International Journal of
Soil Science

Assessing Microbial Community in Andisol Differing in Management Practices by Biochemical and Molecular Fingerprinting Methods

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Several biochemical and molecular methods are used to investigate the microbial community structure and microbial diversity in soils. Biochemical (Phospholipid fatty acid: PLFA profiles) and molecular (Denaturing gradient gel electrophoresis of polymerase chain reaction amplified DNA: PCR-DGGE) fingerprinting methods were employed to quantify soil microbial community in Andisol differing in management practices. No-tillage (NT) soil had significantly higher microbial biomass carbon and microbial biomass nitrogen than conventional tillage (CT) soil. PLFA for gram-positive bacteria, gram-negative bacteria, aerobes, cyanobacteria and fungi were significantly higher in NT than CT. On the other hand, PLFA for sulfate-reducing bacteria, methane-oxidizing bacteria and mycorrhizae were significantly higher in CT than PD and NT. The total DNA extracted from Andisol with differing management practices ranged from 21.0 to 33.0 $\mu g\ g^{-1}$ soil. Soil DNA yielded from puddling (PD) showed highest amount and NTg showed lowest amount. There were no significant variations in DNA yield obtained from Andisol of CT and NTg. Highest bacterial diversity evaluated by DNA band number in DGGE analysis based on PCR amplification of 16S rDNA fragments was observed in PD and can be arranged as: PD>CT>NT. On the other hand, highest fungal diversity evaluated by DNA band number in DGGE analysis based on PCR amplification of 18S rDNA fragments was observed in NT and can be arranged as: NT>CT>PD. Results indicated that microbial community was responsive to management practices demonstrating their usefulness as indicators of soil quality in temperate Andisol. *(International Journal of Soil Science 3 (1): 1-10, 2008; **Doi:** 10.3923/ijss.2008.1.10)*

Analysis of Nitrogen Dynamics and Fertilizer Use Efficiency in Rice Using the Nitrogen-15 Isotope Dilution Method Following the Application of Biogas Slurry or Chemical Fertilizer

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The fates of nitrogen-15 (^{15}N)-labeled biogas slurry (BS) and chemical fertilizer (CF) applied to soil with low fertility cropped with rice were investigated. The ^{15}N dilution method was used to estimate N uptake and recovery; potted soil was labeled with 1.0 atom % excess [^{15}N] ammonium chloride ([^{15}N]NH$_4$Cl). Certain

select soil characteristics were also measured in soil amended with the slurry to explain N losses. The values of the % N derived by fertilizer application to the plant exhibited significant differences among different plant parts. N uptake from the CF applied to rice grain, straw and the roots was significantly ($p<0.05$) higher than that from BS, but the highest proportion of N uptake by rice was from the soil. At harvest, an average of 6.2 and 13.2% of applied N remained in the soil treated with the CF and BS, respectively. Fertilizer use efficiency calculated by the ^{15}N dilution method tended to be higher for CF than BS. A significant amount of N fertilizer (average: 30%) was apparently lost from the soil-plant system by ammonia (NH_3) volatilization. Following BS application, the pH increased by 1 to 1.2 units in the top 5 cm of the soil, resulting in high NH_3 volatilization in the first 2 days of the experiment. The NH_3 volatilization accounted for the decrease in soil ammonium-N (NH_4^+-N) content. *(International Journal of Soil Science 3 (1): 11-19, 2008; **Doi**: 10.3923/ijss.2008.11.19)*

Nutrient Management for Maize Production in Soils of the Savannah Zone of South-Western Nigeria

Olufemi Julius Ayodele and Solomon Olusegun Omotoso

Farmers would adopt fertilizer recommendations that are based on soil fertility information in order to realize the potentials for high maize yields offer by features of the savannah zone. Surface (0-15 cm) samples of soil formed on basement complex rocks in the derived and guinea savannah zone of south-western Nigeria were analysed and nutrient status evaluated in relation to established critical levels. Sample of four commonest soil series used to evaluate response to addition of single nutrient: 100 mg N, 25 mg P, 20 mg Mg, 5 mg Fe, 5 mg Zn and 2.5 mg Cu L^{-1} using dry weight of maize grown for weeks in greenhouse pot studies. Maize grain yield responses to treatments that consisted of N, P, K, NP, NK, PK, NPK, NPKMg, NPKMgFeCuZn and unfertilized control were studied in four sites. The second field study in eight sites involved comparison of maize grain yield obtained from two treatments: + and - respective nutrients. The results indicated that soils are slightly acid to neutral sands and loams with very low to high organic matter and total N, low to medium exchangeable cations, low available P, Cu and Zn while Mn and Fe are high. The order of maize response was N, Mg followed by K, Zn and P in the greenhouse, single application of N fertilizer gave high response while responses to P and K were low where soils exceeded respective established critical nutrient levels. Yield response were enhanced with fertilizer combinations that contained N, P and Mg. The primary needs are N, P and Mg fertilizer soon after opening up the land for cultivation from short fallows. After year of

continuous cropping, K is needed while addition of Cu and Zn would produce higher yields on plots that received NPK fertilizers. The higher correlations with nutrient show that management recommendation must emphasize the need to raise and maintain soil organic matter levels, to ensure nutrient availability and increase response to fertilizers. *(International Journal of Soil Science 3 (1): 20-27, 2008;* **Doi:** *10.3923/ijss.2008.20.27)*

Production of Hydroxamate-Type of Siderophores by *Rhizobium* strains from *Sesbania sesban* (L.) Merr.

