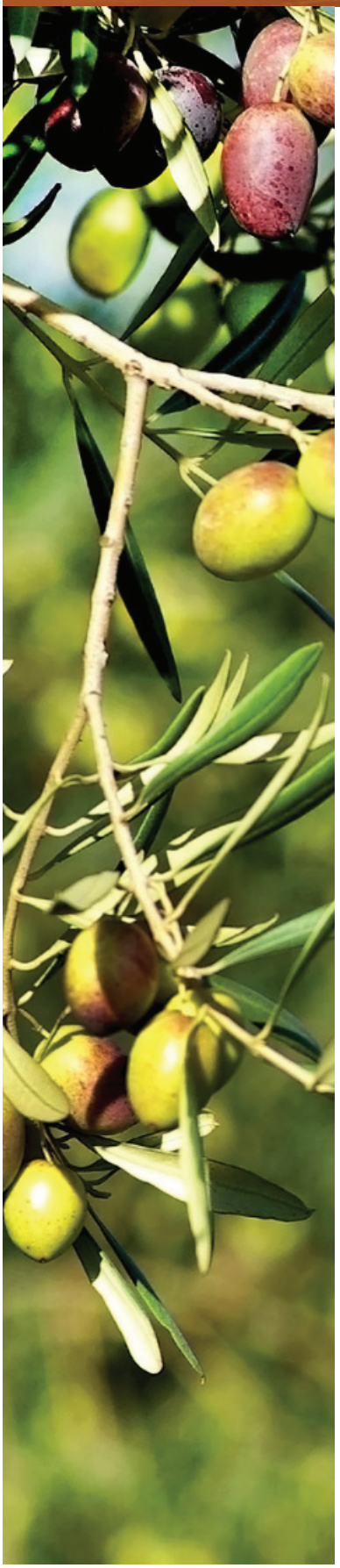
Abstracts



12th International Symposium on Soil and Plant Analysis

June 6 - 10, 2011
Mediterranean Agronomic Institute of Chania, Crete, Greece

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PROGRAM

12th International Symposium of Soil and Plant Analysis
Mediterranean Agronomic Institute of Chania
Crete, Greece

MONDAY, JUNE 06, 2011

Welcome and History of ISSPA

TIME	TITLE	PRESENTING AUTHOR		
9:00 - 9:15	Introduction and welcome	Nikos Barbayiannis Rigas Karamanos		
9:15 – 9:45	History of the International Symposia on Soil and Plant Analysis	Yash Kalra	275	3

Break 9:45 - 10:00

Plenary Session 1: Mediterranean Agriculture

Chair: Nikos Barbayiannis

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10:25 - 10:50	The Traditional Mediterranean Diet of Greece: Principles, Functionality and Perspectives	Alexandra-Maria Michaelidou	289	4
10:50 - 11:15	Temporal variability of soil biological properties in temperate grasslands and croplands amended with organic and inorganic fertilizers	Jorge Paz-Ferreiro	98	4
11:15 - 11:40	Evaluation of potassium status in some sandy soils of Egypt characterized with low values of CEC	Shalaby, Mohamed	196	5
11:40 - 12:05	The use of ground-sensor NIR reflectance to quantify soil organic matter and carbonate content in three representative fields of the Thessaly Plain (central Greece)	Stamatis Stamatiadis	245	5

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Chair: John Ryan

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13:50 - 14:15	Non-destructive total element analysis using portable x-ray fluorescence (PXRF) on cotton leaf tissue and soybean grain	Timothy McLaren	140	7
14:15 - 14:40	Comparison of two sequential extraction methods and the DTPA method for the extraction of micronutrients from acid soils	Theodora Matsi	97	7
14:40 - 15:05	Anionic resin extractable P as an index of P availability in calcareous soils of Crete, amended or non- amended with pig manure compost	Aristeidis Stamatakis	35	8

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Chair: Cynthia Grant

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15:45 - 16:10	Development of a simplified model for N fertilizer recommendation for maize, wheat and helianthus	Vasileios Antoniadis	65	9
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Chair: Christos Tsadilas

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8:55 - 9:20	Microelement status and soil and plant relationships of olive groves in West Anatolia Region of Turkey	Hatice Sevim Turan	283	11
9:20 - 9:45	Effect of potassium on olive production and quality under a fertigation system: Usefulness of sap analysis	Enrique Eymar	249	11

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Chair: Christos Tsadilas

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10:25 - 10:50	Effect of selenium treatment in nutrient solution and soil (rhizobox) by maize and sunflower plants	Béla Kovács	142	13
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Chair: Yash Kalra

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13:30 - 13:50	Nitrogen precision management for wheat-maize double cropping systems in North China Plain	Chunsheng Hu	89	16
13:50 - 14:10	Statistical spatial models for soil parameters. A comparative analysis of several methods applied to Dobrovat basin (eastern Romania)	Cristian Patriche	263	17
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14:50 - 15:10	Potassium nutrition management for enhancing tuber yield of potato grown under short day irrigated condition in Eastern Indo - Gangetic plains of India	Hillel Magen	198	19

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	Concentrations Of Three Different Carbon Forms In Surface Waters From An Agroforestry Catchment In Northwest Spain	Vidal-Vázquez, Eva	2	31
	Temporal Oscillation And Losses Of Three C Forms In A Microcatchment From NW Spain	Vidal-Vázquez, Eva	3	32
	Contrasting Dynamics Of Nitrate And Kjeldahl Nitrogen In A Stream Draining A Rural Catchment In NW Spain	Rodríguez-Blanco, M.L.	4	32
	Can Suspended Sediment Data Be Used To Predict Phosphorus Fluxes In Catchments Dominated By Forest And Grassland Uses?: The Corbeira Catchment	Rodríguez-Blanco, M.L.	5	33
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THURSDAY, JUNE 9, 2011

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Chair: Robert Miller

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9:20 - 10:15	Recent Developments in the Evaluation of Soil Potassium Supplying Capacity	Vissarion Keramidas	287	20
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Chair: Robert Miller

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Chair: David Kissel

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	Improving Effectiveness Of Seedrow-placed N With Polymer-coated Urea (ESN) And Agrotaintm-treated Urea For Emergence, Yield And N Uptake Of Canola And Wheat	Karamanos, Rigas	24	74
	Assessment Of Phosphorous Supply Rate To Common Vetch (*Vicia sativa L.*) By Using Ion Exchange Membranes	Tsadilas, Christos	25	74
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	Herbaceous Plant Diversity And Identification Of Indicator Species In Olive Groves In Central Greece	Solomou, Alexandra	31	79
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	The Effect Of Management Of Plant Residues And N Fertilization On Swards Productivity And On Total Carbon And Nitrogen Content In Soil	Kauer, Karin	33	80
	Relation Between Soil N-NO_3- And N Nutritional Status, Yield Components And Must Quality In Semiarid Vineyards From D.o. Ca. La Rioja	Pérez-Álvarez, Eva Pilar	34	81
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FRIDAY, JUNE 10, 2011

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Chair: Robert Miller

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8:25 - 8:50	Monitoring DNA of soil-borne potato pathogens in agricultural soils	Leigh Sparrow	36	26
8:50 - 9:15	Effect of Phosphorus Form on the Short-Term Solubility and "Availability" of Phosphorus in Soil	Tee Boon Goh	171	27

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	Green Bean Under Organic And Integral Crop System In Mediterranean Area Greenhouse: I. Effects On Production And Fruit Quality	Segura, Maria Luz	3	95
	Green Bean Under Organic And Integral Crop System In Mediterranean Area Greenhouse: II. Effects On Dry Matter And Nutrient Extraction Distribution Pattern	Contreras, Juana Isabel	4	96
	Molecular Analysis Of Four Allium Species Based On Alliinase And 18s rRNA Genes	Drugã, Bogdan	6	98
	The Effect Of Nitrogen Fertilizer And Cattle Manure Application On Growth Characteristics Of Potato	Najm, Amirali	7	99
	Utilization Of Biosolids In Production Of Bioenergy Crops. I: Impact On Canola Biomass, Soil Properties And Nutrient Availability	Tsadilas, Christos	8	100
	Macronutrient Content Of Viola x Wittrockiana Over Different Substrates	Paz González, Antonio	9	101
	The Connection Between Soil, Geomorfology, Hydrology And Vegetation In The Dorozsma-Majsaian Sandlands	Deák, Áron József	10	101
	Trace Elements Content In Soil And Plants Under The Copper Surplus	Sofia, Veliksar	11	102
	Recycling Of Agro-food Wastes Into Vineyards By Composting: Agronomic Validation In Field Conditions	Moral, Raul	12	103
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	Evaluation Of The Different Uses Of Washingtonia Robusta Pruning Waste	Andreu Rodriguez, J.	14	105
	Utilization Of Biosolids In Production Of Bioenergy Crops. Ii: Impact On Bioavailability And Heavy Metals Uptake By Canola	Tsadilas, Christos	15	106
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ORAL ABSTRACTS

12th International Symposium of Soil and Plant Analysis
Mediterranean Agronomic Institute of Chania
Crete, Greece

History of the International Symposia on Soil and Plant Analysis

Yash P. Kalra

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The International Symposium on Soil and Plant Analysis (ISSPA) is the premier gathering and showcase event in soil and plant analysis. The previous Symposia were held in Fresno, California, USA (1989), Orlando, Florida, USA (1991), Olympia, Washington, USA (1993), Wageningen, Netherlands (1995), Bloomington, Minnesota, USA (1997), Brisbane, Queensland, Australia (1999), Edmonton, Alberta, Canada (2001), Somerset West, West Cape, South Africa (2003), Cancun, Mexico (2005), Budapest, Hungary (2007), and Santa Rosa, California, USA (2009). The author has the distinction of being the only scientist in the world to have participated in all the 11 Symposia: An ISSPA record!

In this paper, the author presents the history of the symposia since he participated in the Business Meeting of the Council on Soil Testing and Plant Analysis (now Soil and Plant Analysis Council) at the Annual Meetings of the American Society of Agronomy, the Crop Science Society of America, and the Soil Science Society of America in Anaheim, California, USA, November 27-December 2, 1988. This is where he learnt about the International Symposium on Soil Testing and Plant Analysis (now International Symposium on Soil and Plant Analysis) to be held in Fresno, California, USA onAugust 14-19, 1989. The purpose of the Symposium was to bring together agricultural and natural resource scientists from around the globe to share information on soil, plant, and water analysis for the purpose of efficient resource management and environmental protection.Fresno was chosen as the site due to its diverse and large agricultural industry. The paper concludes with information on the authors contributions to all the symposia.

Common Agricultural Policy: From Production Support To "Greening"

Ioannis Fermantzis

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One of the oldest and most well established public policies in the European Union has gradually shifted focus over the years from production support to land/resources management and environmental stewardship through fundamental reforms, while maintaining its character as a policy for supporting income and regulating markets of agricultural commodities.

A reform of the CAP is on the way for the post 2013 period in an effort to further incorporate (among other things) environmental concerns into sectorial polices. New paradigms for development need to be adopted in order to address some of the major global challenges, such as halting biodiversity loss and adapting to or mitigating climate change.

Agriculture can play a key role in achieving the development strategy goals and farmers need to be rewarded for the provision of public goods. Public goods such as water quality, soil functionality, climate stability are only a few of the services offered to the environment, for which farmers are not compensated through the regular functioning of the markets and this is one of the roles that the CAP needs to play.

The Traditional Mediterranean Diet of Greece: Principles, Functionality and Perspectives

Alexandra-Maria Michaelidou

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In the last decades, epidemiological and clinical studies continue to provide fundamental insights into the dynamic relationships between nutrients and health. Assessing the relationship of health with overall diet rather than with single nutrients has intuitive appeal. For instance, the Mediterranean diet, i.e. the dietary pattern of the geographical region that borders the Mediterranean Sea, is well-recognized by the scientific community for its healthy and preventive dimensions. However, regional variability and disparities should be expected, given that food combinations consumed by the inhabitants of this region, mirror individual food preferences modified by a mix of genetic, cultural, social and economic determinants. Thus, the traditional Mediterranean diet of Greece, before 1960 as exemplified by the diet of Crete, is generally described as providing a plethora of plant foods, favoring the consumption of locally grown, seasonally fresh and minimally processed foods. This diet having, as cardinal characteristic, olive oil as the principal source of fat should not be considered as vegetarian, since it also includes modest amounts of foods from animal sources. Furthermore, this food culture contains fish consumption, depending on proximity to the sea, and moderate amounts of wine.

On the road to optimum nutrition, which is an ambitious and long-term objective, the Mediterranean diet and, in this respect also the traditional Greek diet, is an interesting and stimulating concept that could serve as a general nutritional suggestion with personalized dietary interventions when necessary. As recent literature is characterized by blooming interest in examining the health benefits of this dietary pattern, it appears that the present tendency towards it, does not correspond to a temporary fashion, but has firm biological basis. Furthermore, the Mediterranean diet holding a centuries-old tradition represents an essential part of the world's cultural heritage and remains a target-pattern for a health-promoting diet.

Temporal Variability Of Soil Biological Properties In Temperate Grasslands And Croplands Amended With Organic And Inorganic Fertilizers

Jorge Paz-Ferreiro[1], D. Baez-Bernal[1], J. Castro Insúa[1], M.I. García Pomar[1]

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Soil biological properties have been widely used as indicators of soil quality as they are very sensitive to slight management changes, but the wide use of these properties as soil quality indicators are hindered by the uncertainty of their seasonal patterns. To date, there are not many long-term experiments that account for differences in soil management. In our work we have assessed several biological properties (biomass carbon and nitrogen, net nitrogen mineralization, soil basal respiration, dissolved organic nitrogen and dissolved organic carbon). We assessed the variation of these properties over an almost years period, starting on February 2008 and finishing on December 2010, in 3 different trials, representing 3 management systems amended with different types of fertilizers: a) grazed grasslands b) mown grasslands c) corn cultivated cropland. Additionally, there was another field trial (grazed grassland) to study the influence of stock density on soil biological properties. Trials, located in a temperate area (43°14' latitude, 8°15', longitude and 97 m.a.s.l) of NW Spain, were carried out as a completely randomized block design with three replicates. Our data show a slight seasonality for the studied properties, and a consistent influence of management. Net nitrogen mineralization, soil respiration and dissolved organic carbon increased in the grazed grassland with high animal stock density while on the amendments trial (mown grasslands and maize) there was an increase of some of the soils properties measured in the plots fertilized with cow slurry.

Evaluation Of Potassium Status In Some Sandy Soils Of Egypt Characterized With Low Values Of Cec.

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The current study was carried out to define the relationship between some properties of sandy soils characterized by low values of CEC and their content of different potassium forms. So, surface soil samples (0 – 30cm) were taken and collected from twenty-five location of some sandy soils of Egypt. The investigated soil samples were analyzed for some physical (particle-size distribution and the content (%) of $CaCO_3$) and chemical properties (total soluble salts, soluble ions, CEC, soil pH and OM) also different potassium forms (soluble, exchangeable, available, fixed and total) were determined.

Soluble-K was ranged from 0.0037 to 0.072 meq/100 g soil and it showed a significant correlation with EC and $CaCO_3$. On the other hand, it appeared no correlation with pH, CEC, OM, clay and silt. Exchangeable-K content ranged from 0.065 to 0.341 meq/100 soil and also it was significantly correlated with clay, CEC, silt and OM, but not correlated with EC, pH and $CaCO_3$. Available-K content ranged from 0.094 to 0.389 meq/100 g soil and has a significant correlation with CEC, clay, silt, OM and $CaCO_3$, while, it was insignificant with pH and EC. Fixed-K content ranged from 1.881 and 7.835 meq/100 g soil and this was significantly correlated with CEC, clay, silt and OM. On the contrary, fixed-K showed no correlation with $CaCO_3$, pH and silt. Total-K content ranged between 1.95 and 8.18 meq/100 g soil and showed positive and significant relation with CEC, clay and silt, however, it was not significantly affected with either pH, $CaCO_3$, OM or EC.

The Use Of Ground-sensor Nir Reflectance To Quantify Soil Organic Matter And Carbonate Content In Three Representative Fields Of The Thessaly Plain (Central Greece)

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Surface NIR reflectance of bare soil has been used to infer top soil properties such as organic matter, soil texture, water content, salinity and crop residue cover. With the advent of mobile multispectral sensors, data on soil NIR reflectance can be easily obtained in an attempt to quantify the spatial distribution of soil properties within fields. Mapping of soil properties can be ultimately used as a tool for the implementation of site-specific management practices. In this study, a Crop Circle ground-sensor was used to map soil NIR reflectance in three 10-ha fields of differing soil category and texture ranging from sandy clay loam to clay that were located in different sections of the east Thessaly Plain. The produced NIR maps were used to delineate each field into distinct management zones. Soil samples were randomly taken within each management zone and analyzed in the laboratory for soil organic matter, total C and N content, their isotopic composition, carbonate content, nitrate content, pH, electrical conductivity. Results are presented on the correlation of sensor NIR reflectance with NIR reflectance from satellite imagery, soil organic matter and carbonate content. These results indicated that soil NIR reflectance can be used to characterize and map soil organic matter and the extent of erosion in larger sections of the Thessaly Plain independent of differences in soil category and soil properties.

Solvita® CO_2-Burst Test Indicates Soil Microbial Biomass and Potential N-Mineralization

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The measurement of soil CO_2 respiration provides a gauge of biological soil fertility, but rapid and accurate means to measure respiration and to derive estimates of potential C + N mineralization are lacking. The Solvita® test was introduced recently and is based on measuring the 24hr CO_2 –burst following rehydration of dried soils. Rapid rewetting of soils causes a flush of CO_2 that corresponds closely to soil microbial biomass. In laboratory incubation-mineralization studies short-term flush of CO_2 correlates closely to 3d, 7d and 28d basal soil respiration. Mineralization of N in this period closely matches the yield of CO_2 following rewetting. Since incubations of soil for 1 to 2-weeks to determine potential mineralization are considered too costly for practical application, the Solvita® 24-hour test offers commercial soil laboratories the opportunity to provide economical tests of soil microbial biomass. In America, the ALP program has accepted Solvita® as a provisional test and 6 commercial laboratories are evaluating it during 2011. In this study we compare soils from various soil sampling programs, including ALP proficiency test programs, organic matter rate studies, and commercial organic growing where successive applications of compost with multiple-cropping are employed to release organic-N to available form. Solvita® provided a high level of correspondence to applied organic matter, it also correlated positively to Walkley-Black (digestible carbon) tests. In a comparison of field plot studies, control (unfertilized) plots gathered over 4 years were tested and the Solvita CO_2-Burst correlated very closely with the yield, indicating a relationship of approximately 1:1 (mg kg CO_2-C : mg kg N-mineralization). The data indicate that the Solvita® soil CO_2 analysis kit could be combined with basic soil tests for soluble fractions of nutrients to aid commercial growers better appreciate soil carbon management and optimize N-fertilizer rates for environmental yields.

