with gypsum during seven days. The dissociation constant of CaCl^+ , CaNO_3^+ , CaOAC was calculated using the Davies form of the Debye-Hückel relation for computing activity coefficients. These values are used to predict solubility of gypsum in mixtures of Na salts and calculated values are compared with experimental ones. The solubility of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ increases with increasing electrolyte concentration in a solution with uncommon ions up to 1M. For the same concentration, the solubility increased in the order NaClO_4 , NaCl , NaNO_3 , NaOAC supporting the existence of CaOAC^+ and CaNO_3^+ in solutions.

Tables : - Solubility of gypsum in NaClO_4 , NaNO_3 , NaCl and NaOAC solutions and predicted solubility in NaClO_4 solutions.
- Apparent dissociation constants for CaCl^+ , CaNO_3^+ , CaOAC^+ at 25°C.
- Comparison of experimental and computed gypsum solubility in two-salt mixtures (ditto in three and four salt mixtures).
- Dissolved constituents in a gypsum, Na-salt mixture ($\text{NaClO}_4 = \text{NaCl} = \text{NaNO}_3 = \text{NaOAC} = 0.125\text{M}$).

Key Words: GYPS / SALT /

Author : NAKAYAMA (F.S)
Title : Problems associated with the determination and application
of the solubility product constant.
Public : Soil Sci. Soc. Amer. Proc. 35, 1971.
Pages/ref: 442-445 / no ref.

Summary:

The difficulties of determining the solubility products (sp) of some species frequently encountered in soils of arid regions (calcite, gypsum and dicalcium phosphate) are discussed. For gypsum, the main difficulty arises from the presence of CaSO_4° in solutions. Calculations of sp gives different results whether CaSO_4° is considered or not.

For CaCO_3 , the difficulty comes from the estimation of CO_2^\ominus which gives different results titrimetrically and with glass electrode (pH titration). Furthermore, the estimation of reliable activity coefficient for individual ionic species depends on the adequate estimation of dissociation constants of complex species.

Tables : - Effect of the choice of the dissociation constant of CaSO_4° upon the computed solubility product constant.
- Effect of different Na salts and their concentrations on the solubility of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$.

Key Words: SALI / GYPS-THEOR /

Authors : NELSON (R.E) , KLAMETH (L.C) & NETTLETON (W.D)
Title : Determining soil gypsum content and expressing properties
of gypsiferous soils.
Public : Soil Science Society of Am. J. 42, 4, 1978.
Pages/ref: 659-661 / 2 ref.

Summary:

An indirect method of gypsum estimation is presented and the way of expressing results of soil analysis of gypsiferous soils is detailed.

Gypsum estimation is based on measurement of crystal-water content of two sub-samples, one being placed in a silica-gel dessicator, the other one being dried at 105°C. The method (y) is compared with evaluation of gypsum from SO_4 concentration (x) and correlation was $y = 1.038x + 0.17$, $r = 0.999$ for 20 samples. The theoretical crystal-water content of pure gypsum, i.e 20.91% was replaced in calculations by the experimental value 19.42%.

Figures : Gypsum content calculated from sulfate concentration as related to gypsum content from loss of its crystal-water.

Key Words: GYPS / PRECS /

Authors : NIKOLAYEV (A.V) - NIKOL'SKAYA (R.M) & SHCHERBAKOV (Y.D)
Title : Dioxane method of determining moisture content in gypsum
bearing and saline soils.
Public : Soviet Soil Science 1964.
Pages/ref: 311-313 / 2 ref.

Summary:

The electrical capacity of dioxane $O(CH_2)_4O$ is proportional to its water content. Soil is mixed with dioxane in a cell and resulting capacity of dioxane solution is measured in a bridge. The cell is calibrated with dioxane water mixture and direct $H_2O\%$ readings may be obtained.

The paper describes the manufacturing of the cell and the diagram of the capacity bridge.

Tables : Comparison of determinations of the moisture content of various soils by the dioxane extract and oven drying methods (two tables).

Auteur : xxx/ORSTOM
Titre : Dosage du soufre soluble du sol.
Dosage du soufre total.
Public : RONEO, ORSTOM.
Pages/ref: 6 pages.

Résumé:

Soufre Soluble:

Le soufre est dosé à l'état de sulfate par complexométrie d'une quantité connue de Plomb II ajouté en excès. L'interférence des ions bivalents réagissants avec EDTA est calculée par une titration à blanc.

La mise en solution du sulfate se fait à l'acide nitrique 5%. On ajoute un excès de nitrate de Plomb II en milieu éthanol. On dose à pH 10.0 avec EDTA N/50 au noir ériochrome. La précipitation de l'hydroxyde de Plomb est évitée à l'aide du tartrate de sodium.

Soufre Total:

Deux méthodes de minéralisation sont présentées: par fusion oxydante et par minéralisation à l'acide nitrique. La titration se fait comme pour le soufre soluble.

Figures : Schéma de dosage.