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Twenty six *Rhizobium* strains isolated from root nodules of *Sesbania sesban* (L.) Merr. were screened for their ability to produce siderophores. Among the twenty six strains, twenty strains produced hydroxamate-type of siderophores in Fiss-glucose mineral medium. The maximum amount of siderophore was produced by *Rhizobium* strain 22. The production of siderophore started at 8 h and reached maximum after 24 h. The addition of limited amount of iron in the media increased growth as well as siderophore production. Fiss-glucose mineral medium supplemented with 1% sucrose and 0.1% $(NH_4)_2SO_4$ increased siderophore production. UV-spectrophotometric scanning of purified siderophore showed absorption maxima in the range of 500-520 nm and indicating that it belongs to dihydroxamate-type of siderophore. Tryptophan and tyrosine were identified as conjugated amino acids of the purified siderophore. The outer membrane protein profiles of the *Rhizobium* strain 22 grown in high iron containing medium revealed an unique protein band of molecular mass 45 kDa. *(International Journal of Soil Science 3 (1): 28-34, 2008;* **Doi:** *10.3923/ijss.2008.28.34)*

Irrigation Suitability Evaluation of Asu River Basin Soils, South Eastern Nigeria

A.S. Fasina

A detailed soil survey of about 120.89 ha of land in Asu River Basin was carried out to evaluate the suitability of the soils for irrigation agriculture. The study revealed four (4) major soil types (Ihuibe 1 and Ihuibe 2, Ameta 1 and Ameta 2). The soils are deep (>100 cm) and contain low tolerable levels of calcium carbonate (EC-0.01 mmho cm^{-1} -0.22 mmho cm^{-1}). Soil textures consist of loam (Ihuibe 1), sandy clay loam (Ihuibe 2), clay loam (Ametal 1) and loamy Sand (Ameta 2) on the surface to sandy clay loam (Ihuibe 1), clay loam (Ihuibe 2),

sandy clay loam (Ameta 1) and clay (Ametal 2) subsoil. Three of the soils are imperfectly drained (Ihuibe 1, Ihuibe 2 and Ameta 2) while Ameta 1 is moderately well drained. The soils were classified into irrigation suitability classes for surface/gravity irrigation (Ihuibe 1 and Ihuibe 2 were classified as moderately suitable (S2) while Ameta 1 was classified as highly suitable (S1) and Ameta 2 as currently not suitable. For drip/localized irrigation, Ihuibe 1 and Ameta 2 were classified as moderately suitable (S2) while Ihuibe 1 and Ameta 1 were classified as highly suitable (S1). The study is recommending that for sustainable use of the area for irrigation agriculture, drip/localized type of irrigation should be used to irrigate the soils of the area. *(International Journal of Soil Science 3 (1): 35-41, 2008;* **Doi:** *10.3923/ijss.2008.35.41)*

Soil Mycoflora of Some Commercial Ventures in South West Nigeria

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The mycoflora of the soil of some commercial ventures such as cassava farm, cattle ranch, cocoa farm and sawmill was investigated. *Aspergillus* sp., *Penicillium* sp. were isolated from cassava farm and cattle ranch, while *Absidia* sp., *Curvularia* sp., *Fusarium* sp., *Neurospora* sp. and *Rhizopus stolonifer* were isolated from the cocoa and sawmill soils. Sawmill soil recorded the highest moisture and organic matter contents. The comparatively high pH value of the cattle ranch soil was attributed to large volume of urine and faeces of the cattle in the ranch. Calcium and potassium ions were the most prominent mineral nutrients especially in the cocoa farm and sawmill soils. Only *Fusarium* sp. was highly encouraged when cultured on soil extracts from the cassava farm, cocoa farm and sawmill. Spore germination, initiation of germ tubes and elongation of hyphae of *Aspergillus niger* and *Curvularia* sp. were adversely affected in all the soil extracts. However, the sawmill soil encouraged the production of an appreciable mycelia growth in species of *Fusarium, Neurospora* and *Penicillium.* *(International Journal of Soil Science 3 (1): 42-47, 2008;* **Doi:** *10.3923/ijss.2008.42.47)*

Characteristic Levels of Total Petroleum Hydrocarbon in Soil Profiles of Automobile Mechanic Waste Dumps

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This communication present the results of the determination of total petroleum hydrocarbon content of soil profiles of automobile mechanic waste dumps. The

levels of petroleum hydrocarbon in all sites ranged from 486-4438.7, 116.3-433.4 and 54.5-244.2 mg kg^{-1} for 0-15, 15-30 and 30-60 cm depths, respectively. The concentrations of petroleum hydrocarbon in automobile waste dump sites are relatively high and represent elevated concentrations above background levels found in unpolluted soils. The hydrocarbon concentrations show no relationship with the soil physicochemical characteristics and ages of the dumpsites. Automobile mechanic waste dumps represent a potential sources of petroleum hydrocarbon contamination in soils, sediments, surface water and groundwater in areas remote from oil exploration and production sites. *(International Journal of Soil Science 3 (1): 48-51, 2008; **Doi:** 10.3923/ijss.2008.48.51)*

Translocation of Soil Enzyme Activity by Leachates from Different Agricultural Drainage Systems

Stephan Wirth, Axel Höhn and Lothar Müller

Three different agricultural drainage systems located in the Northeast German lowland i.e., a free drainage of a shallow aquifer, a submerged deep drainage of a shallow aquifer and a free deep drainage were studied in order to detect evidence for translocation of enzyme activities and bacteria in percolating leachates. The activity of fluorescein diacetate (FDA) hydrolase as a measure of over-all microbial activity in the leachates was two up to three orders of magnitude lower as compared to the respective soil substrates. Enzyme activities in the leachates were almost constant throughout the year, except for a significant increase of FDA activity and cellulase activity due to a discharge by preferential flow, detected in the shallow free drainage system. FDA hydrolase was significantly but weakly correlated with chemical properties (NH$_4$N, DOC). The population density of culturable bacteria was rather low (50 up to 300 colony-forming units mL^{-1} drain water) coinciding with a mostly marginal translocation of soil enzyme activity by leachates from arable drainage systems. *(International Journal of Soil Science 3 (2): 52-61, 2008; **Doi:** 10.3923/ijss.2008.52.61)*

Content and Profile Distribution of Extractable Zinc (Zn) and Some Physicochemical Properties of Soil Along a Toposequence at Bauchi, Northern Guinea Savanna of Nigeria

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The content and distribution of extractable zinc within profiles along a toposequence at the Abubakar Tafawa Balewa University, Research Farm