Rapid Measurement Of Soil pH Buffering Capacity

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Soil pH buffering capacity, described here as lime buffer capacity (LBC), is a fundamental soil property needed to estimate the change in soil pH after a known quantity of acidity or alkalinity is added to soil. Its rapid determination can be useful for many purposes, for example, estimating lime needed to raise pH or acid needed to lower pH to a desired level. The objective of the present study was to determine the generality of a statistical relationship developed in previous studies between an LBC determined from a 30-min equilibration with $Ca(OH)_2$ (LBC_{30min}) and LBC determined from a 5-day equilibration with $Ca(OH)_2$ (LBC_{equil}), a time that ensures true pH equilibrium. Eighty seven soils from the state of Georgia, USA were treated with $Ca(OH)_2$ using standard procedures for both 30-min and 5-day equilibrium times and the statistical relationship between the two LBCs was developed. The relationship established in the first study was further tested in a second incubation of 67 soils to determine its accuracy in achieving a target pH_{CaCl2} of 6.0. The data from the second incubation indicated that the target pH was exceeded by an average of 0.1 pH unit and that the average pH spread around the target pH was ± 0.1 pH unit. The statistical relationship between LBC_{30min} and LBC_{equil} was found to be the same in both incubation studies; therefore, the data from both incubations was combined (n=154) resulting in the working equation $LBC_{equil}/LBC_{30min} = 0.00255\ LBC_{30min} + 2.11$ with $r^2 = 0.44$. This equation can be used to estimate LBC_{equil} from LBC_{30min}.

Non-destructive Total Element Analysis Using Portable X-ray Fluorescence (PXRF) On Cotton Leaf Tissue And Soybean Grain

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Elements of agricultural importance were determined on two ground plant tissue matrices, cotton leaf tissue and soybean grain. Using portable X-ray fluorescence (PXRF), a non-destructive multi-element analysis was compared with a traditional acidic digestion method (sealed chamber digest (SCD)). Strong correlations ($r^2 > 0.85$) were found between PXRF and SCD for Ca, Fe, K, Mn, P and S in cotton leaf tissue. Strong correlations ($r^2 > 0.85$) were also found between PXRF and SCD for Ca, Cr, Fe, Ni, S and Si in soybean. Portable XRF provides a faster, cheaper and safer alternative for total element determination in plant tissue matrices for several essential plant nutrients than the SCD method.

Comparison Of Two Sequential Extraction Methods And The DTPA Method For The Extraction Of Micronutrients From Acid Soils

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Two sequential extraction methods were compared for the extraction of various forms of Cu, Zn, Fe and Mn from 29 cultivated acid soils of N. Greece. In addition, the different soil fractions of the micronutrients extracted by the two methods were compared to the “plant available” micronutrients extracted by DTPA.

The methods used were the modified BCR and the original of Tessier et al. Since soils were acid, the second step of the original method of Tessier et al. (connected to the “associated to carbonates” fraction) was excluded. Consequently, both methods extracted the four micronutrients into four fractions: “water-soluble + exchangeable”, “associated to Fe-Mn oxides”, “associated to organic matter”, “residual”.

Significantly positive relationships were obtained for each micronutrient concentrations between similar fractions of the two methods. Iron and Mn distributions among the fractions were similar between the two methods, within the same element, whereas Zn distributions were partially different and Cu was detectable only in the “residual” fractions of both methods.

Clay and organic C were significantly and positively correlated with Fe in the “associated to Fe-Mn oxides” fraction of the original method of Tessier et al. and CEC was significantly and positively correlated with Zn and Fe in the “associated to organic matter” fractions of the modified BCR method. In addition, the three soil properties were significantly and positively correlated with Mn in all fractions (except of the “residual”) of both methods.

The DTPA extractable micronutrients were significantly and positively correlated with the respective micronutrients in the fractions: “associated to organic matter” and “associated to Fe-Mn oxides” of the original method of Tessier et al., for Zn, “associated to Fe-Mn oxides” of the original method of Tessier et al., for Fe, all fractions (except of the “residual”) of both methods, for Mn.

Anionic Resin Extractable P As An Index Of P Availability In Calcareous Soils Of Crete, Amended Or Non- Amended With Pig Manure Compost

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The objectives of this study were: a) the evaluation whether the P supplying power of soils, as assessed by Plant Root Simulator (PRS)™-probes, constitutes a reliable index of bioavailable P in calcareous soils, b) the examination whether pig compost addition to calcareous soils increases their P supplying power, P uptake by the crop and yield. The study was conducted in a pot experiment with 14 calcareous soils and involved control, test and treated with compost soils in which rye grass was grown and harvested every month. Three biomass cuts were obtained and P uptake, P concentration in the biomass and biomass yields were determined.

Correlations of P uptake or P concentration in the biomass versus P supplying power gave statistically significant coefficients of determination ($p \leq 0.01$) which explained 75-88 and 87-92% of the variability of P uptake and P concentration, respectively. The relation between biomass yields and P supplying power of soils obeyed satisfactorily the Mitscherlich-Bray growth function permitting the establishment of a "critical point" of P supplying power which was about 5 μg P/resin surface area/15 day. These results provide strong evidence that the P supplying power of soils, as assessed by PRS™-probes, is a reliable index of bioavailable P in calcareous soils and even more reliable than the one determined by the conventional method of Olsen.

Compost addition to soils had a beneficial effect because it increased their P supplying power, P uptake by the crop and biomass yields but the P supplying power of the treated soils did not correlate with P uptake and P concentration in the biomass. Although this discrepancy could not be explained by the data at hand, it remains certain that pig manure compost increased yields and it might not only complement but also substitute P fertilization.

Soil Test And Plant Tissue Analysis As Diagnostic Tools To Fertilizer Recommendation For Cassava (Manihot Esculenta Crantz) In An Ultisol Of Kerala, India

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Soil and plant nutrient based fertilizer recommendation holds promise in increasing farmers' income for a tropical tuber crop like cassava which influences the food, nutritional and economic security of about half billion people globally due to its biological efficiency,C sequestration potential, sustenance under changing climate and marginal soils, starch content and its diversified uses. Considering the positive response to manures and fertilizers and negative impact of indiscriminate use on tuber quality and soil health, a fertilizer cum manurial recommendation was evolved for the major cassava growing soils of Kerala based on nutrient status of soil and index leaf tissues.

Soil and plant samples from 9 major cassava growing districts was analysed for pH, organic carbon and essential nutrients which formed the basis for arriving the recommendation following its nutritional requirement. The soils of the state was acidic, high in organic carbon, low in N, high in P,K, medium in Ca, Mg, Fe, Cu, Mn, Zn, Na, very low in S. The YFEL at 3-4 MAP showed N as deficient, P, Ca, Zn as sufficient, K, Mg, Cu as high, S as very deficient and Fe, Mn as toxic. The fertilizer recommendation based on soil and plant nutrient status was FYM @7.5 t ha^{-1}, N: P: K: Mg: Zn@ 88:16:69: 0.75: 0.87 kg ha^{-1} in place of the recommended dose of FYM@ 12.5 t ha^{-1}, N: P: K: Mg: Zn @ 100:50:100:3.2:2.5 kg ha^{-1}. Moreover, based on the soil macro and micronutrient status of Kerala, the recommendation (FYM @ 6.25 t ha^{-1}, N: P: K: Mg: Zn @ 82:6.3:68: 2.32: 2.1) evolved was validated in 17 locations of the 2 districts and the soil based application of N, P, K + Zn resulted in the highest BC ratio of 1.75 in addition to enhancing yield, improving tuber and soil quality.

Development Of A Simplified Model For N Fertilizer Recommendation For Maize, Wheat And Helianthus

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In many cases fertilizer crop requirements depend on personal opinions, rather than scientific background, and this, in turn, leads to over-fertilization and waste of recourses. For better fertilizer requirement estimation a model may be necessary, which would suggest the exact rates of nitrogen, based on soil properties of a large number of soil samples. For this reason we developed a model (which was named Theodorou), which is a simplified form of a model by Dr. Koukoulakis. The outcomes of our model were estimated based on 50 soil samples, which represented a wide range of soil properties, and were obtained from Northern Greece. We tested our model for maize, wheat and helianthus, and we evaluated it against the results obtained by the Koukoulakis model, as well as an "independent" model from Alberta University for N. The results showed that the fertilizer requirement recommendations of the Theodorou model (for all three crops) was not significantly different from the Koukoulakis model, while the Alberta model suggested lower fertilizer rates than the two Greek models. The good relationship between the two Greek models was confirmed by the significant correlations of the two models. Although the fertilizer recommendations of the Theodorou model were not significantly correlated with the soil nutrient extractions (when correlated one by one), they showed a significant correlation when they were correlated with all estimated soil properties (with multiple regressions). We conclude that the model we developed was simple and successful in recommending fertilizer requirements for maize, wheat and helianthus.

Developing A Soil Nitrogen Supply Test For Humid Environment Of Atlantic Canada

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Accurate estimate of growing season soil nitrogen supply in humid regions greatly relay on a precise prediction of soil nitrogen (N) mineralization. The objective of this study was to develop a soil N supply test for potatoes and forage grass in Atlantic Canada. A series of laboratory-based measures of soil N supply were evaluated. These measures were tested as predictors of field-based indices of soil N supply within potato and forage grass production systems. Potentially mineralizable N (N_0) was determined by aerobic incubation at 25°C and periodic leaching for 24 and 44wk for soils with or without history of organic amendment application, respectively. Three different pools of mineralizable N were recognized: [Pool-I] The flush in mineral N which occurs in the first 2 wk period following rewetting. This pool represents the mineralization of a labile organic N pool. [Pool-II] intermediate pool of organic N, and [Pool-III] stable organic N pool. Pool I combined with soil mineral N (0-30 cm and 0-15 cm for potatoes and forage grasses, respectively) at planting, and ultraviolet absorbance of 0.01 M $NaHCO_3$ extract at 205 nm represented the best predictors of SNS for potato and forage crops in Atlantic Canada (r^2=0.42-0.58). These tests are in the process of modification for use in soil research laboratory and validation in the field. A further improvement in predictive potential of the test is under investigation by including environmental parameters such as soil moisture and temperature in the model.

Pollution Liabilities Of Gold Mines Determined By Soil And Plant Analyses

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South Africa finds itself in a favorable position with abundant gold but unfortunately also in an unenviable position with all the acid mine drainage, heavy metal pollution and radiation associated with the gold tailings facilities. The aforementioned pollution and negative environmental attributes are produced by large anthropogenic disposal structures which contain subordinate minerals such as pyrite with associated oxidation and weathering. Leachate and seepage from these structures seep into the critical zone and surface water, soil, vegetation and ground water get influenced by the heavy metals at low pH levels. Heavy metals such as Fe, Mn, Co, Cd, Zn, As and U are often associated with the soils in the seepage zones and vegetation growing in these soils. The critical zone is progressively under stress due to continuous pollution and less rehabilitation. Rehabilitation of the tailings dams is a great challenge with minor success unless proper analyses and interpretation are done on the material. The ultimate objective of the rehabilitation is to achieve mine closure which also includes post closure land use. If vegetation is used as a cover material to stabilize the tailings dams it should also be non toxic for animal use or for human consumption. The prime post closure land use is establishment of cash crops i.e. vegetables and grain which could be utilized by the local communities or grazing for domestic and wild animals.

This paper discusses the results and interpretation of tailings, soil, plants and water analyses to determine the threshold concentrations of various heavy metals to decide if the vegetation and water are suitable for irrigation and human and animal consumption.

Effect Of Foliar Boron And Calcium Treatments On Fruit Quality Of 'Ayvalık' Olive Variety

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Ayvalık olive variety comprises 25 % of olive groves located at the western Ege Region. It is a well known variety utilized for oil extraction and green pickling. The research work is carried out on 19 years old olive trees in 2009 and 2010 at Kemalpaşa experimental plot of İzmir Olive Research Institute to test the effect of foliar boron and calcium applications, as combined or alone. Boron is applied as 0.5 % borax ($Na_2B_4O_7.10H_2O$) in April, prior to bloom and in June when fruit are 3-4 mm in diameter. Calcium is applied as 0.5 % calcium nitrate Ca $(NO_3)2$ in mid-June and in early July (pit hardening period). Control trees are treated with water on the dates of applications. Olive fruit samples are collected at monthly intervals and analyzed for average fruit weight, volume, and dry matter, oil, N, P, K, Ca and B contents. Total yield per tree is also calculated. The effects of tested treatments were investigated for two years, on on and off years. Results proved that combined applications of boron and calcium perfomed better. Calcium+boron treatments accelerated fruit boron levels compared to boron application alone due to synergistic effect of calcium. Similarly, oil contents were higher especially during the off year. No phytotoxic effect of Na was observed on trees treated with borax.

Microelement Status And Soil And Plant Relationships Of Olive Groves In West Anatolia Region Of Turkey

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Olive which its importance has gradually increased on human health and nutrition, is a cultivated perennial plant, having economical importance in the Mediterranean Countries, the widespread olive growing area, besides Asia, America and North Africa Countries and also its production is made as table olive and olive oil. Olive growing is increasing in Aegean Region and following by Marmara and Mediterranean Regions in our country. Especially due to the establishment of new olive groves recently, the importance of olive growing has been increased. Although olive trees are resistant unfavorable conditions in comparison to other fruit kinds, the problems like yield and quality losses have appeared because of nutrition deficiency.

For this aim, the amounts of microelement in the soils of fruitful olive groves and the nutritional status of microelements of olive trees were determined and the relationships between the results of soil analyses and the results of leaf analyses were evaluated in the provinces of Ýzmir, Manisa, Aydýn, Muðla, Balýkesir, Çanakkale and Bursa in West Anatolia Region between the years 1997-2009.

In the result of the obtained datas, secure correlative relationships between the amounts of microelement in the soils and the amounts of microelement in the leaves were obtained.

Effect Of Potassium On Olive Production And Quality Under A Fertigation System: Usefulness Of Sap Analysis

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In last decades the olive production has been managed with fertilization techniques as fertigation. To adequate a correct dosification of fertilizers, the growers need fast and efficient techniques of nutrient diagnosis, such as combining soil, leaf and sap analysis.

The present work is focused on the application of all these nutritional tools to evaluate the potassium requirements of olive trees (Olea europea L.) cv. Picual in Jaen (Spain) during two years with a clay-silt soil and water from Guadalquivir river. Two experimental areas were selected (A) and (S), (A) with a plant density of 250 olive trees 15 to 17 year old per hectar and (S) with 140 olive trees 30 to 35 years old per hectar. Each experimental area was divided in two, control with fertigation (A1 and S1), and fertigation plus additional potassium fertilization with foliar spray (A2 and S2). Foliar and fruit analysis were useful to estimate the sink effect for potassium, increasing its concentration in fruit during ripenning. Sap analysis show significant increases of potassium in the second year of experiment, since an adequate supply of potassium during first year by fertigation. Sap is a material much more sensitive and dynamic than leaf analysis, and it allow us to know the nutrient reservoir of potassium of the tree after an adequate fertilization with this nutrient.

After two years using potassium foliar spray plus fertigation no significant differences were found. Consequently foliar spray is not useful when an adequate fertigation is been developed, although it can be used when this fertilization system is not implemented.

The olive production and quality (polyphenol levels) were significantly higher in the (S) experimental area, although no differences were obtained with additional potassium spray. Sap analysis is an excellent tool to evaluate nutritional needs of olive trees and to describe the potassium fate in the plant.

Phosphorus Sorption And Availability To Canola Grown On An Alfisol Amended With Various Soil Amendments

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The aim of this study was to examine the influence of some organic and inorganic soil amendments on sorption and availability of phosphorus (P) to canola grown in an Alfisol amended with sewage sludge (SS) in the past. For this purpose a green house pot experiment was conducted in an acidic Greek Alfisol in which ten years ago SS at a high dose (300 t/h) was applied. The experimental design was complete block randomised including six treatments [soil treated with zeolite (Z), coal fly ash (FA), sugar beet factory lime (SBFL), and compost from olive oil processing wastes (COW), soil alone and the original soil without SS] each replicated three times. The mixtures (5 kg soil plus 50 g amendments) were cultivated with canola.

Soil and plant samples were selected after two month planting period and analyzed for available P. In addition, P sorption isotherms were prepared on soil samples after cultivation. The Freundlich equation was used to describe sorption characteristics. Phosphorus distribution coefficient (Kd) values were also obtained by the same batch equilibrium experiments.

Results showed that, application of high dose SS to the acidic Alfisol ten years ago, increased soil pH from 5.19 to 6.92, canola biomass from 1.96 to 5.3 g /pot, Olsen–P from 25.5 to 57.7 mg/kg^{-1} and plant tissues-P from 1162 to 2881 mgkg^{-1}. Application of FA, Z, SBFL, and OW increased soil pH from 6.92 to 8.05, 7.07, 7.72, and 7.19, canola biomass from 5.3 to 8.6, 7.5, 7.6, and 5.4 g /pot and Olsen-P from 57.7 to 110.5, 61.2, 80.5 and 64.5 mg kg-1 respectively. Application of Z, SBFL, and OW increased plant tissues-P from 2881 to 3048, 3320 and 3523 mgkg^{-1} respectively, while FA application decreased it to 2696 mgkg^{-1}.