Matériel: Creuset nickel.

Produits : ETOH, NO_3H , EDTA (Na_2), Noir d'ériochrome, NaCl, NH_4Cl , Tartrate de Sodium, Bioxyde de Sodium, Nitrate de Pb II, H_2O_2 .

Mots Clés: SULF / GYPS /

Authors : OSTER (J.D) & SHAINBERG (I)
Title : Exchangeable Cation Hydrolysis and Soil Weathering as Affected
by Exchangeable Sodium.
Public : Soil Science Society of America Journal 43-(1)-1979.
Pages/ref: 70-75 / 14 ref.

Summary:

Exchangeable and crystalline cations are released from soil minerals as a result of hydrolysis and weathering. Rates of hydrolysis and the resultant changes in the cation exchange composition of three lime free arid zones soils as affected by different values of exchangeable Na are studied.

Methods:

Lime was removed by 1N NaCl/HCL at constant pH4 to 5; (contact time 24 to 72 hours). Then soils were equilibrated with solutions having a S.A.R. of 5.20 and "infinite" (prepared from chloride of Na, Mg, Ca). PH and Electric Conductivity were measured during the equilibration period (7 to 14 days). The initial CEC was measured by Na-NH₄OAC method and EC by NH₄OAC pH7.

Results:

The conductance of aqueous suspensions when plotted versus the square root of time, exhibited two linear segments. Authors conclude that the release of Ca, Mg, K from silicate minerals is more rapid than the hydrolysis of exchangeable Na and Ca for the three soils considered. The removal of CaCO₃ was suspected to produce intermediate products controlling release of Ca, Mg, K. The rate of exchangeable Ca hydrolysis and release from silicate materials was sufficient to saturate the solution with respect to lime for the calcic haploxeralf soil.

Tables : - General properties of soils (CEC - CaCO₃ - Clay - Silt-clay minerals).
- EC composition before and after the treatments.
- Relation between specific conductance and time for aqueous suspensions of three soils.
- Total initial and final EC and changes in exchange ion composition.

Material : AA Spectrophotometer (for Ca, Mg, Na & K). Chloride Titrimeter. Potentiometric titrator. (For carbonates and bicarbonates). Centrifuge.

Key Words: ECEC / SALI / SODIUM / LABIL /

Auteur : PIECE (R)
Titre : Analyse thermique différentielle et thermogravimétrie simultanées du gypse et de ses produits de déshydratation.
Public : Bull. Suisse de Minéralogie & Pétrographie 41-(2)-1961.
Pages/ref: 303-310 / 1 ref.

Résumé:

Un appareillage d'analyse thermique différentielle (ATD) et de thermogravimétrie simultanée est présentée en détail. Il permet d'obtenir simultanément sur un même diagramme quatre courbes d'ATD d'échantillon différents, une courbe thermopondérale aussi que la température de référence tous les 100°C.

Résultats:

en ATD on obtient un premier pic endothermique concernant la transformation: dihydrate - semihydrate) et un second pic vers 170°C (transformation semihydrate - anhydride III). La meilleure vitesse de chauffe étant 5 deg/min.

La courbe thermopondérale dans l'air montre une décomposition continue de 120 à 190°C. Les semi-hydrates alpha et betha sont reconnaissables à la position différente du petit pic exothermique de transition cristallographique, le premier à 23°C, le deuxième à 380°C. La mesure du rapport des surfaces des pics exothermiques donne un moyen de mesurer les proportions relatives en forme alpha et betha.

Figures : - Courbes ATD temperature / temps pour du gypse pur, et du gypse naturel contenant de la dolomie.
- Courbes thermopondérale du gypse chauffés à l'air du semi-hydrate alpha, et du semi-hydrate betha.
- Thermobalance - appareil ATD.

Mots Clés: GYPS / THERMO /

Authors : POLEMIO (M) & RHOADES (J.D)
Title : Determining Cations Exchange Capacity: A new procedure for calcareous and gypsiferous soils.
Public : Soil Science Society of America Journal 41, 3, 1977.
Pages/ref: 523-528 / 23ref.

Summary:

Two steps method for CEC are presented:

- First step: 4-5 gr of soil is treated by successive equilibrations with 33ml increments of 0.4N NaOAC - 0.1N NaCl solution (at pH 8.2 in 60% ethanol) to obtain saturation of cation exchange sites.

- The second step is the saturation with three 33ml increments of 1N MgNO₃ (pH 7). Chloride is used as index cation so that the soluble sodium may be counted for. Lower CEC values were obtained with the developed method as compared with ammonium acetate method (Bower).

As there is no absolute reference method for CEC, the values were correlated with saturation percentage and air-dry water content. The method is proposed for calcareous and gypsiferous soils, though it necessitates a preliminary washing out of soluble chlorides.

Tables :- Properties of soils and CEC as determined by the Bower & Al (1952) and the newly developed method.
- Relation between CEC and air-dry water content of soils.
- Comparison of CEC of soils as determined by the new and Bower methods.