Bauchi, Nigeria was studied. Soil samples were collected from each identified horizon of five profile pits dug at the crest, upper slope, middle slope, lower slope and valley bottom positions and subjected to laboratory analysis. The soils were sandy loam at the top and sandy clay loam or clay loam in the subsoil. Clay content was generally higher in the subsoil than in the topsoil with the pH values ranged between 5.98 and 6.18. Organic carbon although generally low was higher in the topsoil than in the subsoil and not markedly different with position along the toposequence while CEC (although generally low 3.28-5.26 cmol kg^{-1}) was higher in the subsoil than in the topsoil. The available phosphorus was also low in all the profiles and not markedly different between the profiles. Available zinc distribution followed the pattern of organic matter distribution and it was also low with no marked difference along the toposequence. *(International Journal of Soil Science 3 (2): 62-68, 2008; Doi: 10.3923/ijss.2008.62.68)*

Effects of Tithonia Green Manure and Water Hyacinth Compost Application on Nutrient Depleted Soil in South-Western Nigeria

K.S. Chukwuka and O.E. Omotayo

The study was conducted to investigate the application effects of *Tithonia diversifolia* (Hemsley) A. Gray) green manure and water hyacinth [(*Eichhornia crassipes*) Mart) Solms] compost on nutrient depleted soil from under an alley cropping system. The study was carried out at the Botany and Microbiology Department, University of Ibadan. Three different soil amendment treatments including control were used in the study. These were applied in sole applications as well as in varying combinations of the different treatments. The organic amendment treatments were compared to natural fallow as unfertilized control in a modified screen house experiment replicated 3 times in a Completely Randomized Design (CRD). The results showed that the application of 250 t ha^{-1} of fresh organic amendments increased the soil N, P, K, Ca, Mg, Cu, Zn, Mn, Fe, nitrate and nitrite compounds, pH and organic C of treated soils (both top and sub soil samples). Varying application rates of 187.5 and 62.5 t ha^{-1} also showed increased nutrient status for all aforementioned nutrient elements relative to the control treatment. Combination of *Tithonia* green manure and water hyacinth compost in the ratio (0.25:0.75 kg) was the most effective in increasing soil nutrient status of all treatments applied. The significance of increase in soil nutrient status of amended soils indicates that local farmers can gainfully substitute use of more expensive chemical fertilizers with these more readily available organic amendment resources. *(International Journal of Soil Science 3 (2): 69-74, 2008; Doi: 10.3923/ijss.2008.69.74)*

Phosphorous Sorption in Some Great Soil Groups of Semi-Arid Region of Turkey

Ali Volkan Bilgili, Veli Uygur, Siyami Karaca, Sadik Usta, Orhan Dengiz and Salih Aydemir

Removal of fertilizer phosphorous by adsorption and precipitation processes is an important factor for yield loss in low input soils of arid and semi-arid regions. The phosphate sorption characteristics of surface and subsurface horizons of four semi-arid region soils and their relationships with soil chemical and physical properties were investigated. Two sorption sites were identified. The adsorption capacity was greater for region 1 while bonding energy was higher for region 2 sites. The adsorption maxima (b_1) of the low concentration range (region-I) was 625-1250 µg P/g and adsorption energy coefficient k_1 ranged between 0.159-0.800 mL µg^{-1}. The calculated b and k values of high concentration range (region-II) were not treated as real adsorption parameters, because as the concentration increased, the data weakly confirmed Langmuir isotherm. This revealed the fact that Langmuir isotherm can be applied to phosphorous adsorption in soils and soil materials to a limited extent. Adsorption maximum of soils for P were found to be greater for soils and horizons high in $CaCO_3$, clay and CEC. Statistically significant positive relationships were found between adsorption maximum and $CaCO_3$, clay and CEC whereas important negative relationships were found between adsorption capacity and organic matter, sand, Fe_2O_3 and Al_2O_3 content of soils. *(International Journal of Soil Science 3 (2): 75-82, 2008;* ***Doi:*** *10.3923/ijss.2008.75.82)*

Exploring Folk Knowledge of Soil

I.P. Handayani and P. Prawito

Understanding folk knowledge of soil offers broader insight to help design more appropriate participatory agricultural research programs and facilitate better communication with farmers. To address this issue, semi-structured interviews were conducted with 90 farmers (age > 20 years) from three villages in Bengkulu Province, Sumatra, Indonesia. The objective of this study was to explore the folk knowledge toward soil classification, soil fertility, soil degradation and soil management. Farmers used 11 criteria to classify the soils. They described nine soil classes based on color and texture. Common colors for fertile soils are black, brown and mixed brown-black, but infertile soils are red and red-yellow. To better manage the soils, farmers recognized the importance of manures, crop residues

and compost as soil amendments and legumes in cropping systems. Two-year fallow was commonly applied by farmers to restore soil fertility after five years of cultivation. This study suggests that there is a need to maximize the benefits of local knowledge of soil by combining it with scientific knowledge to enhance rural development projects, help precision farming and better manage natural resources. *(International Journal of Soil Science 3 (2): 83-91, 2008;* ***Doi:*** *10.3923/ijss.2008.83.91)*

Salinity Sensor: A Reliable Tool for Monitoring *in situ* Soil Salinity under Saline Irrigation

Ghulam Hussain and Ibrahim A. Al-Hawas

The main objective of this study was to evaluate the use of salinity sensors with other methods currently being used for monitoring *in situ* soil salinity. Salinity sensors were installed in a field experiment receiving saline irrigation water for screening salt tolerant landscape trees. Soil salinity was measured by conventional analytical procedures (saturation-paste-extract, 1:1, 1:2 and 1:5 soil-water suspension) and the salinity sensors. Soil salinity measured by salinity sensors was very close to the irrigation water salinity than the conventional analytical methods and 1-1.5 times higher than the conventional methods ($r = 0.98$). The soil salinity measured by salinity sensors truly represented the salt concentration of soil solution encountered by the growing plants. The salinity sensors proved cost effective, more practical, easily operational and reliable tool for monitoring *in situ* soil salinity under saline irrigation for increasing agricultural production. It is strongly recommended that the use of salinity sensors should be encouraged for quick results of soil salinity than the conventional methods to improve water use efficiency and also to maximize the use of saline irrigation for increasing land productivity. *(International Journal of Soil Science 3 (2): 92-100, 2008;* ***Doi:*** *10.3923/ijss.2008.92.100)*