Phosphorus distribution coefficient (Kd) were higher in the original soil compared to the soil amended with SS (23.3 vs 12.9 Lkg^{-1} respectively. Application of FA, Z, and SBFL increased P_Kd from 12.9 to 23.19, 13.83, 14.48 Lkg^{-1} respectively, while OW application decreased it to 12.82 Lkg^{-1}. Kd values decreased with the concentration increase of the added P in the test solution in the case of the original non amended soil and FA treatment, while Kd increased relatively as the concentration of the added P increased in the test solution in the SS amended soil and Z, SBFL, and OW treatments.

Key Words: Phosphorus, bioavailability, sorption, biosolids, soil amendments, Alfisols

Effect Of Selenium Treatment In Nutrient Solution And Soil (Rhizobox) By Maize And Sunflower Plants

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On the basis of our experiments, selenium is one of the most mobile element in a plant-soil system. Selenium is an essential microelement, a vital component of antioxidant system of organism. Deficiency of selenium is connected with emergence of many diseases among others the heart and vascular system one and the tumorous diseases. It's contradiction derives from above given concentration dangerous to plants and human too. In the periodical system, selenium has the narrowest tolerance concentration range that is essential and toxic contents are close to one another.

Selenium content of plants influences mainly by the uptakeable selenium content of soil. In many countries soils are lack of selenium like in Hungary.

In our experiment with nutrient solution and in soil (in rhizoboxes) the effect of selenium supply was studied in a monocotyledon (maize) and a dicotyledon (sunflower) plants among controlled conditions.

In the experiments the dose was calculated and added as selenium in selenite form (concentrations: Ø, 1, 10, 100 mg kg^{-1}) and in selenate form (Ø; 0,1; 1; 10 mg kg^{-1}).

On the basis of our results the selenium content of plants was increased significantly by the effect of selenium treatments. This increase of selenium concentration was more intensive by the effect of selenate treatment than by the effect of selenite treatment applying the same level of treatment. The selenium concentration of shoot and root samples was analyzed respectively. Se content was higher in roots than in shoot samples in the case of maize and sunflower as well. This shows that the selenium accumulation in roots was more intensive than in shoots of the applied plants among the applied conditions.

Enhancing The Efficiency Of Applied Fertilizer Nutrients In Aerobic Paddy Through Stcr Approach To Increase The Yield

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Soil Test Crop Response (STCR) approach is the best approach of plant nutrient application for crops, where in contribution of nutrients from soil, manures and fertilizers, and also by fixing the yield target, nutrient requirement of the crop will be decided based on the soil test values. In this study, STCR fertilizer prescription equation developed during 2007-08 for transplanted paddy was evaluated in comparison with recommended practice of fertilizer nutrients application and also to verify the STCR targeted yield equation developed for transplanted paddy for its suitability to aerobic paddy (Var:MAS-946-1), a field experiment was conducted at ZARS, Mandya during rabi/summer 2009-10.

The results clearly indicated that the STCR targeted yield fertilizer prescription equation developed for transplanted paddy can be well adopted for aerobic paddy crop in zone -6 of Karnataka state, India. Paddy grain and straw yields were significantly high (6572 $kgha^{-1}$ and 21160 $kgha^{-1}$ respectively) in STCR target of 75 q ha^{-1} where nutrients were added through integrated STCR approach (50% oragnics+ 50% inorganics). However, yield targets could be achieved only at lower target (50qha^{-1}).

NPK uptake by aerobic paddy was highest in 75 qha^{-1} target either through purely inorganic fertilizers or through integrated STCR approach. However, higher uptake of NPK in STCR target of 75 qha^{-1} through only inorganics didn't influence in increasing the grain yield of paddy. NPK nutrient use efficiency was significantly higher in the treatment where nutrients were applied through integrated approach for a yield target of 75 qha^{-1} , where as lowest NPK uptake and nutrient use efficiency was recorded in 50 qha^{-1} yield target through purely inorganic fertilizer treatment. This clearly indicated that the application of fertilizer nutrients by adopting STCR targeted yield equation through integrated approach will helps in enhancing the efficiency of applied fertilizer nutrients thereby increasing the aerobic paddy yield.

Soil Chemical Methods – Australasia (2011)

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This new, fully-referenced book of 515 pages has 20 chapters, four appendices, and a comprehensive index. Seven of the 225 fully-documented methods are field-based, 15 describe calculated attributes such as effective cation exchange capacity, while the remainder involve laboratory procedures with an Australasian focus. The book significantly expands the contribution made to the soil measurement profession by the Australian Laboratory Handbook of Soil and Water Chemical Methods of Rayment and Higginson (1992). That Handbook, now out-of-print, assisted the processes of method standardisation and analytical quality assurance by government and commercial soil testing laboratories across Australasia. For example, the Rayment and Higginson Handbook defined the chemical methodology used in all inter-laboratory proficiency programs for soils organized by ASPAC.

Chapters in the new book cover soil sampling, sample preparation and moisture content; electrical conductivity and redox potential; soil pH; chloride; carbon; nitrogen; phosphorus; sulphur; gypsum; micronutrients; extractable iron, aluminium and silicon; saturation extracts; ion-exchange properties; lime requirements; total miscellaneous elements; miscellaneous extractable elements; alkaline earth carbonates and contemporary laboratory and field methods for acid sulfate soils.

The preamble information in each chapter plus the soil-chemical methodology described is comprehensive, systematic, up-to-date, and designed to inform and direct practicing soil chemists, laboratory managers, educators, consultants and end-users. There is guidance on sampling and analysis through to reporting of results and expected analytical precision. Optional analytical 'finishes' are provided, including flow-injection analysis, flame technologies, and alternatives to "wet" chemistry. Environmental P tests and quantitative procedures for acid sulfate soils are among the new methodological additions provided. In addition, the new book retains and expands the method-coding system introduced in the Rayment and Higginson Handbook.

The hard-cover book from CSIRO Publishing retails for A$140. To order, contact:

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BACKGROUND INFORMATION on Book Launch at 6th ISSPA, Brisbane
(The following information was included in the Program and Abstracts Booklet for 6th ISSPA.)

Precision Farming - New Opportunities For Soil And Plant Analysis

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Advances in technology available for crop production have brought information management to the forefront in decision-making for production practices and inputs. Collecting, managing, and interpreting the various datasets with this technology help to characterize and document within-field spatial variability of each field. Precision farming is a management system that utilizes that knowledge to adjust practices and inputs to best fit that variability, allowing decisions to be made on a site-specific basis. One of the most basic sources of variation within a field is the soil. With today's technology, digital databases of soil characteristics tied to soil survey information can form the foundation for a record-keeping and management decision system. The farmer and his advisers can use these data to make decisions on fertilizer applications, tillage systems, crop genetics, and other inputs. Soil testing and plant analysis enter the picture as a means of further characterizing the soil variability. Soil testing integrates the natural soil chemistry and the effects of previous management---fertilizer additions and crop removal---giving layers of information on the variability in nutrient availability from the soil. Plant analysis adds another layer of information providing details of actual uptake and removal of nutrients. Soil and plant analysis thus becomes a critical resource for farmers who want utilize precision farming technologies to make better-informed decisions, leading to more efficient use of land, labor, and capital resources, increase yields, and reduce the environmental footprint of the management system. Those who provide these analytical services need to be aware of how the changes in technology on the farm are impacting the value of analytical data in making better-informed decisions for nutrient management. It is creating new business opportunities for your services.

Nitrogen Precision Management For Wheat-maize Double Cropping Systems In North China Plain

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The objective of the study was to establish nitrogen precision management systems based soil Nmin (soil mineral N) test for basal N application and the plant N status diagnosis for topdressing application in North China Plain, where N application rates up to 600 kg N/ha. The field experiments were conducted in common farmer's field and N experiment with 4 treatments of N0, N200, N400, N600 kg N/ha/y. Digital images were acquired using an Olympus 2100UZ. Indexes of N status diagnosing and recommendation N rates were established based on the relationship between digital imaging and crop N status. The results showed that average base application rates of 80 kg N/ha was needed for 7500kg/ha of wheat yield, which range from 0 to 139 kg N/ha according to spatial variation of soil nitrate contents. The normalized green intensity G/(R+G+B) at wheat stem elongation stage and normalized blue intensity B/(R+G+B) at maize six leaves stage, showing best correlations with N status, could be as the indicators to recommend N rates for wheat and maize. 3 levels of Surplus, Optimum and Deficient of wheat N status were classified according to 0.392~0.405, 0.402~0.422, 0.412~0.444 of G/(R+G+B), recommended topdressing N were 0, 60 and 90 kg N/ ha respectively. 4 levels of Surplus, Optimum, Deficient and serious deficient of wheat N status were classified according to 0.241-0.247, 0.216-0.237, 0.201-0.220 and 0.18-0.200 of B/(R+G+B), recommended topdressing N were 50,100,150 and 200 kg N/ha respectively. Demonstration of the practices can save N 34.6% for wheat and 62.4% for maize without yield reduction compare to farmers traditional N used

Statistical Spatial Models For Soil Parameters: A Comparative Analysis Of Several Methods Applied To Dobrovat Basin (eastern Romania)

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Our study compares the performances of several statistical methods for deriving spatial models of soil parameters in the surface horizon. The applications were carried out within a 186 km^2 hydrographic basin situated in eastern Romania. After data quality check, statistical models were computed from a sample of approximately 180 soil profiles, scattered in the eastern half of the basin, the actual number varying from one soil parameter to another. An independent sample of 50 soil profiles was used for interpolation validation and another independent sample of same size was used to validate the results within the extrapolation area (the western half of the basin). We tested the performances of kriging, linear regression, geographically weighted regression, regression trees and regression-kriging for computing spatial models of physical (soil depth, granulometric fractions) and chemical (pH, occurrence depth of calcium carbonates, content of humus, total nitrogen, mobile potassium, mobile phosphorus and base saturation) soil parameters. The predictors included X and Y coordinates of soil profiles, geomorphometrical parameters (slope, aspect, wetness index, terrain curvature), derived from a 10x10 m digital elevation model, climate parameters (mean annual temperatures, precipitations and global radiation), the main soil types, land use and surface lithology. The results show that the optimum statistical method varies from one parameter to another. Parameters such as soil depth, depth to calcium carbonates, pH are better related to terrain variables and therefore may be approached regression analysis and regression-kriging, while parameters such as humus and total nitrogen content are better modeled using the local approach of kriging.

Nutrient Balance In Long-term Experiments - Base For Precise Nutrient Management

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Nutrient balance is one of the indicators of sustainability of production systems. Sustainable farming is based on balanced nutrient management, i.e. inputs = outputs. For nutrient balance calculation in agricultural sector is necessary to observe a lot of factors - nutrient inputs (nutrients in fertilizers, atmospheric deposition, sewage sludge, nitrogen fixation, seeds and planting material, etc.) and on the other hand nutrient outputs (nutrients uptake by main product and by-product, leaching). Central Institute for Supervising and Testing in Agriculture provides in the Czech Republic the net of long-term field experiments in different soil and climate conditions. These experiments have a few combinations of application nutrients levels in regular crop rotation. Results from long-term experiments are optimal background for nutrient balance calculation and next determination of optimal nutrient management for sustainable crop production and their good quality in certain cropping region. Simultaneously nutrient balance calculation in connection with soil testing results is necessary base for precision farming.

Conservation Tillage Effects On The Decay Of Crop Residues Measured Over 15 Years

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Inputs of crop residues in agricultural soils are the primary means of sustaining soil organic matter levels. A field study was set out in 1990 on a loamy sand soil to quantify conservation tillage effects on crop residue-C decay and on its subsequent stabilization. A field technique of pulse labeling was used to produce mature ^{14}C-labeled, above- and below-ground residues for common agricultural crops grown in southern Ontario, corn (Zea mays L.), soybeans (Glycine max L.), winter wheat (Triticum aestivum L.), winter rye (Secale cereale L.) and tobacco (Nicotiana tobaccum L.). Soils were managed under conventional (CT) mouldboard plough-disc and no-tillage (NT), and the recovery of crop C inputs was measured as ^{14}C remaining. The decay rates of the labile residue C were positively correlated to residue water soluble C and N contents and negatively correlated to residue C:N ratios. Decomposition of the labile residue C was faster under CT, indicating that incorporated residues were exposed to a more favourable environment for microbial activity compared with residues left on the soil surface. Kinetic analysis of the patterns of crop residue decay showed that under CT the labile component was larger and decayed faster compared with NT, whereas the resistant component was smaller and decayed more slowly. Thus NT promoted the formation of a larger resistant component. Residue decay models specific for each crop/tillage combination better described the decomposition process than a single overall model.

Potassium Nutrition Management For Enhancing Tuber Yield Of Potato Grown Under Short Day Irrigated Condition In Eastern Indo - Gangetic Plains Of India

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Potato is a major vegetable crop grown on a large acreage (0.15 million ha) but with a poor average tuber yield of 7.9t/ha in Eastern Indian state of Bihar while the adjoining states of Uttar Pradesh and West Bengal have >20t/ha average yield. Poor K nutrition management has been identified as the main reason for poor yield of potato in Bihar state. Hence, field experiments were conducted during winter season of 2009-10 and 2010-11 on potato variety Kufri Pukhraj at farmers' field in participatory mode on sandy loam soils, neutral in reaction and having mean organic carbon 0.28%, available N 126 kg/ha, available phosphorous 11.0 kg/ha and available K 138 kg/ha. The treatments consisted of 4 graded levels of potassium as MOP (0, 50, 100 and 150 kg K_2O ha^{-1}) at constant dose of N (150 kg ha^{-1}) and Phosphorous (60 kg P_2O_5 ha^{-1}) in Randomized block design with 6 replications.

All the K doses promoted plant height and increased the number of leaves per plant. Plant height and number of leaver per plant recorded at K_{150} was at par with K_{100}. The total dry matter production followed similar pattern.

The total tuber yield increased significantly with each increment of potassium dose. The tuber yield increased to 31.01 t ha^{-1} with 150 kg K_2O ha^{-1}. The increase in tuber yield was 19, 28 and 32 percent at 50, 100 and 150 kg K_2O ha^{-1} respectively over the control. The potassium application improved the tuber yield by increasing the proportion of large grade (>75g) tuber yield and decreasing the small grade (<25g) tuber yield. The percent contribution of large grade tuber to the total tuber yield was increased from 33% at 0 kg K2O ha^{-1} to 39% at 50 kg K_2O ha^{-1} and 43% at 100 kg K_2O ha^{-1} and 44% at 150 kg K_2O ha^{-1} respectively. The yield of large size tuber increased by 43, 71 and 84 percent at 50,100 and 150kg K_2O ha^{-1} as compared to no K application. The dry matter content and average tuber weight increased with increasing potassium levels. K application had significant effect on grade wise tuber number as well as total tuber number. The large (>75g) and medium (25-75g) grade tuber and total aggregate tuber number enhanced markedly with each increment in K levels from 0 to 100 kg/ha. However, further increase in K dose from K_{100} did not enhance the medium grade tuber number any more. The small (<25g) size tuber number decreased with increasing K levels.

Application of K also reduced the tuber rottage during 3 months potato storage at ambient temperature. The net economic return increased with increasing levels of potassium application uoto 100 kg K_2O ha^{-1} application, only.

The Physiology Of Potassium Nutrition In Crop Production

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Potassium is an essential plant nutrient required in large amounts for normal crop growth and yield, but is often lacking or unavailable in agricultural soils. The general K requirement for optimal plant growth is 2-5% of the dry weight. When K is limited, growth is retarded due to the central role that K plays in many physiological and biochemical functions. Potassium is not a constituent of any known plant components, but it is integrally involved in metabolism and plant water relations. It serves as an enzyme activator in numerous enzymatic reactions in processes such as photosynthesis, respiration, carbohydrate metabolism, translocation and protein synthesis. In plant water relations, K is integrally involved in numerous physiological processes including maintenance of osmotic potential and turgor pressure, water uptake, and stomatal opening and closing. These roles of K in metabolism and water relations are manifested in K-deficient plants as decreased cell turgor, decreased water and nutrient uptake, decreased plant size, leaf area, photosynthesis, and carbohydrate transport, resulting in general growth retardation and lowered yields and fruit quality.

The cotton crop requires about 13 kg K/100 kg lint or about 2 to 5 kg K ha^{-1} day^{-1}. In cotton, K plays a particularly important role in fiber development, affecting both fiber length due to turgor, as well fiber length and micronaire due to affects on carbohydrate transport and secondary wall deposition. Insufficient K also leads to poor cuticle development in cotton. Potassium has been reported to reduce the incidence of pathogens such as Verticillium wilt although the physiological reasons for this are not clear. Typical K deficiency symptoms in cotton consist of yellowish-white mottling of the leaves and necrosis around leaf margins and between veins, and eventually a rust color. Many of these symptoms are related to the disturbance of tissue water balance. Recent widespread K deficiency has been related to modern varieties developing bigger yields over a shorter fruiting period coupled with inadequate root uptake. The integral role of K in plant metabolism means that perturbations in plant K nutrition will result in decreased growth, yield and fiber quality.

Recent Developments In The Evaluation Of Soils Potassium Supplying Capacity

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Plant availability of K and the prediction of K requirements thereof are conventionally assessed by rapid chemical extractions, for example, using NH4OAc and (dilute) solutions of strong acids/bases. These extractants however suffer from the following weaknesses: they are not of universal applicability, they may cause a redistribution of K forms among the various pools of the element, such chemical extractants don't exist in the soil root environment, and are unable to assess the overall K dynamics in a natural soil. With respect to the latter weakness, it may be remarked that K from mineral reserves becomes plant available through mineral weathering and hence an increased knowledge of the size of the soil K pool and its mineralogical speciation along with the rates of K release associated with it, that is the overall k dynamics is a key requirement for fully understand the K balance and the ability of a particular soil to supply available K in the course of time.

Recent developments aimed in taking into account the role played by soil mineralogy and soil fractions in the transformation of non-available to available K. This has been achieved by quantifying accurately the mineralogy of the various soil fractions and the consequent allocation of K supply not only to a specific K bearing mineral but also to a specific particle-size fraction. However since the above approach is difficult to apply and still does not reflect the physical conditions in a natural soil, research has been directed towards the simulation of the physical conditions in a soil and to a selection of an extractant that would be a closest manifestation of the soil chemical environment as far as K supply is concerned. This has been achieved by the use of synthetic cation exchange resins, the so called Plant Root Simulators, in beads or membrane forms. Resins qualify as the ideal extractant because they function as the plant root does acting as a nutrient ion sink and since they are relatively easy to apply, both in the laboratory and greenhouse experiments and in the field, they can assess the long term nutrient availability by inserting them into the soil at various time intervals during the growing period thus reflecting rates of K release from all the various soil K pools and at different stages of plant growth.