Material : AA Spectrophotometer, Centrifuge.

Chemicals: Ethanol, NaOAC, NaCl, MgNO₃.

Key Words: CEC / CALC. CARBONATE / GYPSUM /

Auteur : FOUGET (M)
Titre : Contribution à l'étude des croûtes et encroûtements gypseux de nappe dans le sud.
Public : Cah. ORSTOM, Série Pédol., Vol.VI, No.3-4, 1968.
Pages/ref: 309-365 / 51 ref.

Résumé:

Les lois de dissolution et de dépôt du gypse sont passées en revue dans une première partie. Quelques profils sont ensuite décrits et les facteurs de formation des horizons de surface font l'objet de la deuxième partie. Le processus de précipitation du gypse dû à la diminution du rapport chlorures / sulfates est examiné en détail. Un cycle saisonnier des conditions de dépôt est décrit. Il est proposé de réserver un sous-groupe spécial aux formations gypseuses de nappe dans le groupe des sols salés de la classe des sols halomorphes, (classification française).

Tableaux : - Influence de la température sur la solubilité du gypse.
- Variation K_{ps} en fonction de température et concentration en NaCl.
- Variation de solubilité (gr/l) en fonction de la teneur en $MgCl_2$.
- Relation entre (Na-Mg) et E_c pour une nappe d'oasis.
- Diagramme des concentrations pour cinq nappes phréatiques et composition chimique.
- Nombreuses données de composition chimique de profils.
- Nombreuses figures et description de profils.

Mots Clés: GYPS / SALI /

Authors : REEVE (R.C) & DOERING (E.J)
Title : Sampling the soil solution for salinity appraisal.
Public : Soil Science 99, 5, 1965.
Pages/ref: 339-344 / 11 ref.

Summary:

The paper describes procedures used in the field and in the laboratory to extract soil solution from undisturbed soils. Ceramic cups linked to vacuum tanks are used in the field. Data for soil solution collected during reclamation of a sodic soil are presented and compared to saturation extracts. Results obtained from laboratory columns leached with saline waters are shown. The methods presented relates better to the soil water that is held at soil suction lower than 500 millibars.

Figures, Tables:

- Drawing of apparatus for sampling the soil solution.
- Equipment and material for sampling the soil solution.
- Total concentration and (Ca + Mg) concentration of the soil solution as sampled in the field during reclamation of saline soil by leaching with successive dilution of high-salt water.
- Electrical conductivity of the soil solution extracted by suction from laboratory soil columns growing birdsfoot trefoil (leaching water has a EC equal to 4.9 mS).
- Salt concentration of the extracted soil solution as compared to that calculated from saturation extract determinations on soil samples.

Material : 1. In the field: Vacuum tank, neoprene tubing, ceramic porous cups, sampling bottles.
2. In the lab. : Leaching columns.

Key Word : SALI

Author : RHOADES (J.D)
Title : Quality of Water for Irrigation.
Public ; Soil Science 113, 4, 1972.
Pages/ref: 277-284 / 46 ref.

Summary:

Salinity and sodicity as two major criteria for evaluating the quality of waters used for irrigation are discussed. Salinity evaluation must include: a) crop tolerance, b) amount of leaching, c) residual salt accumulation; For instance, factor a) is highly dependant on crop characteristics, on crop management, on salinity distribution through the soil profile and on soil physical properties. Secondly, considerations in assessing sodicity of waters are important because of the change in exchangeable sodium that may result in soil submitted to irrigation. The sodium adsorption ratio ($SAR = 1.414 Na / (Ca + Mg)^{1/2}$) may be used as a measure of sodicity of irrigation water providing it is relatable to the resulting SAR of the soil under irrigation. The difficulty of quantifying such relation is demonstrated.

The conclusion is that it is presently impossible to set precise standards of general applicability for assessing quality of water for irrigation. Some fields of research where the solution could be found are discussed: 1) Studies on composition and matrix potential of soil water with respect to time and space. 2) Relation between irrigation water composition and resulting soil water composition.

Figures : - Variation of electrical conductivity and precision of soil water in the root-zone of an Alfalfa crop during five months.
- Relation between Alfalfa yield and time-integrated osmotic water potential in the middle of the root-zone.

Key Words: SALI / WATER /

Authors : RICHARDS (L.A) , BOWER (C.A) & FIREMAN (M)
Title : Tests for salinity and sodium status of soil and of irrigation water.
Public : USDA Circular No. 982-1956.
Pages/ref: 1-19

Summary:

The circular describes into details the equipment required for making saturated soil paste and saturation extracts. Diagrams are given for interpreting salinity and soluble calcium requirements of saline soils. Test for gypsum is detailed and quality of irrigation water discussed as far as sodium hazard is concerned.