Effect of Different Land Use Treatments on Soil Structural Quality and Relations with Fractal Dimensions

A.A. Zolfaghari and M.A. Hajabbasi\

In this study, the feasibility of making the use of fractal dimension to quantify soil aggregate stability in different land use systems was investigated. For this purpose the non-linear fractal dimension (D_{nl}) and the Mean Weight Diameter (MWD) of aggregates were compared. In October 2005, soil samples from three sites with

four adjacent land-use types namely: forest area (F), cultivated lands adjacent to forest (CAF), pasture (P) and cultivated lands adjacent to pasture (CAP) were collected. Cultivated pasture (CAP) had the largest value of D_{nl}, while pasture (P) had the smallest value of D_{nl}. Difference of D_{nl} between forest and pasture was not significant, while both of them significantly differed from that of cultivated forest (CAF) and cultivated pasture (CAP) in this parameter. There were significant differences between forest and pasture for the measured MWD. Coefficient of variations (CVs) between MWD and D_{nl} were also contrasted and the low value of CV indicated the higher precision of the method used. The lowest CVs belonged to D_{nl}, demonstrating that D_{nl} was more accurate than MWD methods. Fractal dimension had negative correlation with MWD, SOM, Hydraulic Conductivity (HC) and macroaggregates (>0.25 mm) and positive correlation with Bulk Density (BD) and Total Porosity (TP). *(International Journal of Soil Science 3 (2): 101-108, 2008;* **Doi:** *10.3923/ijss.2008.101.108)*

The Effects of Iron Content of Soils on the Iron Content of Plants in the Cukurova Region of Turkey

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Soil, leaf and grain samples were collected from wheat (*Triticum* sp.) fields in Cukurova Region of Turkey and the soil samples taken from the root area of plants where the leaf and grain samples were obtained were analysed for iron (Fe) content. The leaf samples taken during the stem development and the grain samples taken at the time of maturation were also analysed for Fe content. The correlation analysis between Fe contents of soil and Fe contents of leaf and grain was performed to determine the relationships among the variables. The Fe content of the soil samples collected in 2005 was between 2.60 and 6.00 mg kg^{-1}. The Fe content of the soil samples collected in 2006 was between 6.96 and 12.70 mg kg^{-1}. The iron content of the majority of soil samples, collected in 2005, was observed below the critical level which is 4.5 mg kg^{-1}. The Fe content of the leaf samples was ranged from 69.50 to 156.70 mg kg^{-1} in 2005 and 138.10 to 518.10 mg kg^{-1} in 2006, whereas the iron content of the grain samples was ranged from 96.00 to 299.50 mg kg^{-1} in 2005 and 11.54 to 134.01 mg kg^{-1} in 2006. Also the Fe content of the leaf and grain samples was directly correlated with the Fe content of the soil. Correlation between iron content of soil and iron content of leaf in 2005 was significant at the 0.01 level according to statical analysis. While there was a direct relation between iron content of leaves and soil samples, there was an inverse relation between iron content of grain and iron content of leaf in 2006. *(International Journal of Soil Science 3 (3): 109-118, 2008;* **Doi:** *10.3923/ijss.2008.109.118)*

Influence of Water Stress on Water Use Efficiency and Dry-Hay Production of Alfalfa in Al-Ahsa, Saudi Arabia

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The main objective of this study was to study the performance of alfalfa under water stress conditions and determine water use efficiency (WUE) for optimal forage production under the arid climatic conditions of Al-Ahsa having limited irrigation water supplies. Plant growth parameters of alfalfa were significantly affected by different irrigation treatments. Mean alfalfa dry forage (hay) yield ranged between 2.21-5.33 MG ha^{-1} in different irrigation treatments. The WUE was higher in T_1 (irrigation at field capacity soil moisture level) than other water stress treatments. It was noticed that alfalfa dry forage yield was severely affected by irrigation stress. In conclusion, the WUE of alfalfa crop was highest in T_1 (irrigation at field capacity level of soil moisture) than other irrigation treatments. The study provided an excellent opportunity for scheduling irrigation of alfalfa crop for optimal dry-forage production under arid climatic conditions of Al-Ahsa, Saudi Arabia. *(International Journal of Soil Science 3 (3): 119-126, 2008;* **Doi:** *10.3923/ijss.2008.119.126)*

Evaluation of Factors Affecting Parameter m in Drained Shear Strength of Over Consolidated Soils

M.S. Pakbaz, S.A. Tabatabaei and B. Boroumandzadeh

This study presents the results of laboratory direct shear tests on two natural over consolidated clay samples and compacted laboratory over consolidated samples of different mixtures of bentonite sand. The intact shear strength of over consolidated soils can be obtained from $\tau_{oc} = \tau_{NC} (OCR)^{1-m}$. In that the intact shear strength of over consolidated soils are higher than shear strength of normally consolidated soils of the same constituent by factor of $(OCR)^{1-m}$. Application of this relationship for compacted over consolidated soil near optimum water content is considered. The effect of composition on the parameter m is sought. The effect of structure on m is evaluated by comparison of above test results with natural samples and with artificially cemented samples tested in direct shear test. The results show decrease in m value with increasing plasticity and cementation. *(International Journal of Soil Science 3 (3): 127-137, 2008;* **Doi:** *10.3923/ijss.2008.121.137)*

Effect of Soil Moisture Regime and Rice Cultivation on Mineralogical Characteristics of Paddy Soils of Mazandaran Province, Northern Iran, Amol