The Role of Potassium in Global Agriculture

Robert Mikkelsen

International Plant Nutrition Institute

The demand for potassium-containing fertilizers continues to grow globally to sustain food, fiber, and fuel production. While the role of potassium in plant nutrition is well known, soil potassium budgets are negative in many parts of the world, where more is removed in harvested crops than is returned back to the soil. The extraction process and production of key potash fertilizers varies depending on the geologic conditions. The major processes for mining and processing will be described. Although potassium is a finite natural resource, abundant geologic reserves are known to exist in many parts of the world and a plentiful supply is anticipated. The global trade and distribution of potash fertilizer is an important contributor to food security and sustainability and will be explained.

Improving The Functional Measurement Of Soil Potassium Supply Using The Plant Root Simulator (PRS™) Probe.

Ken J. Greer

Western Ag Innovations

Soil Potassium (K) moves by diffusion from soil minerals to the plant roots. Soil types with more clay or other readily releasing K minerals are known to buffer the soil solution and result in higher K supply. Conventional soil extractions measure the soil solution K and some proportion of the exchangeable or buffered K. The ion exchange membrane method, known as the Plant Root Simulator (PRS™) probe, was designed to be an integrated measure of the factors controlling K supply namely, soil solution K, diffusion path, and the mineral soil buffer power. The PRS™ probe uses the principle of 'Donnan Exchange' to attract and adsorb K ions from soil solution, creating a concentration gradient that results in more K release from buffering clay minerals. For over 20 years this technology has better explained K supply rates from many soil types in western Canada. One significant observation over time was that certain soil types possessing high proportions of 2:1 swelling clays consistently show a false positive for K deficiency as evidenced by field applied fertilizer omission strips. It was postulated that on these types of clay soils, the contribution of interlayer K was not effectively measured since sodium (Na), currently used as the PRS™ probe counter ion, has a large hydrated radius and could not exchange with interlayer K. This study shows that the cesium (Cs) ion, which has a smaller hydrated radius than Na, and reactive properties similar to K, can be more effective as a counter ion and may better assess the bioavailable K from heavy clay soils. Standard cation PRSTM-probes were treated with 0.001M Cs solution in order to achieve partial membrane saturation. Preliminary results from over 100 soils indicate that Cs:Na counter ion PRS™ probes exchanged more K from these heavy clay soils as compared to the standard Na PRSTM-probes. The K supply rate to the Cs:Na PRS™ probes increased by an average of 30%. Further studies are underway to validate this improvement in measuring bioavailable K by comparing both standard lab methods and K uptake by barley in a growth chamber experiment. Improving the ability of PRSTM-probes to simulate the mechanisms used by the plant to exchange and adsorb interlayer K will improve the management of all K-limited soils.

Total K To Exchangeable K Ratios As A Guide To Sustainable Soil K Supply

George E. Rayment

ASPAC

Many diagnostic soil testing services only use measures of extractable and/or exchangeable K (Exch.K) to provide guidance on the need or otherwise for applications of K fertilizer. Less commonly, soil tests for non-exchangeable, plant-available K are included, although this combination of soil K tests does not unequivocally detect situations where Total soil K reserves are critically low or high. This paper provides examples of how atom ratios between measured values of Total K and Exch.K in soils can alert crop advisors and growers of such situations. Specifically, Total K/Exch.K ratios at different depths in samples from canelands of North-eastern Australia and from cropping lands in Fiji were found to vary from around 1.0 to 1235 in 113 samples at 0–200 to 250 mm. Lowest K-ratio values were commonly recorded in soils from the Bundaberg/Maryborough region of North-eastern Australia and from highly weathered ferruginous latosols supporting “talasiga” vegetation in Vanua Levu, Fiji. The Vanua Levu soils contained much lower Total K reserves than did current cropping soils near Nadi on Viti Levu. Summary details of Total K/Exch.K ratios for the five cane-growing regions of North-eastern Australia are provided, together with soil K data to 800–900 mm in soils from the Fijian Islands. There is need to seriously consider additions of plant-available K when levels of Exch.K are at or below accepted “critical levels” and corresponding Total K/Exch.K ratios are around <2 to 3. Total K and Exch.K in the soils tested were not inter-correlated.

Development Of RISSAC-RIA Fertilizer Recommendation System Based On Ten Years Experiences

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RISSAC-RIA (Research Institute for Soil Sciences and Agricultural Chemistry – Research Institute for Agronomy / Hungarian Academy of Sciences/) fertilizer recommendation system is applied since 2001 in the experimental research field near Mosonmagyaróvár, Hungary belonging to University of West Hungary. The recommendation system – compared to earlier, rather intensive – fertilizer recommendation systems is saving cost and friendly to the environment. The fertilizer recommendations were applied between 2001 and 2006, based on an approximately 0,25 ha treatment unit size. During this time yield has equalled in a high level. From 2007 unified nutrient replenishment was applied again. In spite of not applying variable rate application (VRA) technology, maize yield was homogeneous. At the same time in 2009 winter wheat yield has showed similarity to earlier yield patterns at the beginning of applying precision agriculture technology. In 2010 nutrient replenishment was based again on VRA technology, and relatively homogeneous high yield was seen in the research field again.

For the years 2001, 2002, 2005, 2006 and 2010 when fertilizer recommendation system was applied in corn (Zea Maize L.) and nutrient replenishment was carried out by VRA technology; energy balance of corn production was calculated. The integration of yield maps and results of calculations proved that the advising system is working well concerning yield, however new functions have to be implemented into the model. This would probably result lower and heterogeneous yield in some areas within field, however the energetic and economic efficiency would be higher. We show the advantage of integrating Maximum Technological Energy Input function into the model, aiming to increase the efficiency. At the same time developing the model could slow down or avoid the decrease of trace and micro elements in the soil.

Potassium For Potato Production

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Potassium (K) comes with a wide variety of complimentary cations and anions. Sulfate and chloride (Cl) are the common anions. Magnesium (Mg) is a semi-common cation commonly applied with K (K-Mag). Sandy soils in the Columbia Basin (USA) have dropped in K to less than 100 ppm ($NaHCO_3$). Potatoes are a high demand crop were annual uptake can exceed 600 kg ha^{-1} and daily peak uptake exceed 20 kg ha-day^{-1}. Chloride has long been associated with reduced specific gravity and competing with nitrate for uptake. In this two year study we measured the consequences of K applications of up to 1400 kg ha^{-1} both in the tuber and in above ground dry-matter. Potassium chloride, sulfate and Mg-K fertilizers were applied at emergence. Mg rates in excess of 1400 kg ha^{-1} had no effect on potato yield or quality. Potassium rate had little to no effect on nutrient concentration in the tubers. Potassium rate had a negative effect on Ca and Mg concentration in the above ground dry-matter. Nitrate in petioles was decreased with increased KCl rate. Yield response to K was dependent on year. Specific gravity was decreased with increased Cl rate.

Phosphorus And Zinc Interactions In Bandplaced Fertilizers

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Zn deficiencies in South African soils have been prevented for the last few decades. The inclusion of zinc in commercial fertilizers (compound and bulk blends) has subsequently become a standard practice. Recently however, this problem has become more critically due to the low zinc content of seed crops (maize) produced on Zn “deficient” soils. Many fertilizer input suppliers now advocate higher norms for Zn in soils and therefor higher Zn application levels. The more insoluble Zinc-ash (ZnO) has also been the product of choice, efficacy being ignored, due to lower cost.

Zn deficiencies were identified in the early 60’s in South Africa when fertilizer application practices change from broadcasting to band placement. Furthermore the increased use of bulk blended fertilizers compared to chemical mixes, aggravated the problem, as it is difficult to get a uniform mix of the small (0,5%) inclusion of Zn in bulk blended fertilizers. Pelletized ZnO mixed with bulk blends add a further complication in that Zn is not evenly distributed in the row, resulting in an uneven plant growth in the early stages

Although not widely recognised, high levels of P application band at plant, could lead to P toxicity in plants. In recent pot trials with different Zn sources, it was demonstrated that the toxicity effect of P could be counteracted by Zn application. Also in bulk blended fertilizers the use of the more soluble $ZnSO_4$, proved much more effective than ZnO. A further complication in the case of row crops is the fact that soil samples for fertilizer advisory purposes are traditionally taken away from the band placed fertilizer zone

Changes In Soil Ammonium And Nitrate Concentration Over The Growing Season In Western Canada As Affected By Urea Or Controlled Release Urea Application

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Research trials were conducted over three years at six sites across the Canadian prairies to evaluate the effect of fall or spring-banded application of urea or controlled release urea (CRU) on soil ammonium and nitrate concentration through the growing season of spring seeded wheat or canola. Soil samples were taken early in the spring, at seeding, at anthesis, at harvest and in the late fall at the 0 to 15 cm, 15 to 30 cm and 15 to 60 cm depths, extracted with 2 M KCl and analysed for ammonium and nitrate concentration. Application of N in the fall as either CRU or urea increased nitrate measured in the spring. The soil nitrate measured in the early spring was generally lower with fall-applied CRU than with fall-applied urea because the urea from the coated product was released more slowly than the uncoated urea. Nitrate accumulation tended to follow a seasonal pattern, being high in the spring, decreasing with crop uptake from seeding to anthesis and harvest, then increasing slightly during the fall period until freeze-up. By anthesis, the crops had normally depleted the majority of the available nitrate N, although soil nitrate accumulation was occasionally higher with spring applied urea than in the control. Residual nitrate after harvest was relatively low, although at some sites a large amount of N was mineralized between harvest and freeze-up leading to accumulation of nitrate in the fertilized treatments. The seasonal pattern of ammonium accumulation differed substantially from that of nitrate, tending to remain at relatively high levels in the summer period. This presumably reflects release of ammonium through microbial breakdown of organic matter in the soil. Use of CRU could reduce the risk of N loss in the fall and spring periods by decreasing the concentration of nitrate in the soil prior to crop uptake.

Micro Irrigation Of Annual And Perennial Crops In Central Italy. Assessment Of Seasonal In-field Water Management According To A Simplified Soil-plant-climate Analysis

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A triennial research project on irrigation water use was carried out on 40 farms in Tuscany, Central Italy, under the scientific and technical supervision of the University of Firenze and the financial support of the Agency for Development and Innovation in Agriculture and Forestry of the Tuscan Region (ARSIA). Project activity provided for the investigation of actual irrigation practice at different scale units. Micro-irrigation of annual and perennial crops was assessed on 18 fields (cropping units), according to a comprehensive approach including evaluation of site specific soil properties, crop characteristics across the growing cycle, climate water demand and crop evapotranspiration during the irrigation season, cultivation strategies, and irrigation system performance defined according to the low quarter Emission Uniformity parameter (EUlq). Actual seasonal irrigation supply (ASI) of each cropping unit was compared to calculated net irrigation requirement (NIR), and assessed according to the measured performance of the irrigation system.

ASI of annual crops exceeded NIR in most cases (82%), in a range from 3% to 158%. About half of the perennials (43%) was irrigated under stress conditions (from -33% to -70%), in excess the other 57% (from 26% to 167%). System EUlq varied from 50.3% to 90.4% and from 40.1% to 93.2% on annual and perennial crops respectively.

The average seasonal NIR, EUlq and ASI are 261 mm, 75.8% and 322 mm for annual crops, 281 mm, 74.6% and 300 mm for perennials. Average gross irrigation (AGI), calculated as average NIR/EUlq ratio, shows different cultivation strategies: yield maximization of annual crops (ASI~AGI), search for specific quality response of perennials by using deficit strategies (ASI<AGI). Due to several farmers' typical attitudes towards the irrigation system, such as insufficient management and/or use exceeding the suggested technical lifetime, the fact remains that actual micro irrigation performance is by far below the potential in the project area.

The Use Of Scanning Near Infra Red Spectroscopy As A Quality Control Indicator For Bulk Blended Inorganic Fertilizers.

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The use of bulk blended fertilizers worldwide has become the preferred choice above compounded chemical fertilizers. This poses new problems in obtaining a representative sample for laboratory analysis. There are huge variations in particle size distribution, shape of particles and bulk density. These factors results in separation when attempting to obtain smaller subsamples. Turn-around time of wet chemical analysis by the laboratories (usually 1-2 weeks) further compounds the problem.

A procedure was developed to obtain reliable composition results for quality control of bulk blend fertilizers. Results are available immediately.

Another challenge is in obtaining reliable chemical analyses for preparing the NIRS calibrations. An exact formulation is prepared in the laboratory using the raw materials. The size of each such mixture (Approximately 500grams) is sufficient to allow the complete sample to be scanned on a scanning NIRS instrument with rotating sample container. All raw materials are also scanned individually. Robust calibrations were obtained in this manner and special control systems implemented to ensure and verify the reliability of the results.

The results of the NIRS were shown to be acceptable and on par with the chemical composition for the following elements N, P, K, and S. Better results were obtained for N if separate calibrations were prepared for N-sources (Urea, Ammonium and Nitrate). The best results for all components were obtained using PLS chemo- metrics with SNV Detrend Pathlength correction and wavelengths between 950nm and 1650nm. Calibrations for other parameters are in process.

Monitoring Dna Of Soil-borne Potato Pathogens In Agricultural Soils

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Soil-borne potato diseases such as common and powdery scab, caused by the pathogens Streptomyces scabies and Spongospora subterrranea respectively, and black scurf and stem canker, caused by Rhizoctonia solani, can be significant problems in Australia. This paper presents research on the use of tests of the DNA of these pathogens in soil to monitor changes in soil pathogen load and to predict disease risk in the host crop. DNA of S. subterranea, S. scabies and anastomosis groups AG2.1, 2.2, 3 and 4 of R. solani was monitored annually for 4 years in 28 farm fields and over 3 years in a replicated field trial where the effects of different green manure crops on soil condition and crop production are being measured. The DNA of all pathogens was present in at least some farm fields, but the DNA of S. subterranea and R. solani AG2.1 and AG3 was by far the most prevalent. The presence of the host, potato, was associated with a subsequent increase in DNA of S. subterranea, but temporal changes in DNA of R. solani AG3 were less strongly associated with the presence of potato in the rotation, suggesting it can readily survive on a range of substrates. Concentrations of S. subterranea DNA after potatoes generally remained high for the duration of monitoring, up to 3 years, which may in part reflect the contribution of S. subterranea root galls. In fields where more than one potato crop was grown during the monitoring period, concentrations of S. subterranea DNA increased further. There was a weak linear relationship between S. subterranea DNA concentration and powdery scab severity (r-squared = 0.53), but corresponding relationships for other pathogens and diseases were not statistically significant.

Effect Of Phosphorus Form On The Short-term Solubility And "availability" Of Phosphorus In Soil

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A laboratory experiment was set up to compare solubility and "availability" of three phosphate fertilizer sources over a period of sixteen days after application to soils with varying pH levels. Three soils, one acidic and two alkaline, one of which will be non-calcareous and one calcareous, of similar texture and organic matter, were selected. Three phosphate products, namely, an ammonium orthophosphate (e.g., 6-22-0 or 6-24-0), a polyphosphate (10-34-0), and an ammonium mono phosphate (11-52-0) were applied at 100 mg kg^{-1} and were compared to each other plus an unfertilized control. All treatments were replicated four times. The results are discussed.

POSTER ABSTRACTS

12th International Symposium of Soil and Plant Analysis
Mediterranean Agronomic Institute of Chania
Crete, Greece

The Role Of Antecedent Hydrologic Conditions On Stream Phosphorus Exportation: A Study Case In NW Spain

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The quantification of P export from rural catchments is necessary to determine the rates and magnitudes of P fluxes to receiving waters. Until recently, the monitoring programmers have utilized fixed interval sampling combined with continuous discharge measurements. However, these approaches are inadequate when trying to estimate the annual P export from catchments dominated by diffuse source pollution. It is known that in these catchments most P export occurs during runoff events. However, it remains unclear how antecedent flow conditions affect the P export during rainfall-runoff events. This paper examines the impact of antecedent hydrologic conditions on runoff response and P export for 132 events measured over a 5-year period (2004/05-2009/2010), with the aim of investigating if the estimation of P export can be improved taking into account antecedent flow conditions. The study was conducted in the Corbeira catchment, a small agroforestry catchment (16 km^2) located in the NW Spain, i.e., under temperate humid climate. The study demonstrates the importance of runoff events in annual export as approximately 75% of annual P export occurred during runoff events. Phosphorus' export response to antecedent flow conditions is complex and non-linear, making it difficult to predict patterns of P export using linear relationships. It has been shown that other factors such as erosion on cultivated land as well as the timing of mineral fertiliser and manure applications play an important role in the P export in this catchment. This work also demonstrates the need to examine larger data sets when the relationships between hydrologic and P export response are analyzed to capture the high variability shown in these type of catchments.

Concentrations Of Three Different Carbon Forms In Surface Waters From An Agroforestry Catchment In Northwest Spain

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Carbon levels in waters allow us to assess the risk of pollution of the streams and they also indicate their organic matter content. Intensification of crops and animal farming in many areas has created regional imbalances of several elements, such as carbon inputs and outputs in farm practice. The aim of this study was to assess the temporal changes in the concentration of three different carbon forms: total, organic and inorganic at the outlet of an agroforestry catchment under Atlantic climate conditions. This research was conducted at Valiñas River catchment in Coruña (NW Spain), a periurban area of 36.3 km^2. The study data sets range from January 2007 to December 2009. The total sample number was 205, namely 57 in 2007, 88 in 2008 and 60 in 2009. Carbon forms were determined using a total organic carbon analyzer. Total dissolved organic carbon values ranged from 7.39 to 7.94 mg L^{-1}, inorganic carbon varied between 4.91 and 5.61 mg L^{-1}, and organic carbon oscillated between 2.03 and 2.84 mg L^{-1}, during the studied years. Significant correlations were observed between the three considered carbon forms during the study period, except that of inorganic and organic carbon in 2007. The lowest mean values of the three total organic carbon forms were observed in winter in 2007 and 2009 and in autumn in 2008, whereas, the highest concentrations were observed in autumn in 2007 and in summer in 2008 and 2009. Total and inorganic dissolved carbon presented low values in winter whereas the organic was lower in spring. Year did not significantly affect carbon concentrations in water; however, season significantly influenced these concentrations, maybe because of the rainfall distribution. Taken into account water discharge measurements and carbon concentrations, carbon losses at the outlet of the catchmenent were assessed.