Field equipment for salinity and sodium test is described, it relies on EDTA titration of (Ca + Mg), in saturation extract; Na is estimated as the sum of cations (as related to Ec) minus (Ca + Mg). Sodium status of soils, as expressed by Exchangeable Sodium Percentage (ESP), is given by the formula relating ESP and SAR (Sodium Adsorption Ratio of saturation extract or $1.414 \text{ Na} / (\text{Ca} + \text{Mg})$).

Figures : - Interpretation of the EC measurement.
- Diagram for distinguishing 4 salinity classes and 4 sodium status classes for soil. Suggested rate of application of amendments as related to the soluble calcium requirement. Gypsum content of soil as related to the electrical conductivity of a test solution (acetone precipitation and redissolution in water). Diagram for conductivity classes and sodium hazard classes of irrigation water.

Equipments: Conductivity bridge.

Chemicals : (For field test kit): Sodium diethyldithiocarbamate, NaHCO_3 , Na_2CO_3 , Na_2Mg EDTA, EDTA, CaCl_2 , Gypsum, HCL.
(For Ca requirement and gypsum kit): EDTA, Gypsum, Acetone.

Key Words: SALI / SODIUM-ECEAN /

Auteur : RIEU (M)
 Titre : Sodium adsorption ratio et estimation du pouvoir alcalinisant des eaux.
 Public : Cah. ORSTOM, Série Pédol., Vol. XVIII No.2, 1980-1981.
 Pages/ref: 123-128 / 17 ref.

Résumé:

La relation classique entre le SAR des eaux et le ESP des sols ne tient pas compte de la différenciation du pouvoir alcalinisant des eaux selon l'anion dominant. Si le SAR est calculé à partir des activités des ions en solution (SAR_a), on peut le relier à une quantité appelée échangeable fraction ratio ou EFR = $Na/CEC (1-Na/CEC)^{1/2}$ (unités: meq/100gr). Les conditions expérimentales en laboratoires simulant une irrigation réelle, sont décrites telles qu'elles sont appliquées à un sol de Polder du lac Tchad. La relation $EFR = \beta(SAR)$ est testée pour différents systèmes:

a. Un système à bicarbonate dominant:

$$EFR = 0.0113 SAR + 0.0052 \quad (r = 0.993)$$

b. Un système à sulfate dominant:

$$EFR = 0.0093 SAR_a + 0.0052 \quad (r = 0.988)$$

La relation théorique linéaire est pour ces systèmes:

$EFR = 0.01 SAR_a$; Cette dernière relation linéaire ne peut être utilisée que dans un domaine où la composition ionique varie peu et où la composition de la garniture absorbée est éloignée des pôles homoioniques.

Tableaux : - Composition du sol et des eaux utilisées dans l'expérience.
 - Equilibres d'échange représentés par SAR, SAR_a , EFR, ESP et suivant les valeurs SO_4/HCO_3 .
 - Etude de la relation entre EFR du sol et SAR de la solution d'équilibre.

Mots Clés: SALI / Na-LABIL / Mg-Ca LABIL /

Authors : RHOADES (J.D) & VAN SCHILFGAARDE (J)
Title : An electrical conductivity probe for determining soil salinity.
Public : Soil Science Society of American Journal 40-5-1976.
Pages/ref: 647-651 / 7 ref.

Summary:

A single soil salinity probe in which four electrodes are mounted as annular rings is used for determining soil salinity. Construction details and parts for the probe are illustrated. The electrical conductivity is measured with the salinity probe by inserting it into the soil. The value of the conductivity (EC_a) is measured when the soil had drained to about field capacity, and compared with the value of the conductivity of the soil sample (EC_s) taking from the same position (50cm) and measured in the laboratory on a saturation extract. The probe is said to be particularly adapted to measurement within small localized soil regions.

Precision: The correlation between EC_a and EC_e as given by the equation: $EC_e = mEC_a + b$ gave values of m from 4,2 to 10,6 for six different soils.

Figures : - Principle of the probe and construction diagram.
- Distribution of EC_x under trickle-irrigated citrus tree with radial distance from the trunk and depth below the ground surface.
- Comparison of saturation extract electrical conductivity EC_e and soil electrical conductivity EC_a as measured with the salinity probe for six soils with corresponding saturation and field-water contents.
- Comparison of soil interval electrical conductivity (EC_x) as determined with the salinity probe as estimated from Eq(1).

Material : Soil Salinity Probe.

Key Words: SALI / COND / ELEC /

Authors : SAYEGH (A.H), KHAN (N.A), KHAN (P), & RYAN (J)
Title : Factor affecting gypsum and cation exchange capacity determination in gypsiferous soils.
Public : Soil Science 125, 5, 1978.
Pages/ref: 294-300 / 15 ref.

Summary:

The effect of soil fineness, and soil/water ratio on gypsum and soluble salts determinations was investigated in a first part of the paper. In a second part, pretreatment of soil sample prior to determination of cation exchange capacity by sodium acetate / ammonium acetate method is shown and a procedure for CEC determination in soils containing gypsum is proposed.