H. Hassannezhad, A. Pashaee, F. Khormali and M. Mohammadian

The clay mineralogy of paddy soils with different water table depth and drainage of Northern Iran were investigated to determine their origin and factors controlling their distribution pattern in soils. In this study sand, silt and clay fractions were separated by centrifuge after the removal of organic matter, carbonates and sesquioxides. For identification of clay minerals, clay suspensions were saturated by Mg and K and then 10 mg of clays were placed on glass slides for XRD analysis. In all of the soils studied, smectite, illite, chlorite, kaolinite and quartz were identified. Clay mineralogy is probably more affected by parent materials and less influenced by aquic and anthraquic conditions. However, there are some indications that aquic and anthraquic condition may affect on quantity of clay minerals, as shown by higher smectite in poorly drained soils. *(International Journal of Soil Science 3 (3): 138-148, 2008; **Doi:** 10.3923/ijss.2008.138.148)*

Morphology and Micromorphology of Paddy Soils under Different Soil Moisture Regime and Ground Water Table in Mazandaran Province, Northern Iran, Amol

H. Hassannezhad, A. Pashaee, F. Khormali and M. Mohammadian

The morphology and micromorphology of paddy soils under different soil moisture regime and groundwater table of Northern Iran were investigated. Aquic conditions in soils are often associated with redoximorphic features. The depths at which the features occur are often used as an indicator of the location of the seasonal water table. Morphological and micromorphological characteristics could be used to identify the hydromorphism degree of soils and their properties. In this study, morphological and micromorphological characteristics of paddy soil samples with different water table depth and drainage were investigated. Thirty nine undisturbed blocks of soil were taken. Thin sections were observed with a polarized microscope and described according to thin section interpretation. This study demonstrated the extensive pedogenic changes and micromorphological evidences. Studied soil samples are exposed to alternative fluctuations with water saturation in different time. The various type of iron and manganese oxides show the difference of environment and their movement and formation are the most

important factor to form hydragric anthrosol. This study demonstrated that moisture regimes in soils with anthraquic saturation can be characterized in the same way as in soils with either episaturation or endosaturation. And also the effect of irrigation water on pedogenesis with respect to saturation, reduction and redoximorphic features was greater than that of the shallow ground water. *(International Journal of Soil Science 3 (3): 149-156, 2008;* **Doi:** *10.3923/ijss.2008.149.156)*

Movement of Nitrogen, Phosphorus and Potassium Fertilizers in Undisturbed Soil Columns as Affected by Soil Compaction

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The objective of this study was to investigate the movement of the added fertilizers to soil as affected by soil compaction. In the experimented soil, three compaction levels were used. The soil was also irrigated for four times and after the each irrigation, Phosphorus (P) and Potassium (K) in the drainage water (effluent) was measured using standard methods. After the fourth irrigation, each soil column was divided to five equal parts and the elements in the columns were measured and finally the data were analyzed using the statistical software. The results showed that as the compaction is increased, the movement of nitrogen (N) and K downward is reduced, but the movement of P is increased. The reason for the movement of N in low compaction is the existence of macropores for preferential flow and suitable conditions for nitrification. The movement of the most of K in low compaction is due to movement through macropores and preferential flow. The increase in P movement in high compaction is caused by high moisture and movement by diffusion. *(International Journal of Soil Science 3 (3): 157-163, 2008;* **Doi:** *10.3923/ijss.2008.157.163)*

The Effect of Tillage and Herbicides (Rimsulfuron and Codal Gold) on Weed Regeneration

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The effect of three tillage methods (No-till, NT; Plough, P and Plough and harrow, (P+H) and the efficacy of Rimsulfuron (N-(4,6-dimethoxyl-2-pyrimidinyl) (amino carbonyl)-3-(ethysulfonyl)-2-pyridinesulfonamide) applied at 30 g ai ha^{-1}, Codal gold (a formulated mixture of metolachor (2-chloro-N-(2-ethyl-6-methylphenyl)-N-)2-methoxl-1-methyethyl) acetamide) and prometryn (N,N'-bis(1-methylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine) applied at 1.23 kg ha^{-1}

on weed regeneration in maize (*Zea mays* L.) was studied at the University of Benin, Benin City, Faculty of Agriculture farm. The experiment was a split-plot arrangement in a completely randomized block, with tillage methods as the main treatment and weed control methods (Rimsulfuron, RIM; Codal Gold, CG; No weeding NW; HW) as sub treatment. Tillage methods significantly influenced weed biomass (1556, 980.12 and 1024.57 kg ha^{-1} for NT, P and P+H respectively, (p<0.05), but there were no significant differences in weed biomass between P and P+H. Weed control methods also significantly affected weed biomass, 1153.12, 1048.49, 1010.04 and 1535.91 kg ha^{-1} for CG, HW, Rim and NW, respectively (p<0.05). Tillage and weed control methods significantly influenced maize plant height and dry matter. Tillage methods significantly affected maize grain yield with values of 801.37, 1131.55 and 1272.37 kg ha^{-1} for NT, P and P+H, respectively. Codal Gold significantly depressed grain yield irrespective of the tillage system. *(International Journal of Soil Science 3 (3): 164-168, 2008; **Doi:** 10.3923/ijss.2008.164.168)*

Effect of Si/Al Ratio of Allophane on Competitive Adsorption of Phosphate and Oxalate