Temporal Oscillation And Losses Of Three C Forms In A Microcatchment From NW Spain

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Long-term agricultural sustainability and water quality may be threatened by a range of chemicals, such as phosphorus, nitrogen and carbon. Losses of carbon at the catchment scale depend largely on land use and management practices. In “El Abelar” farm (A Coruña, NW Spain), pig slurry was intensively discharged into agricultural fields during years. Moreover, diffuse pollution due to cattle grazing was also present in this area. In 1998, land use changed from agriculture to forest, specifically, an Eucalyptus globulus stand was planted in almost all the surface of this catchment. Water quality was periodically evaluated at the outlet of a small catchment in this farm, about 10.5 ha in surface. The purpose of this work was to assess the concentrations of three carbon forms: total, inorganic and organic, after reforestation. This study reports data from March 2007 to December 2009. The total sample number was 115; namely, 11 in 2007, 68 in 2008 and 56 in 2009. Carbon forms were determined through a total organic carbon analyzer TOC-V CSN (Shimadzu). Mean carbon concentrations were 214.38 mg L^{-1}, 120.51 mg L^{-1} and 94.56 mg L^{-1} for total, inorganic and organic carbon, respectively. The origin and evolution of these high values is discussed. The greatest values of the three forms of carbon were registered in 2008. Significant correlations were observed between the three considered carbon forms during the study period, except that of inorganic and organic carbon in 2009. The lowest mean value of total organic carbon was observed during spring in 2008 and 2009 and the highest one during autumn in 2007 and 2008 and in winter in 2009. No differences on carbon concentrations were observed between years; however, season influenced the carbon concentration. Using water discharge measurements and carbon concentrations, losses at the outlet of the catchment were calculated.

Contrasting Dynamics Of Nitrate And Kjeldahl Nitrogen In A Stream Draining A Rural Catchment In NW Spain

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Quantifying and understanding the dynamics of nitrogen from agricultural land to watercourses is essential in controlling soil over-fertilization and in implementing appropriate mitigation practices to reduce stream nitrogen. In this study, the temporal variability of nitrogen transport was monitored in a small rural catchment (16 km^2) located in NW Spain with the aim of identifying the most relevant factors controlling nitrogen transport in this catchment. Measurements of climate, hydrology, and nitrate ($N\text{-}NO_3$) and total Kjeldahl nitrogen (TKN) concentrations during 54 runoff events over three hydrological years were carried out at the catchment outlet and the relationships between nitrogen loads ($N\text{-}NO_3$ and TKN) and hydroclimatic variables within runoff events were analyzed. The contribution of the runoff events to the total nitrogen annual export and the contribution of $N\text{-}NO_3$ and TKN to total nitrogen were also calculated. The total annual nitrogen varied from 8.82 t in 2004/05 to 20.34 t in 2006/07, with a mean annual load of 16.03 t and a mean specific yield of 0.98 t km^{-2} y^{-1}. This rate is low in relation to rural catchments in other regions with similar size and distribution of land use. Nitrate, which represents about 81% of the nitrogen transported, was mainly mobilised during baseflow (59%), while most of the TKN export occurred during runoff events (58%). Statistically strong correlations were found between $N\text{-}NO_3$ and TKN transport and rainfall, runoff and peak discharge, being the runoff the main factor controlling $N\text{-}NO_3$ and TKN export. This variable explains about 98% of $N\text{-}NO_3$ in the runoff events and about 96% of TKN load. A significant difference in the transport behaviour of $N\text{-}NO_3$ and TKN within the catchment was observed. The relationship between $N\text{-}NO_3$ concentrations and discharge within runoff events was mainly dominated by anticlockwise behaviour, while in the case of TKN, predominated the clockwise behaviour.

Can Suspended Sediment Data Be Used To Predict Phosphorus Fluxes In Catchments Dominated By Forest And Grassland Uses?: The Corbeira Catchment

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The loss of sediments and nutrients from agricultural land to surface waters continues to be an important source of nonpoint source pollution. The close relationship between loadings of suspended solids and total phosphorus has been reported in many studies, particularly in areas dominated by cultivated land. In this study, long term (October 2004-September 2007) monitoring of suspended sediments and P was used to investigate if suspended sediment concentrations can be used to predict P loads in the Corbeira stream (Galicia, NW Spain), which drains a catchment of 16 km^2 with 65% of its area dedicated to forestry and 26% to grassland. Water samples were collected at the catchment outlet both in baseflow and runoff events, being the suspended sediment and P concentrations determined immediately afterwards. The relationship between SS and P is strong (r^2=0.91), suggesting that P concentrations can be easily predicted if SS concentrations are recorded, which would, undoubtedly, make it possible to obtain P data quickly and reduce costs in terms of analysis. This strong positive relationship is likely to exist due to the fact that most of P exported in this catchment is PP (72% of TP), unlike most of the catchments with a high percentage of grassland. At event scale, although there is a significant positive relation, large differences in regression slopes have been noticed. Several factors could account for this, including the suspended sediment source as well as the size of the transported particles.

Assessing The Influence Of Catchment Land Use Patterns On The Nutrients And Major Ion Chemistry Of Drainage Water

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In NW Spain, the cattle industry is the most important form of agriculture and produces significant quantities of manure, especially slurries. When applied to agricultural land manures in amounts greater than can be utilized by crops and retained by the soil, manure constituents may be transported to surface water and groundwater through runoff and infiltration and contaminate the waters.

This work analyzes the influence of soil use on the evolution of nutrients (NO3, NO2, NH4, P-PO4) and major ions (Ca, Mg, Na, K, Si, Cl, SO4) concentrations in drainage water of a catchment with two consecutive land use: first agricultural and forest after. This is a small catchment with previous agricultural diffuse and accidental pollution mainly due to the spreading of slurry. The concentrations of ions listed above have been monitored over a 6-yr period approximately (January 1997-July 2002) at the catchment outlet. Agricultural land use was replaced by Eucalyptus plantations from mid-July 1998. The results show that there is a great temporal variability for each ion and also among ions. The mean concentrations of studied ions were highest at agricultural period. The most pronounced differences occur for the NH4 (about 59 times greater in the first), P-PO4 (32 times greater), K (5 times greater) and NO2 (3.3 times greater).

They all present the highest concentration peaks in the agricultural phase with the exception of Ca. During this period reached the following concentrations (mg/L): 110 of NO3, 31 of NH4, 3.76 of NO2, 35.96 P-PO4, 30 of Ca, 12.42 of Mg, 97 of K, 50 of Na, 13.9 of Si, 96 of Cl and 16.6 of SO4. The slurries seem to have contributed notably toward the increase in the concentration of nutrients and certain major ions in the drainage water of the catchment, affecting the water quality.

Micronutrient Losses In Drainage Water Of A Reforested Small Catchment With Previous Disperse Pollution From Agricultural Practices

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Dispersion of nutrients and trace metals into the rural environment through the use of sewage sludge, fertilizers and manure has been worldwide reported. Long-term agricultural sustainability and water quality may be threatened by a range of chemicals, including heavy metals. Losses of heavy metals at the catchment scale depend largely on land use and management practices. In “El Abelar” farm (Coruña province, Spain), pig slurry was intensively discharged into agricultural fields during years. In addition, diffuse pollution was also present in the study area as a consequence of cattle grazing. Soil analysis showed hot spots with high N, P, Cu and Zn contents resulting mainly from slurry application. Subsequently, high levels of nutrients and heavy metals, were found in drainage water. These results illustrate how poor the studied site was managed from an environmentally point of view when devoted to agriculture. In 1998 land use changed from agriculture to forest, following Eucalyptus globulus plantation. Water quality was monitored at the outlet of a small catchment, about 10.7 ha in surface. The purpose of this work was to analyze the heavy metal losses after reforestation at the small catchment level. The study period was from 2007 to 2009. Soluble Fe, Mn, Zn and Cu were measured at the catchment outlet Water metal content was analyzed by ICP-MS. Nutrient and heavy metal concentrations strongly varied along the study period. Highest levels have been found to depend on storm flow dynamics but also on previous soil use. Element contents have been related also with suspended solids and other water quality parameters. Losses of microelements at the catchment outlet have been assessed from concentration and water discharge measurements.

Inorganic And Trace Organic Composition At An Agroforestry Catchment In Atlantic Europe

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Currently, physico-chemical parameters and inorganic composition are employed for assessing water quality. Little is known about organic composition in aquatic ecosystems. In this study concentrations and distribution of inorganic elements and compounds as well as trace organic compounds were examined in water samples from a small agro-forestry catchment located in northwest Spain. Parameters analyzed were electrical conductivity, pH, suspended solids, total organic content (TOC), anions (Cl^-, NO_3^-, SO_4^-), cations (Ca, Mg, Na, K, Fe, Mn, Cu, Zn), and 59 trace organic compounds. Target organic compounds were 21 organochlorine (OC), 11 carbamates, 14 organophosphate (OP), 3 triazines and another 10 pesticides with a different composition. Water was sampled at five different locations during two dates. Physico-chemical parameters and inorganic composition were determined by routine techniques. Carbamate extraction and clean-up were based in US EPA 8318 method followed by flow-injection electrospray ionization (ESI-MS/MS). Extraction and clean-up procedures performed for the remaining 48 pesticides were based in EN ISO 14181:2000 and determinations were made by high resolution gas chromatography using a high resolution mass spectrometry (GC/MS) detector. Electrical conductivity was low, as expected sue to Atlantic climatic conditions, pH was from 6.2 to 6.8 and TOC was from 2,2 to 7,5 $mg.L^{-1}$. The highest anion and cation content was for Na, due to catchment proximity to Atlantic ocean. Total pesticide content was higher than the EU recommended threshold of 0.5 µg/L. In some cases, individual OC and OC compound have been found at concentrations higher than 0.1 µg/. Relatively high concentrations of cations, anions and organic compounds were found in water collected from the middle and the lower reaches of this River, where the agricultural soil use was widespread. In contrast, where soil use was solely forestry concentrations of trace organic and inorganic compounds was significantly lower.

Study Of The Organic Fraction In Biosolids

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Biosolids are commonly used in agriculture in the European Union, and especially in the Mediterranean countries, since biosolids can act both as fertilizer and organic amendment, the application dose being based on the specific composition of the waste according to the European legislation of sewage sludge. Organic matter nature and type of organic compounds in biosolids are extremely complex depending on the use of flocculants and or coadjuvants in wastewater treatments and therefore the classification into labile, non-labile, humic-like compounds, etc. should be necessary to elucidate the potential dynamics into soil-biosolid systems. In addition, long-term studies are needed to evaluate the effect of biosolids on soil properties, especially considering soil organic matter pools.

Therefore, the use of chemical techniques to estimate pools of carbon and nitrogen in biosolids could be interesting. In this study, more than 390 biosolid samples were collected and analysed from 80 different wastewater treatment plants in southern Spain, during the period 2001-2008. The accumulated equivalent population was over 500,000 inhabitants. The treated volume of wastewater per year was about 200 hm^3, with a sludge production of 80,000 tons, approximately. The biosolid samples were originated by aerobic or anaerobic stabilization using different wastewater treatments (64.46% by prolonged aeration, 29.75% by active sludge, 1.37% from percolator filters, 1.37% from biocylinders and 3.03% from biodisks). All samples were dried, grounded, dried again at 105 ºC and stored prior to their analysis. Total organic carbon (TOC), total nitrogen (TN), water-soluble C and N, humic acid-like (HA) and fulvic acid-like (FA) compounds were determined in all the samples and correlated with wastewater treatments.

Influence Of Sample Preparation On Determination Of Soil Nitrogen Fractions

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This study was undertaken to define main factors influencing changes in soil $N\text{-}NO_3$ and $N\text{-}NH_4$ during sample transport and storage before analysis. 14 agriculture topsoil samples from arable land were collected for the study. The soil samples represented major soil types and climatic regions in the Czech Republic. 17 different sample preservation methods were chosen for the investigation. Soils were analyzed immediately after delivery to the laboratory, after storing at 4°C up to 7 days, after freezing at -18°C, after drying at 20, 60, 105 and 200°C. The dried samples were analyzed immediately after drying and also after 2, 7 and 25 weeks of storage at the laboratory temperature. Changes of both studied nitrogen fractions at 4°C were found to be relatively slow and samples showed no statistically significant differences after storing up to seven days. For longer period of storage freezing was necessary. Drying of the samples always increased the content of $N\text{-}NH_4$. Nevertheless drying was found to be a possible alternative of sample preservation in the cases when the content of $N\text{-}NH_4$ was negligible and only determination of $N\text{-}NO_3$ was demanded. Drying at 105 – 200°C did not cause any statistically significant changes in $N\text{-}NO_3$ but lower drying temperatures resulted in statistically significant increase of N-NO3 content.

Influence Of Soil Tillage System And Crop Rotation On Soil And Wheat Production

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The paper presents the influence of the conventional ploughing tillage technology in comparison with the minimum tillage, upon the soil properties and yield in the case of winter wheat (Triticum aestivum L.) in a three years crop rotation. The tests were organized at the University of Agricultural Sciences and Veterinary Medicine of Cluj Napoca, Romania, in the pedoclimatic conditions of Transylvanian Plain, on luvic phaeozem soil. The experimental soil tillage systems were as follows: Classic system: V_1 – reversible plough + disc – 2x (witness). Minimum tillage systems: V_2 – rotary harrow, V_3 – chisel plow + rotary harrow, V_4 – paraplow + rotary harrow.

Soil tillage system, through direct action and indirect effects, influence the fertility features of luvic phaeozem profile and determine changes in field cultural stage, which impose technological difference for wheat culture. Compared to the control variant - reversible plough + disc-2x the level of stability was higher at minimum tillage systems with: 1.6-5.6% on 0-10 cm depth, 1.1-3.5% on 10-20 cm depth and with 5-6% on 20-30 cm depth. The incorporation of all the vegetal waste in soil, at 20 – 25 cm depth, in the case of arable field and about 50 – 60% in the case of worked variants with rotary harrow, chisel and paraplow and deep, mainly only on the marks of the active equipment of chisel and paraplow determines difference in the modification of the structure quality.

Within crop rotation, autumn wheat had the best influence upon the hydric stability of the soil structure, so that the hydro stability level has the highest values in the experience (up to 83.5%), especially at 10-30 cm depth, by applying minimum soil tillage systems. This motivates wheat crop in crop rotations, even when the minimum soil tillage systems are used.

At wheat crop, the tillage system has a direct and indirect influence upon seeds germination level, level of weeding, wheat springing and finally upon production. At the crop harvest the number of weeds is with 8.2-50.6% higher at variants worked after minimum tillage system, compared with the classical tillage system. Is pointed out a reduce of the percentage of annual dicotyledonous from 85.9% at the variant with plough at 71.5-78.9% at the variants in minimum tillage systems and an increase of perennial dicotyledonous (of 7.9% at 8.4-13.8%) and of monocotyledonous (from 6.2 to 11.6-20%). The production of wheat achieved by using minimum soil tillage systems with chisel and paraplow are close to the ones obtained in the classical system, being at the level of 97.8-98.2%, compared with the control variant, with reversible plough.

Soil Moisture And Temperature Monitoring For Sustainable Land And Water Management In Transylvanian Plain, Romania

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The Transylvanian Plain (TP), Romania is an important region for agronomic productivity. However, limited soils data and non-use of best management practices hinder land productivity. Transylvanian Plain, with an area of approx. 395,000 ha, has a predominantly agricultural character, and in the past, because of the large areas of agricultural land, with fertile soil, produced large quantities of grain, for economic and social needs of the country. Cereal and steppe character (or anthropogenic steppe) of the area, led to widespread of the popular term “plain”, as over 30 villages, located in mid-southern region, wears, along with their name, the addition “plain”. In time, however, because of rugged terrain, deforestation, fixation of the public lakes on quick slopes and irrational agrotehnics for the crops, large areas of productive agricultural land were turned into degraded land, with reduced productivity or unproductive. After Ministry of Agriculture and Rural Development of Romania data, about 1954 hectares of the Transylvanian Plain area, are aside agricultural production and tens of thousands of hectares are with productivity greatly reduced under the normal. Another feature of the TP is that, although it is lower than the surrounding region, no major river valleys, no major roads, do not converge to its center, but it surrounds it on the periphery. So it is a poor area in water resources, avoid by the heavy traffic, and so it partly explains its rural character and layout of cities around the edges.

The last research upon the evolution of the climate inside the Carpathian basin, pointed out an increase of the air temperature in the last one hundred years with about 0.7 C. This fact is also shown by the fact that, six of the warmest years of the 20th century were registered in 1990’s. Contrary to its name, the TP is not a geographically flat plain, but rather a collection of rolling hills approximately 300 to 450 m above sea level in the south and 550 to 600 m above sea level in the north. Climate of the TP is highly dynamic, ranging from hot summers with high temperatures of >25 C to very cold winters with lows -5 C. The southern TP generally has a xeric moisture regime with steppe vegetation while moisture increases somewhat in the northern TP as an udic moisture regime. Twenty datalogging stations have been deployed across the TP on divergent soil types, slopes, and aspects. The location of each site was recorded using Garmin eTrex Vista (Olathe, KS, USA) handheld GPS units. Ten datalogging stations were installed in March of 2008, with an additional ten stations installed in March of 2009. HOBO Smart Temp (S-TMB-M002) temperature sensors and EC-5 (S-SMC-M005) moisture sensors were connected to HOBO Micro Stations (H21-002) at each site (On-set Computer Corp., Bourne, MA, USA). Additionally, at 10 of the 20 sites, tipping bucket rain gauges (RG3-M) were deployed (On-set Computer Corp., Bourne, MA, USA).