Results: Dissolution of gypsum increased with soil fineness from 5% to 12% at 1/500 soil/water ratio and for particle size 2 mm down to 50 microns. At fixed soil water ratio (1/100) solubility increased from 4% to 7% with soil fineness.

For cation exchange capacity satisfactory results were obtained only when gypsum was removed or complexed. Prior to CEC (100 microns) was pretreated by shaking with a solution of sodium oxalate during two days, an acceptable value of CEC was found by the conventional sodium acetate, isopropanol / ammonium acetate method.

Tables : - Distribution of total gypsum in soil profiles.
- Effect of soil/water ratio and particle size on total gypsum and soluble (Ca + Mg).
- CEC values as determined by various procedures with and without pretreatment (1 day of shaking).
- CEC as affected by variable time of pretreatment with different reagents (1 to 6 days treatment).

Material : Centrifuge , Shaker.

Chemicals: - (For the recommended method only):
Ammonium acetate, Sodium oxalate, Isopropanol, Sodium acetate, Acetone, ETPA (or EDTA).

Key Words: ECEC / GYPS /

Authors : SCHULZ (R.K) - OVERSTREET (R) & BARSHAD (E)
 Title : Some unusual ionic exchange properties of sodium in certain salt affected soils.
 Public : Soil Science 99-3-1964.
 Pages/ref: 161-165 / 7 ref.

Summary:

For some soils containing zeolithic minerals, the authors propose to consider as acceptable exchangeable sodium the sodium removed from the soil by exchange Ca^{++} ion. In their experiment, a soil sample was equilibrated with Na22 and then labeled-samples were extracted by CaCl_2 , NaCl_2 , NaCl , KCl , NH_4OAc and HCl solutions. Na22 remaining fixed on exchange sites of soils was minimum after NaCl extraction (0.3 meq/100 gr for an initial value of 20.5 meq/100 gr), and maximum after CaCl_2 extraction. This unusual behavior led to an x-ray diffraction study of clay material which revealed apart from 35% illite, 15% montmorillonite, some 35% of analcime, or $\text{NaAl}(\text{SiO}_3)\cdot\text{H}_2\text{O}$. This zeolithic mineral may be responsible of the fixation of sodium in such a way that it may be removed more easily by K^+ or NH_4^+ than by Ca^{++} .

Tables : - Exchangeable Na content of soil determination by isotopic dilution experiments.
 - Effect of various extractants on Na22 labeled soil.
 - Diagnostic x-ray spacings for the identification of analcime.

Material : Radioisotope counter.

Chemicals: NH_4OAc - CaCl_2 - KCl - Na22.

Key Words: SODIUM EXCHAN / X-RAY / RADIO / SALI /

Auteurs : SERVANT (J) & SERVAT (E)
Titre : Introduction à l'étude des sols salés littoraux du Languedoc-Rousillon.
Public : Annales Agronomiques 17-(1)-1966.
Pages/ref: 53-73

Résumé:

Les auteurs étudient la salinisation des sols par la nappe phréatique dans le midi-méditerranéen de la France. Le choix des méthodes analytiques adaptées à ces sols constitue une grande partie du travail présenté. La variation de la conductivité électrique et des solutions de sol sont étudiées en fonction du report eau/sol (de 1 à 10). Pour des sols très salés, il est montré que les extraits à grande dilution donnent des résultats trop élevés. Les bilans anioniques fournissent la relation S (anions) = $9.9 CE + 0.2$, alors que pour la somme de cations on a une moins bonne corrélation. Trois méthodes de mesure du sodium échangeable sont passées en revue: (1) Bower 1952, (2) Backbock 1960, (3) Calcul par la relation avec le S.A.R. Quelques critères analytiques sont proposés pour la classification des sols salés. Les données pédologiques nécessaires à la cartographie des sols salés font l'objet d'un chapitre à part.

- Figures : - Relation entre conductivité (mmhos/cm) et extrait sec (gr/l) pour 50 nappes phréatiques $CE_{25} = 1.4 E.S.$
- Classification des nappes phréatiques et grandes associations végétales.
- Relation entre somme des anions et conductivité des extraits 1/5.
- Relation entre somme des ions et conductivité des extraits saturés.
- Variation du pH en fonction du rapport sol/eau.
- Relation entre $\log_{100} (Na/Ca + Mg)$ et pH.

Key Words: SALI / COND / PH / SODIUM /

Author : Soil Conservation Service
 Title : Soil Survey Laboratory methods and procedures for collecting soils: pg. 35-36: Gypsum.
 Public : US. Dep. of Agriculture, Soil Conservation Service (SCS), Washington, April 1972.

Summary:

Two methods are detailed: Precipitation by acetone, redissolution of the precipitate and measurement of electric conductivity. Gypsum is measured by comparison with a standard curve.