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Allophane is a soil clay constituent with high adsorption capacity for cationic and anionic solutes and the adsorption characteristics depend on its Si/Al molar ratio. Adsorption experiments of phosphate and oxalate on two natural allophane samples with low (0.67; KyP) and high (0.99; KnP) Si/Al ratios were conducted at initial adsorbate concentration of up to 0.6 mM and at pH of 5.0 to 7.0. In both single and binary (equimolar phosphate and oxalate) adsorbates systems, KnP had less capacity for adsorption of both phosphate and oxalate than KyP had, because in the structure of KnP, accessory Si is already adsorbed onto aluminol groups to which phosphate and oxalate will be adsorbed. For KyP with lower Si/Al ratio and higher adsorption capacity, the efficiency of phosphate to depress the adsorption of coexisting oxalate, $E_{OX \leftarrow P}$, was always greater than the reverse efficiency, $E_{P \leftarrow OX}$, at a same condition; the ratio of oxalate/phosphate adsorbed in the binary system was less than unity and the ratio decreased with increasing pH and initial adsorbate concentration. These indicated higher selectivity of KyP for phosphate than for oxalate and the selectivity increased with increasing the competition between phosphate and oxalate toward KyP. KnP with higher Si/Al ratio showed higher selectivity for phosphate than KyP did, but the ratio of oxalate/phosphate adsorbed was almost constant when pH and initial adsorbate concentration were raised. This means that even under the lowest pH and the

lowest adsorbate concentration examined (pH 5.0, 80 μM), the competition between phosphate and oxalate toward KnP was already severe and further increase in the phosphate selectivity was not caused. *(International Journal of Soil Science 4 (1): 1-13, 2009;* **Doi:** *10.3923/ijss.2009.1.13)*

Determination of Critical Levels of Micronutrients by Plant Response Column Order Procedure for Dryland Wheat (*T. aestivum* L.) in Northwest of Iran

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Plant response column order procedure was used to determine critical levels of Fe, Mn, Zn, Cu and B for dryland wheat in West Azarbaijan, East Azarbaijan, Kurdestan and Kermanshah Provinces of Iran. Series of experiments were conducted in randomized complete block design with 4 treatments of each micronutrients (0, 5, 10 and 15 kg ha^{-1} Fe as iron chelate (NaFeEDDHA); 0, 5, 10 and 15 kg ha^{-1} Mn as manganese sulfate; 0, 5, 10 and 15 kg ha^{-1} Zn as zinc sulfate; 0, 2.5, 5 and 7.5 kg ha^{-1} Cu as copper sulfate and 0, 1.5, 3 and 4.5 kg ha^{-1} B as boric acid) with three replications for four years (1998-2002). The collected data were used in plant response column order procedure and interaction chi-square (probability of no interaction between soil classes) models. The results for boundary of between soil deficient and sufficient classes or critical levels by plant response column order procedure and interaction chi-square model for Fe, Mn, Zn, Cu and B critical values were determined as 4.7, 11.2, 0.7, 1.4 and 0.5 mg kg^{-1} soil, respectively; predictable values for critical levels of micronutrients were also calculated as 99.5, 94, 87, 88 and 78%, respectively. From the results, it can be concluded that soil Fe, Mn, Zn, Cu and B requirements and dryland wheat response relationships can be determined by plant response column order procedure and interaction chi-square methods. These methods can be applicable for classifying and prediction of soil micronutrient needs in dryland wheat cultivation in Northwest region of Iran. *(International Journal of Soil Science 4 (1): 14-26, 2009;* **Doi:** *10.3923/ijss.2009.14.26)*

Effects of Ammonium and Iranian Natural Zeolite on Potassium Adsorption and Desorption Kinetics in the Loess Soil

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Information about the adsorption and desorption kinetics of potassium and the consequent alterations with zeolite additions are limited in Golestan Province loess

soils with illite dominance in the clay fraction. The kinetics of potassium adsorption and desorption with different Kcl concentrations (0, 40, 60, 80, 110 and 140 mg L^{-1}) and KCl+NH$_4$Cl concentrations (K80,N60; K80,N120; K60,N60; K110, N120; K80, N90 and K110, N90 mg L^{-1}) on the soil, the zeolite and their incorporation (within 2 and 1800 h) were investigated with this research using batch method. Potassium adsorption and desorption was initially fast (first 48 h) but continued with low speed (after 48 h) until the end of the experiment. Results shown increasing of K$^+$ concentration increased rate of adsorption and desorption in soil, zeolite and their incorporation and zeolite increased adsorption and decreased desorption rate by incorporation with soil. Ammonium presence decreased potassium adsorption and it increased potassium desorption. K/NH$_4$ desorption rate did not follow exactly K/NH$_4$ adsorption ratio for all treatments. The kinetic equations used to estimate data were zero order, first order, simple Elovich, parabolic diffusion and power function. The Elovich model described the adsorption and desorption processes on soil and soil with zeolit (0.88<R^2<0.99). Elovich and power function models described adsorption and desorption processes, respectively for zeolite well (0.65<R^2<0.97). The models indicated that K$^+$ adsorption and desorption was diffusion controlled. Potassium adsorption and release by batch method did not simulate potassium uptake by wheat. *(International Journal of Soil Science, 4 (2): 27-45, 2009;* **Doi:** *10.3923/ijss.2009.27.45)*

Copper Correlation of Irrigation Water, Soils and Plants in the Cukurova Region of Turkey

Seyyid Irmak

In this study, copper content of soil and irrigation water and copper content of leaves and grain of wheat (*Triticum* spp.) were studied. Study samples of soil, leaf and grain were collected from wheat (*Triticum* spp.) fields in Cukurova Region of Turkey. Soil samples taken from the root area of plants where the leaf and grain samples were collected and analyzed for copper (Cu) content. The leaf samples taken during the stem elongation and the grain samples taken at the time of maturation were also analyzed for Cu content. The correlation analysis between soil-Cu contents and leaf and grain-Cu contents was performed to determine the relationships among the variables. The Cu content of the soil samples collected in 2005 was between 0.78 and 1.56 mg kg^{-1}. The Cu content of the soil samples collected in 2006 was between 1.12 and 1.96 mg kg^{-1}. The copper content of the majority of soil samples, collected in 2005 was observed above the critical level

which is 1 mg kg^{-1}. The Cu content of the leaf samples was ranged from 26.30 to 67.60 mg kg^{-1} in 2005 and 3.06 to 18.02 mg kg^{-1} in 2006, whereas the copper content of the grain samples was ranged from 11.77 to 17.89 mg kg^{-1} in 2005 and 7.37 to 14.06 mg kg^{-1} in 2006. According to data analysis performed in collected samples, the Cu content of the leaf and grain samples was directly correlated with the Cu content of the soil. Correlation between copper content of soil and copper content of leaf in 2006 are significant at the 0.01 level based on the statistical analysis. Also, correlation between copper content of soil and weight of 1000 grain in 2005 and in 2006 are significant at the 0.01 level in respect of statistical analysis. *(International Journal of Soil Science, 4 (2): 46-56, 2009;* ***Doi:*** *10.3923/ijss.2009.46.56)*