At sites with a tipping bucket rain gauge, the following data were recorded: soil temperature at 10, 30, and 50 cm; soil moisture at 10 cm; surface air temperature; and precipitation. At sites without a tipping bucket rain gauge, the following data were recorded: soil temperature at 10 and 50 cm; soil moisture at 10 cm; and surface air temperature. Data is downloaded from the Micro Stations every two months via laptop computer using HOBOware Pro Software Version 2.3.0 (On-set Computer Corp., Bourne, MA, USA).

Calculation of soil temperature regime according to the Soil Survey Staff (2006) consists of averaging soil temperatures at 50 cm between summer (June, July, and August) and winter (December, January, and February). The Soil Survey Staff (2006) defines mesic soil temperature as a “mean annual soil temperature that is >8 C, but <15 C where the difference between mean summer and mean winter soil temperatures is more than 6 C at 50 cm or at a densic, lithic, or paralithic contact, whichever is shallower.” Year 2 data from sites 1-10 show that all sites have a mean annual soil temperature of 10 C at 50 cm with more than 6 C variation between summer and winter. Thus, it appears as though mesic is the appropriate soil temperature regime for soils of the TP.

However, differences in seasonal warming and cooling trends across the plain were noted. These have important implications for planting recommendations.

The Influence Of Wetting/drying Cycles And Biotic Factors On Aggregate Formation In A Vertisol

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Vertisols have the tendency to restore damage of their structural units through sequential wetting/drying cycles. The aim of this study was to evaluate the influence of microbial activity and plant growth on aggregate formation in a Vertisol. Surface soil was collected, air-dried and pushed through a 1mm sieve, to break up all macro-aggregates >1mm.The homogenized soil was exposed to five wetting/drying cycles under two water regimes as follows i) continuously wet (c/w): the soil was watered to field capacity and allowed to dry until the 50% of field capacity was reached, and ii) wet-dry (d/w): the soil was watered to field capacity and left to air-dry. In sub-samples of the c/w water regime, plants of Lycopersicon esculentum were grown. During the first wetting/drying cycle two biocides, a fungicide (natamycin) and a bactericide (cloramphenicol), were mixed to the drenching water to suppress microbial populations. For each of the former treatments, there were samples that served as controls. After the end of each wetting/drying cycle, the aggregate size distribution (ASD) and the bulk density of the different size classes of aggregates (ABD) were determined.

Water regime influenced aggregate formation and bulk density. D/w cycles enhanced the formation of smaller and denser macro-aggregates, compared to c/w. The microbial activity had little impact on ASD. Plant growth influenced strongly the dynamics of small macro-aggregates. ABD increased as aggregate size decreased. Biocides application reduced ABD, compared to the control. Only in the presence of plant, inhibition of microbial activity resulted in the formation of denser aggregates.

Effect Of Time And Glucose-C On The Fractionation Of Zn And Cu In A Slightly Acid Soil

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The effect of time and a carbon source was investigated on zinc (Zn) and copper (Cu) availability, in a slightly acid soil. A two factor experiment (time and glucose) was carried out with four replicates per treatment and the effect of both factors was monitored and analyzed (Tukeys HSD test). Glucose was used as the carbon source to examine the effect of the expected induction of microbial activity on the metal availability during the experimental period. 500 mg kg^{-1} of Zn and of Cu were added to soils as nitrate salts in a water solution containing either 4 g kg^{-1} glucose (MG, metals-glucose) or no glucose (M, metals-no glucose). The treated soil samples were incubated for 3 h, 1 day, 3, 10, 30 and 60 days at 20°C at constant moisture (approx. 50% of the soil's water holding capacity). At the end of each incubation period, destructive sampling was performed and the Tessier fractionation procedure was applied to the samples, aiming to determine five metal fractions defined as exchangeable, acidsoluble, reducible, oxidizible and residual. Zn and Cu exchangeable fraction values (regarded as a measure for potential metal availability) showed a decreasing tendency with time, while the opposite was observed for the other fractions. Up to day 30 the presence of glucose resulted in significantly lower exchangeable fraction values for both metals, pointing to lower availability of the metals. Glucose, as an easily metabolized carbon source, induced a sharp rise of the microbial activity, leading to immobilization of metals and potentially to their gradual absorption on carbonaceous microbial metabolites. However, at 60 days the MG exchangeable fraction values were increased considerably, suggesting a decline of the microbial population and a consequent mobilization and release of the two metals in the soil environment.

Keywords: Zn; Cu; Heavy metals; Soil; Tessier fractionation; Glucose

Effect Of Nitrogen And Boron Fertilization On Lettuce *(Lactuca sativa L.)* Mineral Nutrition In A Calcareous Soil

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A fertilizer factorial experiment of randomized complete block design was conducted in pots under greenhouse conditions using lettuce (Lactuca sativa L.) as test plant. Plants of lettuce were grown in a calcareous sandy clay loam soil with different N and B fertilizer levels, in order to investigate the effect of applied nitrogen and boron as well as their interactions on nutrient distribution in leaves and roots of lettuce plants. Treatments consisted of four levels of N (0, 200, 400, and 600 mg N kg^{-1} soil) and two levels of B (0 and 5 mg B kg^{-1} soil). The results showed that increasing N level up to 600 mg N kg^{-1} significantly increased soil NO_3- - N and K but had no effect on soil available P and B. Application of 5 mg B kg^{-1} soil significantly decreased available K while P concentrations increased. Nitrogen application increased leaf and root N and reduced leaf P and K. By increasing N concentration in the soil, leaf B concentration was reduced in all N treatments. However, B had no effect on the N, P, and K content of leaves.In the case of roots, B was affected by N treatments and it was reduced significantly in the treatment of 600 mg N kg^{-1} soil + 5 mg B kg^{-1} soil.

These results suggest that nitrogen fertilization has a potential effect to prevent B toxicity and to keep leaf B concentration at normal levels in lettuce plants. Therefore, the appropriate management of N fertilizers in soils with excess B is very important.

Growth, Nutrient Status And Biochemical Changes In Sour Orange *(Citrus aurantium L.)* Plants Subjected To Sodium Chloride Stress.

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One year old sour orange (Citrus aurantium L.) trees were subjected to four levels of sodium chloride salinity stress (control, 40mM, 80mM and 120 mM sodium chloride) for 60 days. At the end of the stress period plant growth was evaluated by measuring leaf, shoot and root dry weights, while carbohydrates, chlorophylls, lipid peroxidation and electrolyte leakage were also determined in leaves. Plant nutrient status was evaluated in leaf, shoot and root samples, while soil was also analyzed for nutrient content. Leaf turgor status was determined in order to assess water stress induced by salinity. Salt stress induced a significant accumulation of sodium and chloride in leaves, shoots and roots. Potassium and phosphorus concentration in leaves as well as iron and copper concentration in shoots were enhanced under salt stress. Inconsistent changes were detected concerning magnesium, zinc, manganese and copper concentrations in leaves. Soil electrical conductivity, sodium and chloride concentration increased with increasing salt concentration, while potassium concentration decreased. Sucrose and glucose concentration was significantly reduced under salt stress. Leaf and shoot dry weight was not significantly affected, while root dry weight decreased with salt stress. Chlorophyll concentration was also reduced under stress, maintaining though cell membrane integrity, based on lipid peroxidation and electrolyte leakage indexes. Based on leaf characteristics indexes, leaves' water stress was negligible, even after two months under salt stress. Based on the present results, sour orange accumulate significant amounts of sodium and chloride ions, without affecting its growth, although the reduced carbohydrates in the leaves indicate probably a reduction of carbon assimilation rate, which in the long run could result in reduced growth.

Analytical Methodology Validation For Polycyclic Aromatic Hydrocarbons Extraction From Either Fresh Or Dried Spent Mushroom Compost By HPLC-HDA

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Polycyclic Aromatic Hydrocarbons (PAHs) are a family of compounds classified as Pollutant Organic Persistent, hazardous for environmental and human health. These are ubiquitous and they are found in agricultural ecosystems in different matrices such as soils, plants and different organic amendments. Spent Mushroom Compost (SMC) is employed for soil bioremediation and environmental research. On this paper, four solvents (acetone:CH2Cl2 1:1 mixture; acetone:hexane 1:1 mixture; methanol and acetone), among those already used as PAHs solvents, were chosen to be tested with two extraction methodologies (ultrasonic extraction and mechanical shaking). All extracted PAHs were identified and quantified by HPLC-PDA. Certified soil CRM141, containing 16 PAHs listed in the US EPA priority list, was used to validate the above mentioned methodologies. Mechanical shaking procedure was validated and selected since all detected and quantified PAHs were within CRM141 prediction interval and less variability data than ultrasonic extraction was obtained for all tested solvents.

Once mechanical shaking methodology was chosen, Fluorene (Flu), Phenantrene (Phe), Anthracene (Ant) and Pyrene (Py) standards were added on fresh (60% of moisture) and dried SMC. Mechanical shaking procedure were carried out over 24 hours and 1 month later, to avoid PAHs degradation and to provide PAHs interaction with solid matrix respectively.

PAHs mechanical shaking extraction over dried SMC showed large recovery percentages for all tested solvents. PAHs extracted from fresh SMC showed not biodegradation after 24 hours. Acetone:CH2Cl2 (1:1), methanol and acetone employed over fresh SMC obtained less recovery percentage than over dried SMC. Acetone:hexane (1:1) obtained recovery percentages higher than 80% and not showed recovery decrease over fresh SMC. Results indicate that is not necessary a dryness step previous PAHs extraction if acetone:hexane (1:1) mixture solvent is employed.

Proposed methodology for PAHs extraction includes mechanical shaking of fresh compost with acetone:hexane (1:1) solvent mixture and quantification by HPLC-PDA.

Study Of Phosphorus Adsorption In Soils Containing Different Soil Improvements And Its Impact On The Morphological Characteristics Of Plants

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In the present paper, adsorption experiments of phosphate ions from their aqueous solutions were conducted with the use of five different materials (zeolite, bentonite, goethite and zeolite-goethite systems I and II). The adsorption of phosphate ions were examined after mixing 2 g of each of the above materials with ten different phosphate concentrations (1.6, 3.2, 4.8, 6.5, 32.3, 193.5, 322.6, 483.9, 645.2, 871.0 μmol/l). The phosphorus adsorption increases as initial concentration increases for the materials. The higher adsorption of phosphorus and the higher rate of adsorption were presented to the zeolite-goethite system I. The experimental equilibrium adsorption data were analysed using the Frendlich and Temkin equations. Results indicate the following order to fit the isotherms equations: Freundlich>Temkin. Moreover, the above five materials were used as soil improvements to soils which were cultivated with wheat, maize and cotton. Forty days after germination, the plants were collected, the morphological characteristics were identified and the available phosphorus in soil and the total phosphorus in plants were determined. Comparing the experimental results, goethite and zeolite-goethite systems I, II present the best impact in the height, leave surface, wet weight and the root length of each plant. The adsorption capacity of phosphorus from the soil improvement materials in soils which were cultivated with wheat, cotton and maize increases as follows: a) Bentonite > Goethite > Zeolite > Zeolite-Goethite system II > Zeolite-Goethite system I (for wheat) b) Zeolite-Goethite system I > Goethite > Bentonite > Zeolite > Zeolite-Goethite system II (for cotton) and c) Zeolite-Goethite system II > Zeolite-Goethite system I > Bentonite > Zeolite >Goethite (for maize).

Keywords: Phosphorus, zeolite, goethite, bentonite, zeolite-goethite systems, maize, cotton, wheat

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Study Of Pb Transfer Reduction From Pb-contaminated Soils In Plants

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In the present paper, the reclamation of Pb-contaminated soils by adding zeolite, bentonite, goethite and two newly produced adsorbents consisting of zeolite and goethite (systems I and II) was studied. The above adsorptive materials were used to reduce the transfer of Pb to plants which were cultivated to these soils. For this purpose, a greenhouse pot experiment was conducted in four replicates as follows: 5 g of zeolite or bentonite and 1 g of goethite or zeolite – goethite (system I or II) were added in pots which contained 1 kg of soil. Then, 1 mg of Pb and plant seeds of wheat, maize and cotton were added. A number of 300 pots were produced including also the unamended control. Forty days after germination, the plants were collected, the morphological characteristics were identified and the available Pd in soil (extracted with DTPA) and the total Pd in plants were determined. Comparing the experimental results, the highest decrease of available Pb was presented to soils, which contained goethite and zeolite-goethite (system II) and in pots grown with wheat and maize, respectively. Moreover, the adsorption of Pb from plants was significantly reduced in all treated soils especially in the zeolite-goethite treatment (system I) in pots grown with maize, compared to the unamended control.

Keywords: Pb, zeolite, goethite, bentonite, zeolite-goethite systems

Sampling design optimization on arable lands for integrated soil monitoring for sustainable production

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Proper experimental design that leads to effective sampling of each recorded environmental variable is essential when planning integrated soil-monitoring programmes with the aim of assessment of the ecological state of soils.

We tested three different regular sampling designs ('standard' – 50 000 m^2, 'reduced area' – 635 m^2 and 'reduced area and sampling size' – 2500 m^2) and calculated the required sampling size for 10, 20 and 40 % minimum detectable change. We examined which sampling design leads to the most effective sampling – a sampling with the highest precision and the lowest bias.

The parameters measured in this study were the following: total microbial activity, concentration of 14 potentially toxic microelements and basic soil physical and chemical characteristics.

We took 20-120 soil samples per parcel from arable lands under intensive and organic cultivation as well as from a pasture and a protected grassland as a control.

We concluded that both for microbial activity and microelement concentration measurements 10% minimum detectable change requires enormous sampling effort at each site and sampling design. The required sampling size is especially high at the organic sites and the grassland, due to high standard deviation, and especially high mean total microbial activity.

With a sampling using either the 'standard' or 'reduced area' design, 20% difference in total microbial activity can be detected using a reasonable (< 25) sampling size.

However, 'reduced area' design minimizes spatial heterogeneity, thus requires smaller sampling effort and can be an ideal compromise.

In the case of microelement concentration, 'standard' sampling design was more sufficient to detect a 20% change.

Designs that were declared most efficient in this study have been combined into a joint sampling scheme that will be applied in the first cycle of the new Hungarian Soil Degradation Monitoring System.

Rapid Determination Of C, N, Si, P And K In Sugar Mill Byproducts, Mill Mud And Ash, Using Near Infrared Spectroscopy (NIRS)

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The objective of this study was to evaluate the ability of NIRS methods to monitor various constituents in sugar mill byproducts. Current practice in Australia is to apply large quantities of mill mud (residue from filtering clarified cane juice containing significant calcium and phosphorous) and ash (residue from burning bagasse in the boilers containing significant potassium and silicon) to cane farms as a soil conditioner and alternative nutrient source. However, recent legislation intended to protect the Great Barrier Reef Marine Park has necessitated better information to account for nutrient application rates and run-off from cane farms.

Thirty seven mill mud samples (some of which were composites of mill mud and ash) and 23 ash samples were obtained from three sugar mills in the Mackay region of Australia during the 2009 crushing season. Each sample was sub-sampled three times and analysed using standard chemical methods for C, N, Si, P and K. This analytical data was used as the response variables in the subsequent chemometrics analysis.

Samples were received frozen and allowed to defrost before being scanned using a FOSS XDS NIR spectrometer fitted with a Rapid Content Analyzer. The spectra were recorded over a wavelength range of 400-2500 nm (with spectral data collected every 0.5 nm), with 128 scans co-added to provide the final spectrum. Regression models were developed for each constituent using Partial Least Squares (PLS) regression analysis and incorporated various pre-treatment methods with raw spectra converted to 1st and 2nd derivatives.

Preliminary results have demonstrated that NIR calibrations are feasible for all of the constituents examined. Acceptable correlations were obtained based on an analysis of both R2 and standard error of cross validation (SECV) values. Future research will examine the development of robust NIR calibrations for these parameters and applying them within laboratory and/or on line methods to be employed at the sugar mill which will permit monitoring of these particular constituents in various sugar mill byproducts.

The NAPL Retention Of Mineral Mixture Series Containing Different Clay Minerals

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The pollution of soils with nonaqueous phase liquids (NAPL) may endanger the quality of soils, their utilization and the groundwater reservoir, respectively.

In the last 50 years several researches done to develop NAPL transport models. The most important input soil parameters of these models are the hydrophysical properties of the solid phase (e.g. retention capacity). Because of the measurement of these soil properties is time consuming and costly, in most cases they are predicted. However, the common used estimation methods are mostly validated with laboratory measurements performing with soil columns made from sand, quartz or glass bleed samples, with negligible contents of clay and organic matter. So in these estimation methods the soils conceived as ideal porous medium. Thus these methods may not provide appropriate results for soils with variably physical and chemical properties.

From the 1990th a series of research has began at our University to create an appropriate estimation method for predicting the NAPL retention capacity of soils. Two estimation methods, the Leverett equation and the empirical, average NAPL retention values proposed by the CONCAWE with a new method by creating pedotransfer functions (PTF) were compared. We assumed that the oil retention of soil is sufficiently predictable from basic soil properties. But later it has come up, the NAPL retention of soils may influenced by different properties in higher pressure level than in lower pressure. Moreover the quantity and the quality of clay minerals in soils may influence the retention capacity of soils.

The aim of this study was to determine the effect of different investigated soil parameters on NAPL retention measured at different pressure values. For the investigation a series of mineral mixtures containing different clay minerals were used. The PTFs were created and the main soil properties role in the soil NAPL retention was investigated with statistical analysis.

Acknowledgement:

The financial and infrastructural support of the State of Hungary and the European Union in the frame of the TÁMOP-4.2.1/B-09/1/KONV-2010-0003 project is gratefully acknowledged.