In the second method, all the gypsum is dissolved in water by 12 hours shaking in a wide soil/water extract. Sulfate (SO_4) is measured in this extract (i.e. Ed.), and in saturation extract (sat. SO_4). Gypsum is calculated in extract E_d as the difference: (total SO_4 minus non gypsum SO_4).

To estimate gypsum SO_4 it is assumed that the solubility of gypsum is 2.58 gr/l (i.e 30 meq/l of Ca and SO_4) and that a saturation extract will dissolve first non-gypsum sulfates and then the gypsum sulfate. According to these two assumptions:

(a) If (Ca) and (SO_4) concentrations in saturation extract exceed 30 meq/l, non-gypsum SO_4 is taken as (total SO_4 in saturation extract 30 meq/l).

(b) If (Ca) is greater than (SO_4) in saturation extract, there are calcium salts other than gypsum dissolved in saturation extract and presumably no sulfates other than gypsum, therefore: total SO_4 = gypsum.

(c) If (SO_4) exceeds (Ca) in saturation extract there are other sulfates than gypsum in the soil and non-gypsum $SO_4 = (SO_4) - (Ca)$ in saturation extract.

Material : Equipment for extracting soil saturating extract.

Chemicals: Those necessary for SO_4 and Ca determination.

Key Words: GYPSUM / SALI /

Auteurs : SUSINI (J) & ROUAULT
Titre : Utilisation d'une electrode spécifique pour le dosage du sodium dans les eaux et les extraits de sol.
Public : Cah. ORSTOM Pedo. Vol. X, No. 3-1972.
Pages/ref: 12 pages / 8 ref.

Résumé:

L'article commence par un bref rappel théorique sur le fonctionnement des electrodes ioniques spécifiques et des interférences à craindre. L'appareillage pour le dosage du sodium est décrit en détail. La pente moyenne de la courbe d'étalonnage est de 59mV avec l'appareillage utilisé.

L'effet de la température est étudié et une variation de $\pm 5^{\circ}\text{C}$ produit une erreur décroissante de 20% pour 1ppm Na à 7.5% pour 10^3 ppm (l'erreur est négligeable au niveau de 10^4 ppm de Na).

L'influence du pH et des anions Cl^- , $\text{CO}_3^{=}$, $\text{SO}_4^{=}$ est étudié à un pH constant de 10 obtenu par barbotage d'amoniac.

L'effet du gypse est étudié également, l'interférence n'existe que pour Na inférieur à 3 ppm, ce qui est une valeur rare dans les extraits des sols gypseux. L'utilisation de l'electrode spécifique à la mesure du sodium dans les extraits de sol et les eaux salées est comparée avec la photométrie de flamme.

Figures : - Etalonnage de l'électrode (-160 à +110mV).
- Variation de pente avec la température pour des concentrations de 1 à 10^4 ppm Na.
- Variation absolue en mV suivant le pH (pH= 5 à pH= 10).
- Interférences des sulfates, carbonates et du gypse.
- Etendues des mesures: de 23.000 à 0.23 mgr/l en Na (soit pNa 0 à 5).

Précision: - L'écart-type calculé sur 10 mesures ne dépasse pas 3 mV de 1 à $5 \cdot 10^4$ ppm en Na.
- Pour des eaux de pH compris entre 7.7 et 8.4 l'erreur relative par rapport à la mesure en spectrophotométrie de flamme est:
- 1% au niveau de 100 ppm Na
- 2% au niveau de 400 ppm Na
- de 4 à 8% pour des valeurs inférieurs à 60 ppm Na.

Mots Clés: SODIUM / SALI / GYPS /

Authors : TABIKH (A.A) & RUSSEL (J.C)
Title : Use of Cation-Exchange Resins in evaluating soil salinity.
Public : S.S 91, 1, 1961.
Pages/ref: 70-73 / 6 ref.

Summary:

An alternative to the electrical conductivity as a mean to evaluate soil salinity is presented. It uses a cation exchange resin (H form) and subsequent titration with 0.1 NaoH of the hydrogen replaced by the cations of the soil solution.

Method: 5 ml of saturation extract of soil is leached through a column filled with about 5gr of Dowex 50-H⁺ exchanger. The column is washed with 50 ml of distilled water; the eluate is collected and titrated with 0.1N NaoH with bromothymol blue as indicator. (The method is not suitable for extracts containing appreciable amounts of carbonates and bicarbonates). The salinity is expressed as meq/l of cations replaced.

Precision: The salinity of 35 soils of Iraq, as measured by the proposed method (value x, meq/l) was compared with their electrical conductivity (value y, mS). The curvilinear relationship obtained was approximated as three straight-line segments.

from 0 to 32 mS	$y = 0.07780x + 0.107$	$r = 0.986$
from 32 to 68 mS	$y = 0.07028x + 3.19$	$r = 0.971$
from 68 to 145 mS	$y = 0.05967x + 13.00$	$r = 0.985$

Key Words: SALI / RESIN /

Authors : TANJI (K.K) & DONEEN (L.D)
Title : Predictions on the solubility of gypsum in aqueous salt solutions.
Public : Water Resources Research 2, 3, 1966.
Pages/ref: 543-548 / 14 ref.