Influence of Compaction Curve Modeling on Void Ratio and Pre-Consolidation Stress

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The objective of this study is to investigate the influence of different consolidation curve models on the initial void ratio values and through which on the obtained pre-consolidation stress. Further, this study verifies the dependence of pre-consolidation stress on the initial void ratio value measured at 1 kPa. This was done in order to check the trend between the consolidation curve models and the deviation in pre-consolidation stresses. Three different Oedometer tests have been carried out which were denoted as undisturbed, disturbed and disturbed-rewetted. The curves were fitted using two different curve models (Assouline and Van Genuchten models) and the graphical calculation of the pre-consolidation stress was done using two different methods (Casagrande and Silva methods). The curve models are applied on the compaction data obtained from the soil classified as loamy sand. A good consolidation curve fit to the data (R^2 ranging between 0.97 and 0.99) has been verified for a wide range of applied stresses (0 to 2500 kPa), including stresses less than the pre-consolidation stress. Huge differences in the initial void ratio values (Δe ranging between 0.003 and 0.423) have been observed with different curve models and with which a huge difference in pre-consolidation stresses (ΔP ranging between 0 and 57 kPa) have been observed. This study clearly showed that the pre-consolidation value obtained was mainly dependent on the curve fitting model and also on the calculating method. This study also showed a dependence of pre-consolidation stress over the void ratio measured at 1 kPa. *(International Journal of Soil Science, 4 (2): 57-66, 2009;* ***Doi:*** *10.3923/ijss.2009.57.66)*

Soil Enzymes Activities in Irrigated and Rain-Fed Vertisols of the Semi-Arid Tropics of Sudan

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Soil management practices that involve intensive traditional ploughing and disking may affect soil quality. Soil enzymes activities were investigated from crop rotations in irrigated and rain-fed areas. Soil samples collected from long term (79 years), medium-term (46 years) and short-term (22 years) irrigated cotton (*Gossypium hirsutum*) schemes and rainfed cultivation of sorghum (*Sorghum bicolor*) and sesame (*Sesamum indicum*) in a semi-arid tropical Vertisol. Alkaline phosphatase was significantly higher in both short-term (661 µg p-nitrophenol g^{-1} soil h^{-1}) and rain-fed cultivation (605-747 µg p-nitrophenol g^{-1} soil h^{-1}). Long- and medium-term cultivation in the irrigated sector had significantly less protease activity [3.75-4.73 µg tyrosine g^{-1} soil $(2 h^{-1})$] compared to other cultivation systems [11.54-15.09 µg tyrosine g^{-1} soil $(2 h^{-1})$]. Except, long-term cultivation, there was a general separation in the activity of β-glucosidase between irrigated [average of 21.9 µg saligenin g^{-1} soil $(3 h)^{-1}$] and rainfed Vertisols [17.9 µg saligenin g^{-1} soil $(3 h)^{-1}$]. Correlation analysis and Principal Component Analysis (PCA) revealed that only alkaline phosphatase activity was positively correlated with total soil N and carbon contents. These results may draw attention on the impact of intensive application of agro-chemicals (pesticides, herbicides and fertilizers) on soil health in the world biggest Gezira cotton scheme. *(International Journal of Soil Science 4 (3): 67-79, 2009; **Doi:** 10.3923/ijss.2009.67.79)*

Reuse of Date Palm by-Products for Efficient Use of Nitrogen Fertilizer

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The present study aims to improve the efficiency of nitrogen fertilizer applied to soil by reuse of date palm by-products after grinding and mixing with sandy loam soil. The date palm by-products collected from different areas, then air dried and grinded. Two fractions selected (i.e., less than 0.5 and 1-2 mm size). The powder mixed with sandy loam soil at the rates of 0.0, 1.0, 2.5, 5.0, 7.5 and 10.0% (w/w). The treated soil incubated at field capacity in plastic container for 30 days. After the incubation period, the soil was air dried and passed through a 2.0 mm

sieve. The physical and chemical analyses of sandy loam and treated soils performed. The PVC transparent columns with of 6.0 cm diameter and 30.0 cm length packed with sandy soil at 1.6 g cm^{-3} soil bulk density to 20 cm depth and then a 5 cm surface layer of treated soil applied. The soil columns arranged as follows: 1) size fraction of date palm by-product, 2) the rate of date palm by-products applications and 3) rate of water applied (5 and 10 pore volumes). The fertilizer applied at the required rate (250 mg L^{-1}) to soil surface and then the water applied at required rates (0.2 and 0.4 cm min^{-1}). The leachate out of soil columns received. Volume of leachate and concentration of NO_3 was determined. At the end of experiment, the soil was cut to 2.5 cm slices for determining the soluble NO_3. Total NO_3 in soil and percolate were calculated and then the loss of fertilizers and fertilizer use efficiency calculated under the experimental conditions. The results showed that increasing the rate of date palm by-products reduced the NO_3 in leachate and increased NO_3 in soil columns. In addition, increasing water application rate increased fertilizers loss in the leachate. The fine fraction of date palm by-products reduced the NO_3 leaching out of soil by about 14.86 and 5.90% for low and high water application rate, respectively in case of fine fraction, reduced nitrate losses. The corresponding values for coarse fraction were 9.73 and 4.35%, respectively. According to the present results, it is possible to reuse the date palm by-products for increasing the fertilizers use efficiency and reduces the problems of groundwater pollution and accumulation of these by-products in farm. *(International Journal of Soil Science 4 (3): 80-92, 2009;* **Doi:** *10.3923/ijss.2009.80.92)*