A Comparison Of Methods To Quantify Organic Carbon On Soil Samples From São Paulo State, Brazil

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Soil carbon determinations are important for soil quality assessment and nowadays international conventions and agreements also focus on soil carbon. The standard method that is used in São Paulo state to determine soil organic carbon is de modified Walkely-Black method. This method brings about some disadvantages, because of the time needed for implementation and has also some environmental flaws due to the use of potassium dichromate. Therefore, the aim of this work was to tests the efficiency and to compare the following methods: a) humid oxidation of organic carbon (OC-HO) followed by spectrophotometer determination, b) dry incineration using a muffle furnace (TC-I) and gravimetric determination and c) C-N-S elemental analyser (TC-EA). Sixty one soil samples collected at the 0-20 cm depth on agricultural soils of São Paulo state were analyzed. The set of studied samples exhibited a wide variability of carbon content so that TC-EA ranged from 0.43 to 9.14%. Soil samples were dried at 65ºC, ground and sieved through a 0.09 mm sieve. Carbon content was determined in triplicate. In all the studied soils, the TC-I method much superstimate the carbon content when compared with OC-HO and TC-EA methods. So mean carbon content was 5.61%, 1.96% and 1.94% for TC-I, OC-HO and TC-EA, respectively. Losses of structural water and inorganic colloidal compounds such as gibbsite dues to high temperature during incineration were probably responsible for the higher carbon contents obtained by the TC-I method. Correlation coefficients between the three methods were of the same order of magnitude: TC-I and TC-EA (r=0.87), TC and OC-HO (r=0.83) and TC-EA and OC-Ho (r=0.84). It was concluded that carbon extraction by the standard, routinely employed OC-HO method can be replaced by the TC-EA method, which has environmental advantages.

Study Of Arsenic Species (arsenite, arsenate) Stability In Soil Samples During Storage

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Pollution by arsenic is a potencially serious problem throughout the world. Arsenic may occurs from geological (As-bearing minerals) and anthropogenic sources (coal combustion, irrigation with arsenic containig water, arsenic based herbicides and insecticides). Inorganic arsenic species are the mainly present forms, which can be found in surface and subsurface water bodies, many foods, and soils, except in marine boita where the organic compounds (e.g. arsenobetain) prevail. The mobility, uptake and toxicity of arsenic compounds vary with valance states (As(III), As(V)) and forms (inorganic, organic).

An experiment was built to evaluate the usability of stored soil samples originated from the long-term field experiment Nagyhörcsök (Hungary) for arsenic speciation investigation. It is know that inorganic species may alter during storage neither in water nor in soil samples. To establish the conversion rate soil samples was loaded with arsenite and arsenate apart. A pretreatment procedure was developed to extract the arsenic species to be able to determine the change in their concentration. Shaking methods and extractants were compared.

The results indicated that both forms suffered change during a year-long storage, moreover presumably oragnic compounds formed in the air-dried samples. Thus arsenic speciation investigations must be done straight after sampling.

Parameter Optimization Of Inductively Coupled Plasma Mass Spectrometer To Analyze Arsenic And Selenium

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In the last decades an increased interest has been evolved about arsenic and selenium. The aim is to understand the environmental, agricultural and biological role of the these elements. In case of arsenic the mayor reasons are the relatively high concentration of arsenic in marine biota (mg kg^{-1}) and the arsenic contaminated drinking waterbases of some Asian countries besides Hungary. The toxicity of higher level selenium content is also known, nevertheless selenium is essential for some biological functions. Considering its essentiality, in our country the insufficient selenium intake rate causes lack of selenium. Measuring the concentrations of these elements are crucial but not satisfactory information, but the speciation, that is the form of an element presented in a sample is also required.

In both cases the most suitable method to determine concentration is the inductively coupled plasma mass spectrometry (ICP-MS). My objective was to optimize the changeable parameters of the ICP-MS for reaching the lowest (the best) detection limit. For this purpose I have investigated the effect of parameter change on nett signal intensity and relative signal intensity. With the optimization of parameter settings the limit of detection for arsenic and selenium were determined, which are 0,032 µg dm-3 for arsenic, and 0,097 µg dm^{-3} for selenium.

A Study Of Northern Corn Leaf Blight Effect On Yield Of Waxy Corn Inbred Line For Parent Line Selection In Thailand

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The inbred line improvement program, the selection of high yield inbred line is a prime criterion for parent line selection to receive high yield hybrid. The development of inbred line by selfing or sibbing for many generations to reach homozygosity could reduce the strength of inbred line due to inbreeding depression. According to the change of environmental condition, inbred line became susceptible to both physical and environmental stresses. Northern Corn Leaf Blight caused by Excerrohilum turcicum is one of the important disease which reduce waxy corn yield or even total yield lost in severely infection case. The objective of this experiment was to select the waxy corn inbred line that resistant to Northern Corn Leaf Blight to use as parent line in hybrid production. Forty nine inbred lines from 4 sets of The Waxy Corn Breeding Program were grown and comparison between normal and stress environment in dry season (December 2009-March 2010) at the National Corn and Sorghum Research Center. The result found that Kswi # 4 and Kswi # 24-4-1 were resistant to Northern Corn Leaf Blight and high yield in both environment. There was an inbred line that had the best level of resistance, Agsh2 302/Agwx13//Agsh2 302-BC1S2M7. Two inbred lines were good level of resistance, Agsh2 201/Agwx18//Agsh2 201-BC1S9 and Agsh2 201/Agwx18//Agsh2 201-BC1S2T7. And 2 inbred lines were moderately resistant level, Agsh2 302/Agwx13//Agsh2 302-BC1S9 and Agsh2 201/Agwx18//Agsh2 201-BC1S2M7. From this experiment, there were 19 waxy corn inbred lines that gave higher yield than average under the suitable condition of infection.

Effect Of Surface Cleaning On The Deoxynivalenol (DON) And Heavy Metal Contents Of Winter Wheat Grains

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Cereals and cereal based foods are one of the main sources of mineral elements in nutrition, but may contain harmful ones as well. The sources of toxic and potentially toxic elements are partly the soil, in which the plants develop, partly the other, non production related environmental factors as nearby industrial activity or traffic. The most of minerals are accumulated in the bran or adsorbed on it, which part is commonly removed during preprocessing of milling industry. The different kinds of surface cleaning methods have different decreasing effect on the total element contents as well as the element composition.

The toxins, produced by Fusarium species and which causes serious health problems, can be found mainly on the surface of kernels, thus the surface cleaning methods can be effective ways in their reductions. To analyze the effectiveness of different cleaning methods an experiment was made on the evaluation of several cleaning methods on the toxin contents of wheat samples.

Different winter wheat samples, contaminated naturally by DON toxin in different degree were collected and analyzed. The effects of different dry (brushing, hurtling and airblow) and wet (washing and ultrasonic) surface cleaning methods were evaluated on the DON content and the toxic element contents and composition of winter wheat whole-meal flour, white flour and bran. Beside the effect of cleaning methods, the effects of milling methods (roller mill and hammer mill) were also examined. DON toxin contents by ELISA and element compositions were determined by ICP-OES.

Our findings give information on both the efficiency of cleaning methods, regarding food safety considerations and the role of laboratory sample preparation on the sufficiency of analytical results.

Effect Of Soil Amended With Cd And Pb On Growth, Yield And Metal Accumulation In Cabbage

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A greenhouse pot experiment was made to determine the Cd and Pb distribution and accumulation in cabbage grown on soil amended with Cd and Pb. The soil was amended with 0, 5, 10, 40, and 80 mg Cd kg^{-1} in the form of Cd $(NO_3)_2$ and with 0, 10, 50, 100 and 500 mg Pb kg^{-1} in the form of $Pb(NO_3)_2$. Main soil properties, concentrations of total and DTPA extractable metals Pb and Cd in soil, plant growth and yield, and total content of metals in shoots and roots were measured. The results showed that the DTPA extractable Cd and Pb was significantly and positively related to addition of Cd and Pb respectively, while soil availability of Cd and Pb in the highest rates of Pb (500 mg kg^{-1}) and Cd (80 mg kg^{-1}) respectively was significantly reduced compared with the lowest rates. Shoot and root biomass was increased significantly in cadmium and lead treatments compared to the control. Further addition of Cd and Pb had a positive but no significant effect on biomass. Cadmium accumulation in cabbage plants was increased with the increase of Cd rates while lead accumulation was not significantly affected by Pb rates. The effects of lead and cadmium on their availability in soil and plants and their relation to other metals are also discussed.

Specifying Of The Land Quality Estimation Based On The Data Of Large-scale Soil Mapping

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Our research aim was to prepare a method that enable to the estimation of soil's variation level fertility reflecting the effective productivity in different area scale, based on soil and crop production databases. We analyzed the possibility of the emending of the fertility estimation accuracy on the National Pedological and Crop Production Database (NPCPD; in Hungary AIIR). The NPCPD database is possession of limited data queue to that chernozem soil's variations, which are soil specific and can be characterized by specific soil properties. For this reason, the fertility data collected from the NPCPD database from 1985 to 1989 cannot be consider statistically reliable in case of certain soil varieties, and the applicability during the land qualification is questionable.

The plant production providing ability of the soil is expressible with different land quality indices. In Hungary, these indices come to in the late 1970'a years, and are based on field and laboratory measurements. The analysis of the important soil properties (soil variety, humus-, salt-, lime content, pH etc.) comes within these measurements, to which soil samples were collected from average 10-12 hectares areas from the plant cultivation lands. The Hungarian large-scale soil mapping [1:10000] is on ground of the results of the soil samples' analysis and the derivative data of the field soil survey.

We elaborated an iteration method based on the derivative soil mapping information from the measured soil parameters, and on the soil and crop production databases, to make more precise the soil variation fertility estimation processes. We used this method on southern Hungarian plough-land areas. Our method is enabling to make more precise the soil-variation fertility data of the national-scale agricultural databases on the sample-area level with site- and plant specific. During the iteration we corrected the soil variety-average yields from the NPCPD with the multiannual parcel-level crop-yield data measured in the sample area. We analyzed the success of the estimation efficiency through the regression relations, and through the difference between the measured crop-yield and estimated fertility.

Concentration And Shaking Time Of Organic Acids Extractant For Cu, Fe, Mn And Zn From Contamined Soil

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Organic acids has been developed for assessing the phytoavailability of micronutrients in soils, using highly concentrated solution and long shaking time. The objective of this study was to evaluate the performance of the organic acids extractant in three lower concentrations (100%, 50% and 25%) and four shaking time (30, 90, 180 and 360 minutes), comparing with the Mehlich-3 and DTPA extractant. The ability of organic acids (100%, 50% and 25%), DTPA and Melihch-3 for evaluating Cu, Fe, Mn and Zn were significant ($p > 0,05$) when correlated with the amounts of these elements extracted by wheat. Reducing th e organic acids concentration to 25% and the shaking time to 30 minutes, the extractant was as effective as the original one, suggesting that the organic acids extractant can be used diluted to 25% and 30 minutes shaking, favoring economy of reagents and analytical time in predicting the phytoavailability of soil Cu, Fe, Mn and Zn.

The Effect Of Soil Properties On Napl Retention Of Soils Treated With A Cationic Surfactant

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Surfactants are widely used in household and in industry. There has been increasing interest in the environmental impacts of surfactants. However, we have only little information about the behavior of these products in soils. Surfactants may influence the transport of organic pollutants e.g. the migration of Nonaqueous Phase Liquids (NAPL). By the alter of interfacial and surface tension the physical and chemical properties of soils might be changed.

The use of surfactants to enhance oil recovery was investigated at first by petrol industry. Moreover, with surfactants we could improve the effectiveness of the different remediation technologies (e.g. extraction, flushing) in soils polluted with NAPLs. Nowadays, several researches deal with the problem how to remove NAPLs from subsurface efficiently, or how we could reduce the volume of residual NAPL with surfactants.

The amount of residual NAPL is mainly influenced by the soil oil retention capacity. In the soil physical and environmental protection practice it is commonly estimated from the soil water retention (with the Leverett equation) or by average empirical values composed from soil texture. The Leverett equation neglects the interactions between the solid and the fluid phase with different polarity. Moreover the residual NAPL may be affected in different amount by surfactants with various physical and chemical properties.

In case of average retention values, it might not express the differences in oil retention caused by the variety in soil properties.

In our recent study the NAPL retention of mineral mixtures samples untreated and pretreated with HDPCL (Hexadecylpyridinium chloride monohydrate) were investigated. According to our results the cationic surfactant in various concentrations affects the oil retention and the amount of residual saturation of soils different rate. Further investigations are necessary with different type of surfactants and in different pressure range too.

Soil Quality Under Different Farming Systems In Santa Clara, Cuba

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The aim of this research was to identify physical, chemical and biological soil properties that accurately indicate soil quality in farm systems with differing management regimes in similar soils in the municipality of Santa Clara, Villa Clara province, Cuba. In three contrasting types of farms (state farms, cooperatives farms and small independent farms) with distinct management practices applied in the production of grains, tubers and vegetables, the index of ecological quality of production technologies was calculated following Sanchez (1193). Soil samples were collected in representative fields of between 1 and 2 ha under crop rotations considered typical of each respective system. Biological and physical parameters showed to be significantly different between farming systems, where the small independent farms had better soil quality than the state farms. Final analysis of the results is still in progress and will be detailed in the full paper.

Comparative Study Of Biomass Production And Nutrient Uptake Of Cold Tolerant And Traditional Maize Hybrids

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The new corn hybrids with extremely short growing season can provide new opportunities in comparison to the traditional hybrids. One of the most important characteristic of these new hybrids is that they very well tolerate the cold and they can be drilled as early as late March and early April in Hungary, when the soil temperature is only 5-6oC. Mentioned as an advantage in these hybrids, for example, that the emerging plants can use better the available soil moisture in spring and due to their short growing season, the flowering occurs before the July heat and it helps to reduce the fertility problems. The most valuable property is the perfect integration in the crop rotations.

Taking an average year, these hybrids can be harvested with 20% grain moisture around the 3rd decade of August, so it can be an excellent force crop for the autumn drilled crops. Weather has a great impact to the success of the crop production these days.

To minimise the impact of the extremely changeable weather (e.g. rainfall), to provide a safer production in corn, inevitably request some technological changes in the traditional maize cultivation practices.

Experiment was established in 2010 in Hungary, Zala county, close to the city of Keszthely in field condition with plot size of 0.2 hectares in 4 replications on different corn hybrids in extreme weather conditions. The weight of corn plant biomass, shoot length, nutrients (N, P, K) content was measured. Comparative evaluation was performed with this data.

Investigation Of Water Capillary Rise In Soil Columns Made From Clay Mineral Mixtures Pretreated With Cationic Surfactants

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The study of the environmental pollution effect of surfactants has an outstanding importance nowadays. The surfactants as organic micro-polluters can infiltrate into soils for e.g. with slurry and with liquid residues resulted by soil-washing clearing. Surfactants can modify the wetting capacity of soil particles and the capillary pore system of soils.

The surface modifying effect of the adsorption of a cationic surfactant (hexadecyl-pyridinium-chloride) was studied on different genetic soil-types (meadow solonetz, Ramann brown forest soil, brown forest soil with clay illuviation, pseudogley, pseudomyceliar calcareous chernozem, non-carbonate meadow soil) and on mineral grist mixtures assembled in different proportion (bentonite-loess-sand, kaolinite-loess-sand).

Cationic surfactants are adsorbed on the surface of phyllosilicates by ion-exchange and molecular adsorption which changes the swelling of smectites. Surfactant surface modification was delivered on soil samples and mineral grist with the addition of specific quantities of surfactants related to the isotherms of the previously measured saturation values.

Results were evaluated according to the interfacial (surface tension of liquid phase, contact angle) and soil physical (particle size distribution, structure) properties of the studied samples.

Changes of water capillary rise depended on qualitative and quantitative characteristics of clay minerals in soils were studied on mixture series of surfactant pretreated mineral grist. The surface modifying effect of humus materials presented in real soils in different quantity and the water capillary rise modifying effect of the structure of soils can be excluded with the research of mineral mixture series.

The results of our research are essential for the interpretation of the changes happened in the water balance features (aquifer capacity and permeability) of soils polluted with surfactants.

Estimation Of Soil Bulk Density Using Detailed Soil Physical Database

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Knowledge of soil's hydraulic properties has main importance in agriculture since these properties have a significant effect on soil fertility, soil aeration, soil temperature, drainage, irrigation and cultivability. The most common hydraulic properties – by which the soil water regime can be well characterised – are the hydraulic conductivity and the soil water retention capacity. The lack of sufficient data of these parameters often limits the application of different simulation models. Consequently, since a long time there has been an interest in methods for estimating soil hydraulic parameters from commonly available (more easily or routinely measured) soil parameters. Beside the particle-size distribution and organic matter content the bulk density is one of the most important parameter used in estimations. Unfortunately in many cases there is no information about this soil parameter.

The aim of our recent study was to analyse how accurate the soil bulk density can be estimated from other easily measured soil properties and morphological data based on soil taxonomical information. For our research the newly developed Hungarian Detailed Soil Hydrophysical Database (MARTHA ver2.0) was used.

It was found that using categorical type soil structure data the estimation efficiency of the soil bulk density improved. The results may serve additional information to predict soil hydrophysical data more accurately.

Multi Residue Analysis Of Pesticides In Sediments From The Upper Middle São Francisco River (Bahia, Brazil)

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The upper middle São Francisco is the more arid region from the São Francisco Valley. The main economic activity is the irrigated agriculture, being focused on irrigated plantations of fruit. The irrigated areas are occupied by forty seven different crops with predominant grape and mango. The determination of pesticides in sediments can provide information to assess exposure and fate of these compounds in freshwater ecosystems. In this study were analyzed forty nine pesticides including various organochlorines, organophosphates, triazines and carbamates in sediments from the upper middle of São Francisco River (Bahia, Brazil) in order to evaluate their potential pollution risks. Samples of surface sediments were collected using a Petersen dredge at twenty one stations located between Sobradinho and Curaçá. The pesticides analyzed were: dichlorvos, chlormephos, ethoprophos, trifuralin, chorpropham, phorate, diazinon vinclozolin, chlorpyriphos, pirimiphos, malathion, fenitrothion, ethion, quinalphos, triadimenol, tetradifon, fenamiphos, chlorphevinphos, tebufenpyrad, procymidon, promethryn, p'-DDT, p,p'-DDD, p,p'-DDE, dicofol, methoxychlor, HCHs, aldrin, endrin, endrin aldehyde, endrin ketone, dieldrin, heptachlor, heptachlor epoxide, endosulfan (α, β and sulfate) and chlordane (α and γ). Extractions were carried out using the microwave-assisted extraction (MAE) method and multi residue pesticides determination was achieved by gas chromatography - mass spectrometry (GC/MS). The total pesticides concentrations ranged between 58.96 – 1,335.34 ng g^{-1}, indicating low to high levels. The most frequent pesticides were endrin aldehyde, γ-HCH, β-HCH, α-HCH, heptachlor, heptachlor epoxide, chorpropham, chlorpyriphos, procymidon and triadimenol.