Summary:

The solubility of gypsum in aqueous salt solutions was calculated using three different methods of estimating activity coefficients. Simple ion activity coefficients were approximated by the original Debye-Hückel equation and modified forms proposed by Güntelberg and Guggenheim-Davies.

The calculation was done by computer care being taken of the possible formation of ion pair CaSO_4^0 ($k = 4,9 \cdot 10^{-3}$) and MgSO_4^0 ($k = 6,3 \cdot 10^{-3}$ when applicable. The cycle of successive approximation step is stopped when Ca concentration in solution is known to the nearest 10^{-5} m/l. Calculated values are compared with experimental ones obtained from an earlier paper. (For instance in water at 25°C the values given by the three forms of the Debye-Hückel equations are 30.68 , 31.94 , 30.68 in comparison with an average 30.61 meq/l obtained in the literature, these values being calculated with a dissociation constant taken as $2,40 \times 10^{-5}$ for gypsum.

Data are given for solutions 1 to 40 meq/l of NaCl, MgCl_2 , CaCl_2 , and MgSO_4 .

Tables : - A comparison of measured and computed solubility of gypsum in different salt solutions at 25°C .
- Computed values of undissociated MgSO_4^0 in saturated gypsum solutions containing Mg^{++} .

Key Words: SALI / GYPS / THEOR /

Author : U.N.E.S.C.O
 Title : Relation between Alkalization & Salinity Chap. II.
 Public : Tunisia: Research & Training on Irrigation with Saline Water.
 TECH. RPT / UNESCO / UNDP (SP) TUNIS - PARIS 1970.
 Pages/ref: 79-83

Summary:

Studies were made during the period 1962 on 6 regions of Tunisia under intensive irrigation, to study the effects of the factors of alkalization. The analytical results produced make it possible to relate exchangeable sodium percentage (Na/T) of the soil to electric conductivity (EC) and sodium absorption ratio of the saturation extract (SAR). Relations are given also between the concentration in gr/l and the conductivity in mS/cm of the irrigation water used in stations at Cherfech (1), Ksar Gheriss (2), Tozeur (3) and Nakta (4) are given as $c = a E_c^b$ where a & b are coefficients dependant on level of gypsum and salinity.

Station (1)	a = 0.625	b = 1.078
(2)	a = 0.884	b = 0.993
(3)	a = 0.592	b = 1.134
(4)	a = 0.679	b = 1.082
(5)	a = 1.010	b = 0.90

$$\text{Na/T} = 0.894 \text{ EC}_e + 3.11 \quad r = 0.893 \quad n = 75$$

$$\text{Na/T} = 0.988 \text{ SAR} - 0.61 \quad r = 0.937 \quad n = 75$$

(These equations apply low Na/T values soils).

Tables : Relation between EC_e , EC_s , Cs appendix contains 42 tables on climatology, soil characteristics, composition of irrigation water, crops and water supply, pF curves.....

Key Words: SALI / COND /

Author : VERIGINA (K.V)
Title : A comparison of methods of determining exchangeable calcium and magnesium in calcareous and gypsiferous soils.
Public : Soviet Soil Science 1964.
Pages/ref: 969-976 / 12 ref.

Summary:

Four methods are compared:

Method (a) relies on NaCl solution to leach out exchangeable calcium and exchangeable magnesium. Correction is made for soluble Ca assuming that calcium carbonate dissolution is proportional to the volume of leaching solution. Method (b) uses also a NaCl solution but the amount of calcium carbonate dissolved is estimated by measuring the alkalinity of the filtrate. Method (c) uses a single 3N NaCl treatment. Method (d) uses a mixture of ammonium, acetate oxalate and carbonate which is said not to dissolve any carbonate.

For gypsic soils, two methods (e) & (f) are compared: in method (e) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ is changed into calcium carbonate by treating the soil (10 gr), with barium (1 gr), and then as proposed in methods (a) to (d). In method (f), soil is treated with an alcoholic solution of sodium sulfate in which neither calcium carbonate nor gypsum are dissolved. Exchangeable calcium is precipitated as CaSO_4 and estimated from the decrease in SO_4 concentration.

After having tested all the methods, the author concludes that the method (a) gives results too low by 10-15%, method (b) is not applicable to dolomite soils, but is convenient for calcareous soils, in method (e) calcium carbonate is dissolved, method (d) gives only exchangeable calcium, method (e) gives good results providing the soil is shaken with barium carbonate during 24 hours, method (f) underestimates exchangeable Ca.

Tables : - A comparison of values of adsorption capacity and methods (a), (b) & (c) on Chernozem and Sierozem (three tables).
- Solubility of calcium carbonate in NaCl, CaCl_2 mixtures (two tables).
- Effect of time of reaction of CaSO_4 with BaCO_3 on completeness of reaction.