Spatial Variability of Soil Organic Carbon in Oil Palm

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This study aimed at quantifying the spatial variability of SOC and estimating SOC concentration in oil palm. This study was carried out in a commercial oil palm plantation bearing 27 year old palms. A systematic design was employed for soil sampling at the 0-20 cm depth based on a cluster of 4 palms that included three operational areas Weeded Circle (WC), Frond Heap (FH) and Harvesting Path (HP). A total of 60 sampling clusters were established. SOC was analyzed using dry combustion method. All measurement points were geo-referenced by a differential Global Positioning System (dGPS). The SOC data were first explored using descriptive statistics, normality check and outlier detection. This followed by

variography and interpolation techniques to quantify the spatial variability of SOC. Results showed that all three operational areas exhibited a definable spatial structure and were described by either spherical or exponential models. SOC from WC and HP showed moderate spatial dependence while that from FH showed a strong spatial dependence. The FH had a shorter effective range than other operational areas. Contour maps for WC, FH and HP clearly showed spatial clustering of SOC values. All three operational areas fulfilled the interpolation accuracy criteria. This study suggests that site-specific management could be considered as a strategy to increase SOC sequestration in oil palm. *(International Journal of Soil Science 4 (4): 93-103, 2009;* ***Doi:*** *10.3923/ijss.2009.93.103)*

Carbon and Nitrogen Storage in Soil Aggregates from Different *Terminalia superba* Age Plantations and Natural Forest in Kouilou, Congo

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A comparative study was carried out in Mayombe, between the soil of natural forest and the soil under three *Terminalia superba* plantations of 7, 12 and 48 year-old. In each plantation type and natural forest composite soil samples were taken in 0-10 cm layer. The goal was to investigate the dynamic of total carbon and nitrogen in whole and soil aggregate fraction in order to assess the impact of reforestation on the soil fractions. Organic carbon was analyzed by the modified Walkey and Black method. Total nitrogen was determined using the Kjeldhal procedure. Statistically differences between the sites were tested using the Analysis of Variance (ANOVA). The results showed that in the surface soil the carbon content and total nitrogen were respectively 22.2 and 1.56 μg g^{-1} in the forest. The carbon content was between 14.9 and 23.5 mg g^{-1} while total nitrogen was between 1.31 and 2.24 μg g^{-1} in the plantations. The results also revealed that plantation aging had a marked impact on the total carbon and nitrogen concentration of soil aggregate fractions. The carbon and the nitrogen associated with the sand and the clay exhibited a significant increase. The carbon concentration was between 1.51 and 2.09 mg g^{-1} in the light aggregate fractions and between 0.95 and 1.04 mg g^{-1} in the organomineral aggregate fraction. The accumulation of total carbon in the whole soil and soil aggregate fractions and their increase during plantation aging suggested that the *T. superba* plantations could facilitate significant carbon storage. *(International Journal of Soil Science 4 (4): 104-113, 2009;* ***Doi:*** *10.3923/ijss.2009.104.113)*

Correlation Study Between Soil Nutrient Indices and Yield of Wheat and Barley in the Ganjabasar Region of Azerbaijan

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The objective of this study is to investigate the correlation between soils nutrient regime indices and the yield of winter wheat (*Triticum aestivum*) and barley (*Hordeum vulgare*), the main cereal crops of the Ganjabasar region. Using experiments planning method a regional (the Ganjabasar region of Azerbaijan) conceptual and mathematical model was developed for soils fertility management. In this regional fertility model, all indices of fertility criteria of researched soils were combined in 5 blocks (agroecology, soil content, soil nutrient regime, soil properties and agromelioration). Unlike the prior models, included are Immediate Nutrient Reserve (ImdNR), Intermediate Nutrient Reserve (IntNR) and Potential Nutrient Reserve (PNR) forms to the list of criteria of soil nutrient regime block in the regional fertility model using the Gorbunov method. The majority of the correlation relations were consistent ($0.56 < r < 0.89$). Among the variables of soil nutrient regime, total nitrogen content, Cation Exchange Capacity (CEC), Immediate Nutrient Reserve (ImdNR) of phosphorus and potassium consistently correlated and Intermediate Nutrient Reserve (IntNR) of phosphorus and potassium were slightly correlated in yield, of which CEC and IntNR of P and K was steady but others were dynamic variations. It revealed that in the final mathematical models, 71% of wheat yield variability was accounted for variation in above dynamic indices. *(International Journal of Soil Science 4 (4): 114-122, 2009;* **Doi:** *10.3923/ijss.2009.114.122)*

Irrigation Water Quality Evaluation of Al-Mendasah Groundwater and Drainage Water, Al-Madenah Al-Monawarah Region, Saudi Arabia

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Groundwater and drainage water samples were collected from Al-Mendasah area, North-West of Al-Madinah Al-Munawarrah for irrigation water quality evaluation. The well waters were classified as C4S2 to C4S4 waters i.e., very high salinity and medium sodium to severely saline and very high sodium waters. The drainage waters were classified as C3S2 to C4S3 i.e., high salinity and medium sodium to severely saline and high sodium waters. The groundwater is dominated by Na and Cl ions. The Saturation Indices (SI) showed that the groundwater is unsaturated with respect to anhydrite, halite, gypsum and fluorite; and saturated with respect

to calcite and dolomite. The concentration of calcium is much higher than that of Mg. The nitrate contents are much higher than the recommended safe limits of 30 mg L^{-1} for drinking and other uses. The fluorite (F) concentration in 40% of well waters was higher than the recommended safe limits for drinking water. The strong correlation between SAR vs. adj. SAR and adj. R_{Na}, Na vs. Cl, Mg vs. Cl and Mg vs. SO_4 ions indicate the dissolution and precipitation reactions in the rock-water interface that affect groundwater chemistry. The soil infiltration rate will not be affected either by well water or drainage water irrigation. Only, 12% well waters are safe for irrigation directly without serious soil and crop production problems. The use of remaining 78% well waters requires the adoption of certain management practices such as adequate drainage, selection of salt tolerant crops and application of leaching requirements. *(International Journal of Soil Science 4 (4): 123-141, 2009;* **Doi:** *10.3923/ijss.2009.123.141)*