Chemicals: Sodium chloride, Ethanol, Calcium chloride, Ammonium carbonate, Ammonium oxalate, Barium carbonate, Sodium sulfate.

Key Words: GYPS / ECEC /

CODE: 2722-09 / c-47-54-c / 80

ORDR: 0276

Auteur : VIEILLEFON (J)

Titre : Recherches sur l'analyse granulométrique des sols gypseux.

Public : ORSTOM, Ministère de l'Agriculture Tunisienne. Division des Ressources en eau et en sol. TUNIS 1977, Pub. No. ES137.

Pages/ref: 18 pages / 8 ref.

Résumé:

Une méthode analytique pour détermination des fractions granulométriques des sols gypseux basée sur la correction de la constante de Stokes est proposée. La suspension de sol est stabilisée par le sulfate de baryum et les sables (diam. sup. à 50 microns sont prélevés en premier lieu après tamisage sous l'eau.

L'importance des différents paramètres expérimentaux (temps d'agitation - teneur en gypse - quantité de dispersant..) conduit à adopter un protocole d'analyse très rigide mais donnant satisfaction.

Figures-Tables:

1. Analyse granulométrique classique des sols gypseux de la région de Sidi-Mansour et du Djebel Dissa.
2. Effet de la température de séchage 50° et 105°.
3. Variation du déficit de séchage en fonction de la teneur en gypse.
4. Temps de sédimentation pour la mesure Argile + Limon à 10 cm en fonction de la teneur en gypse et de la température.
5. Profondeur de prélèvement pour l'argile (6 heures) en fonction de la teneur en gypse et de la température.

Précision: Pour 24 sols ayant de 2.5 à 15% en gypse, 3 à 15% d'argile, la somme des fractions granulométriques donne 97.7% comme moyenne avec 2.7% comme écart-type.

Produits : Hexamétaphosphate de Na - Chromate de K - Chlorure de Baryum.

Mots Clés: GYPS / PHYS /

VIEI

Auteur : VIEILLEFON (J)
 Titre : Etude de l'application des phénomènes de deshydratation et de réhydratation du sulfate de calcium à l'estimation des teneurs en eau et en gypse des sols gypseux.
 Public : ORSTOM - DRES, Tunisie Pub. No. ES146 Juillet 1978.
 Pages/ref: 1-35 / 26 ref.

Résumé:

L'allure des courbes de deshydratation du sulfate de calcium déhydraté bien qu'elles dépendent de nombreux facteurs (type d'échantillon, rythme de montée en température, pression..) peut-être mise à profit pour une détermination rapide de la teneur en gypse des sols en même temps que leur humidité hygroscopique.

Méthode: 10 gr de sol sont séchés en étuve ventilée à 60° pendant 24 heures puis pesés (P1): on obtient ainsi la teneur en eau d'imbibition. On ajoute 20 ml d'eau et on laisse en contact 12 heures en chambre humide. On sèche à 60° pendant 24 heures, on pèse, soit P2, on calcule la teneur en semi-hydraté: $100 (P2 - P1) \times 145 / 27 P2$.

On sèche à 105° pendant 4 heures, on laisse réhydrater une minute en chambre humide, puis on sèche de nouveau à 60°C soit P3 le nouveau poids, la teneur en gypse est donnée par: $100 (P3 - P1) \times 172 / 27 P1$.

Figures : Nombreuses figures d'analyse thermique différentielle de gypse, de mélange d'hydrates et semi-hydrates et de sols gypseux.

Précision: Comparaison avec dosage chimique:

% gypse (chimique) = % gypse (hydratation) x 0.855 + 7.23
 (r = 0.955 et n = 30).

Mots Clés: GYPS / PHYS /

Authors : YEGOROV (V.V) & GORINA (N.I)
Title : Salt associations in soils of the gaspian lowland as related to their genesis.
Public : Soviet Soil Science 6, 1974 (translated from PCH 12, 1975).
Pages/ref: 654-660 / 3 ref.

Summary:

The qualitative composition of salts in soils is discussed and related to cycles of transformation which can be part of the genesis of lowland, soils of the gaspian region. Several combinations have been identified, two of them being qualified as primary, (with respect to solonchack inheritance); the transformation to secondary association, due to leaching leads to increased alkalinity.

The transformation depends on the order of removal of salts during leaching. To evaluate qualitatively this order, the authors propose a scheme of ion bonding between HCO_3 , Ca, Mg, Na, SO_4 and Cl. The general order of precipitation proposed is CaHCO_3 , ($\text{Mg}(\text{HCO}_3)_2$ or CaSO_4), MgSO_4 , (MgCl_2 or Na_2SO_4) and finally NaCl. This scheme based on qualitative considerations about the solubility and affinity of salts and separate ions may be finalized by five different ways which are characteristic of salt association and salinity genesis.

Figures : - Scheme of ion bonding.
- Occurrence of different salt associations in the soils of the northwestern Gaspian Region.

Key Word : SALI /