Determination Of Soil pH, Extractable Potassium, And CEC Using Strontium Chloride

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In North America soil pH and extractable cations are dominate soil test methods performed in commercial testing labs. Although of interest Cation Exchange Capacity (CEC) is performed on a limited basis due to the complexity of the test and cost. Estimation CEC methods are often used on neutral to acid soils, but fail on soils containing calcium carbonate. The objectives of this study were to: (i) evaluate four extraction methods (1.0 N NH_4OAc buffered pH 7.0, Mehlich 3, 0.01 M $SrCl_2$, and silver thio urea) for their effectiveness in quantifying soil extractable cations and CEC. An additional evaluation was performed to evaluate 0.01 M $SrCl_2$ for the determination of soil pH, NO_3-N, extractable aluminum (Al) and sulfur. Results indicate good agreement with 0.01 M $CaCl_2$ of forty soils selected from the ALP proficiency program and with 0.01 M $SrCl_2$ and for 1.0 N KCl extractable NO_3-N, calcium phosphate extractable sulfur and Al using 1.0 M KCl. Results for extractable cations (i.e. K, Ca, Mg, and Na) indicate SrCl2 had lower recoveries relative to NH_4oAC and Mehlich 3 extractants, and was variable dependent on the soil. NH_4OAC buffered to pH 7.0 resulted in extraction of Ca from free lime on soils with greater than 1% $CaCO_3$. Estimation of CEC using $SrCl_2$ was in good agreement for soils cation replacement methods for soils with CEC less than 7.0 cmol kg^{-1} however poor agreement was noted on soils higher CEC values.

A New Field Soil Quality Index (FSQI) For Olive Groves In The Province Of Jaén (southern Spain)

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Soil field properties are easier and cheaper to obtain than analytical, but no Field Soil Quality Index (FSQI) has been proposed. Here, a FSQI has been made using a non-linear PCA with optimal scaling (NLPCA) and applied to evaluate olive groves in Jaén.

A soil data base was implemented with 169 soil profiles and 22 field variables (categorical) based in the next properties: color, structure, consistence, texture, porosity, roots, topography, terrain position, slope gradient and parent material. Each soil profile corresponds to one of the next Land Use Types: Little-disturbed forest (Quercus broteroi; LDF), Xeromorphic woodland (Quercus rotundifolia; XW); Semi-naturalized plantation forestry (Pinus sp.; FP), Xeromorphic Scrub (XS); Pastures and degraded grassland (PDG), Annual field cropping (AFC) and Olive groves (OL). Variables were further combined into a FSQI that would take into account their respective abilities to separate sites with different soil qualities.

First, the original data matrix was randomly divided in 2 sets: a 100x22 matrix (the training set) and a 69x22 matrix (the validation set). Second, NLPCA was applied to the training set, obtaining a set of optimal scores for the categories of the variables and the Variance Accounted For each variable (VAF). Third, the original categories in the validation set were substituted by its optimal scores. Finally, the FSQI were obtained as the sum of the optimal scores weighted by the VAF and reduced to a common range (between 0.1 and 1).

The mean FSQI value was significantly lower ($p > 0.001$) for OL (0.381) than for the next subgroups: 1) AFC and PDG (0.416 and 0.506, respectively); 2) XS, FP and XW (0.650, 0.724 and 0.754, respectively); and 3) LDF (0.941). Likewise, the FSQI introduced the ability to separate ($p < 0.001$) the OL management systems in Jaén: Traditional farming (0.381) vs. Ecological farming (0.742).

Olive Grove Cultivation Quality Influence Of Management And Soil Type

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Soil quality has a huge influence on plant quality. However, the factors affecting soil quality may be strongly influenced by different agronomic practices that are performed, as well as soil type and physiographic position. For this reason we have compared the influence of two types of agricultural practices (conventional and organic) and two soil types (on marls and colluvial limestones) on the physiological quality of the olive trees in a semiarid Mediterranean climate area from Barranco del Atanor (Sierra Mágina Natural Park, Southern Spain), where the study is located. Ethylene content and water content both in leaves have been measured.

The preliminary results for these parameters show that between the marly soils and colluvial soils were not statistically significant differences. However, for water content, we see that there was greater water capacity in plants from colluvial soils. For this plant parameter we found significant differences between organic and conventional management, with a greater water capacity in the latter. With respect to the ethylene content was not found significant differences between plants from colluvial soils and plants from marly soils, but there is a trend for olive plants in colluvial soils have less amount of ethylene. Similar results were obtained by comparing the amount of ethylene under conventional management and other organic; the amount of ethylene was lower in an organic management. The physiographic position factor also affected the amount of ethylene in leaves, because it was found that the highest positions had a lower content of ethylene that the middle areas, and increases in the lower positions. Overall, these data show that the plants are less stressed under organic management, and also this can be considered as environmentally sustainable management.

The Influence Of EDTA Application On The Translocation Capacity Of Lead In Soil

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Large areas of agricultural soils in Romania are contaminated by heavy metals that mainly originate from industrial emissions. To achieve high heavy metals removal rates, the concentrations of soluble heavy metals in the soil must be enhanced. Several chelating agents can effectively increase the solubility of metallic contaminants in soil and subsequently enhance their uptake by crops.

In the pots experiments, described in this study, we tested the direct and residual effects of applying a chelating agent (EDTA) on the accumulation of Lead in plants.

Two experiments on Lead contaminated Chernozem have been set up in the Green House in three time periods (Cycle I, Cycle II, Cycle III).

Obtained data revealed that there are significant differences as concern the biomass and the Lead accumulation in the shoots of maize related to the treatments applied. The aim of EDTA added was to mobilize and increase metal accumulation in maize, Lead being one of the largest immobile heavy metals in soil.

Non significant modification at the most important chemical properties such as: organic carbon, total nitrogen, phosphorus and potassium mobile contents have been observed, excepting soil reaction.

Dry Matter And Crude Protein Of Bracharia Brizantha Production In Oxisol Treated With Organic-Mineral Fertilizer

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The use of the organic-mineral fertilizer produced by the manufacturing industry of lysine and threonine amino acids in tropical soils can improve their fertility. The objective of the present study was to evaluate the influence of different dosages of the product named Ajifer L-14 on the increased production of a forage crop in a Red Latosol in the northwestern region of São Paulo State, Brazil. A randomized block design was used with seven treatments and four replications. The treatments were: T_1- control (without application of Ajifer L-14); T_2- control with natural vegetation; T_3- mineral fertilization according to the cultivation need and soil analysis (using 1.35kg urea, 2.20kg single superphosphate and 0.51kg potassium chloride per plot, which corresponds to 60kg N, 40kg P_2O_5, 30kg K_2O per ha^{-1}); T_4- fertilization with Ajifer L-14 according to the recommendation resulting from the chemical soil analysis (40 liters per $plot^{-1}$, which corresponds to 60kg N ha^{-1}); T_5- fertilization with Ajifer L-14, with dose 50% above the recommended (60 liters per $plot^{-1}$, which corresponds to 90kg N ha^{-1}); T_6- fertilization with Ajifer L-14 with a dose 50% below the recommended (20 liters per $plot^{-1}$, which corresponds to 30kg N ha^{-1}); T_7- fertilization with Ajifer L-14 with dose 25% above the recommended (50 liters per $plot^{-1}$ which corresponds to 75kg N ha^{-1}); T_8- fertilization with Ajifer L-14 with dose 25% below the recommended (30 liters per $plot^{-1}$, which corresponds to 45kg N ha^{-1}). In regression analysis there was a polynomial relationship between the application rates of organic-mineral fertilizer and the production of dry matter and crude protein of Bracharia Brizantha.

Preliminary Study Of The Nutritional Status Of Pistachio In Aegina, Greece

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Pistachio trees have been cultivated on the island of Aegina, Greece, since 1860. The dominant variety 'Aegina' is one of the finest pistachio varieties in the world.

The aim of the study was to collect some information on the inorganic nutrition of pistachio in the area in order for fertilization recommendations to be more appropriate. Additionally, the causes of two types of symptoms observed in some orchards during summer were to be investigated. The first one concerned severe burning or scorching on the tips or edges of the leaves, while the other concerned small, narrow, leaves, bunched together at the tips of the shoots.

Thus, in the first days of August, fully expanded sub-terminal leaflets from non-fruiting branches from 41 commercial orchards, consisting of pistachio trees var. 'Aegina' grafted onto Pistachia terebinthus cv Tsikoudia, were collected and chemically analyzed.

The results showed that 54 % of pistachio orchards included in the study presented leaf nitrogen concentration below the critical value; the relevant percentage in the case of phosphorus was 20 % and that of potassium 22 %. Calcium level was found to be within the normal range in all orchards whereas leaf chlorine was in excess in some cases. With regard to micronutrients, iron, manganese and boron, levels were within the normal ranges, 30-50 ppm, 20-80 ppm and 100-200 ppm, respectively but zinc was found to be below the critical value in 51 % of the orchards tested. As for the symptoms observed, the first type of symptoms should be related to low K and/or excessive Cl^- concentrationwhereas the second one should be to Zn deficiency. The investigation of both the aforementioned nutritional disorders will be continued in the following growth period in the area by studying several plant, soil and irrigation water parameters.

Targeted Yield Sustainability Through Ipns Approach For Brinjal *(Solanum melongena L.)* Crop

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To develop the soil test and crop response (STCR) fertilizer prescription equation for brinjal *(Solanum melongena L.)* crop, a field experiment was conducted on red soils (*Kandic paleustalfs)* of GKVK, Bangalore, Karnataka State, India, during kharif 2009-10. After developing three fertility gradients strips viz; low-medium-high in the same field, main experiment was conducted by growing brinjal as test crop. In each strip 21 NPK combinations + 3 controls were imposed by taking 7 NPK combinations + 1 control in each of the three FYM blocks. Same treatments were randomized in the other two gradient strips to have totally 72 treatments.

In each of the fertility strips having 21 treatments of NPK combinations and 3 controls, were imposed by taking different 7 NPK combinations + 1 absolute control in each of the three FYM blocks. Similarly, same NPK treatment groups which were imposed in each FYM blocks were randomized in the other two gradient strips to have totally 72 treatments.

Highest brinjal fruit yield of 537.59 q ha^{-1} was recorded in high fertility strip where 3-1-1 levels of NPK were applied along with 25 t ha^{-1} FYM, whereas lowest yield of 90.50 q ha^{-1} was obtained in low fertility strip, where no FYM and no NPK were applied. Highest nutrient required (NR) was nitrogen (0.366 kg) followed by potassium (0.317 kg) and phosphorus (0.143 kg) to produce a quintal of brinjal fruits. Nutrient contribution from the fertilizer (%CF) was maximum (45.353 % N, 50.129 % P_2O_5 and 150.187 % K_2O) for getting the maximum yield of brinjal, where as soil contribution (%CS) was slightly lower (24.583 % N, 25.584 % P_2O_5 and 24.207 % K_2O) and very low contribution from the (%C-OM) organic matter (0.051% N, 0.057 % P_2O_5 and 0.055 % K_2O) was recorded.

Initial soil data, fruit yield and NPK uptake by brinjal crop from all the 72 plots were used to obtain important basic parameters viz., NR, % CF, % CS and % C-OM. These parameters were used for developing the following fertilizer adjustment targeted yield equation.

- F.N = 0.8081 T - 0.5420 STV($KMnO_4N$) - 0.00113 OM
- F.P_2O_5 = 0.2843 T - 0.5104 STV(Bray's-P_2O_5)- 0.00113 OM
- F.K_2O = 0.2113 T - 0.1612 STV-(Am.Acet-K_2O) - 0.00036 OM

Comparison of STCR approach with the present soil testing laboratory (STL) method followed in Karnataka, India, to produce a fixed yield target by brinjal, clearly indicated the superiority of STCR targeted yield approach in efficient and economic use of costly fertilizers in conjunction with locally available organic manures in a balanced way by the farmers without any wastage, thereby helps in sustaining the soil and crop productivity for a longer period.

Assessment Of Environmentally Harmful N Surplus By 0.01 M $CaCl_2$ Soil Extractant In Long-term Experiments

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We studied the 0.01 M $CaCl_2$ extractable N fractions (NO_3-N, NH_4-N, N_{org} and N_{total}), N balances and yields in two long-term NPK fertilization experiments located in the Great Hungarian Plain. Our aims were to investigate whether the effects of long-term fertilization and irrigation are reflected in the 0.01 M $CaCl_2$ extractable nutrient content of the soil profile and to study the importance of nitrate leaching on Chernozem soils (USDA soil taxonomy: Molllisols) under different nitrogen- and water supply conditions.

On Haplic Phaeozem soil all nitrogen rates caused significant increase in $CaCl_2$-extractable NO_3-N and N_{total} fractions. These fractions were in significant and close correlation (r = 0.87; r = 0.88) with nitrogen balances as well, which means that 0.01 M $CaCl_2$ method is able to assess both N deficit and N surplus. On Calcic Chernozem soil, the 240 kg ha^{-1} nitrogen rate increased NO_3-N and Ntotal fractions significantly. This result is in accordance with yield data that proved that 240 kg ha^{-1} nitrogen rate was not utilized. In this experiment, nitrate leaching was also investigated. Our study confirmed that as an effect of high rate nitrogen fertilization year by year deeper layers are affected by leaching. On irrigated plots nitrate leaching was more intensive.

Our results confirmed that Norg fraction has a high importance on the studied soils (14-44 percent of N_{total} fraction). Significant positive correlation (r=0.53) was observable between N_{org} content and the previous yield. It can be concluded that the N_{org} fraction depends on yearly mineralizable root and stubble residues, so it characterizes easily mineralizable N reserves.

The Effects Of Increasing Nitrogen Doses And Soil Types On The Chemical Composition Of Tomato And Sweet Corn

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As a part of our research project according to nitrogen flow in soils and vegetable cultures, were made our experiments in the nursery garden of our Institute (Kecskemét College, Faculty of Horticulture), using large volume lysimeters. At constant phosphorus and potassium fertilizer doses (P_{60}:K_{120}), four different nitrogen doses (0, 60, 120 and 180 kg ha^{-1} N) were used. Three different soil types (sandy, alluvial and chernozem soils) were studied. Total N levels and other parameters were determined in two harvesting times according to tomato (type K-549) and sweet corn (type Spirit) as well.

Laboratory tests were made in the Soil and Plant Testing Laboratory of our institute. Total nitrogen levels were determined by Kjeldahl method (FOSS Kjeltec 2300), total phosphorus and potassium contents were analyzed by an ICP spectrometer (HORIBA Jobin Yvon) after microwave digestion. Leaf analysis clearly confirmed N translocation from the old leaves to the young ones. Translocation of potassium in leaves was also shown, whereas phosphorus content did not differ in young and old leaves considerably. These observations emphasize the importance of sampling in the planning of these examinations. Potassium levels in tomato fruit decreased continuously by increasing N doses. Plant examinations in sweet corn confirmed the translocation of nitrogen during growing and ripening, and the effects of N doses were shown as well.

According to the chemical composition of the tested vegetables, organic acid contents increased in tomato berry on sandy and alluvial soils at higher nitrogen fertilizer doses. Sugar content was higher in tomato grown on alluvial and chernozem soils. Nitrogen doses decreased sugar contents in chernozem in the case of both vegetables. The increase in vitamin C levels of tomato in sandy soil was slight due to higher nitrogen doses.

Results Of Soil Testing And Land Parcel Information System - Basic Tools For Fertilizer Recommendations In Czech Agricultural Practice

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Some of the selected basic parameters of soil fertility are observed in the Czech Republic in long term system of agrochemical soil testing, due to the use of fertilisers. More than 500 thousand hectares agricultural soil are tested every year and take away almost 80 thousand soil samples. The results of determination of soil reaction and contents of available essential nutrients (P, K, Mg, Ca) are stored in Land Parcel Information System (LPIS) - system based on the actual use of land in a geographic information database. Ministry of Agriculture of the Czech Republic uses LPIS as an administrative tool in control system and LPIS also functions as a service for the farmers themselves. A basic goal of LPIS is to allow farmers to obtain high-quality and comprehensible information about the blocks they use including current status of basic soil properties (pH value and available nutrients content) and fertiliser recommendations based on results periodic soil testing.

Effects Of Manure And Chemical Fertilizer Management On Yield Of Cassava On Map Bon, Coarse-Loamy Variant

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The study on effects of manure and chemical fertilizer management on cassava yield. The cassava cultivar HB 80 was grown on Map Bon, coarse-loamy variant at Khao Hin Son Research Station, Khao Hin Son sub-district, Phanom Sarakham district, Chachoengsao province. The experiment was carried in RCBD with 3 replications. There were 10 treatments: 1) without fertilizer 2) with 50 kg of chemical fertilizer grade 15-15-15 per rai at one month after planting 3) with 50 kg of chemical fertilizer grade 15-5-20 per rai at one month after planting 4) with 1000 kg of chicken manure per rai before planting 5) with 500 kg of chicken manure per rai before planting and 25 kg of chemical fertilizer grade 15-15-15 per rai at one month after planting 6) with 500 kg of chicken manure per rai before planting and 25 kg of chemical fertilizer grade 15-5-20 per rai at one month after planting 7) with 1000 kg of chicken manure per rai before planting and 25 kg of chemical fertilizer grade 15-15-15 per rai at one month after planting 8) with 1000 kg of chicken manure per rai before planting and 25 kg of chemical fertilizer grade 15-5-20 per rai at one month after planting 9) with 25 kg of chemical fertilizer grade 46-0-0 per rai at one month after planting and 25 kg of chemical fertilizer grade 15-15-15 per rai at two month after planting and 10) with 50 kg of chemical fertilizer grade 46-0-0 per rai at one month after planting and 25 kg of chemical fertilizer grade 15-5-20 per rai at two month after planting. The experiment was carried on during June 2009 to June 2010. The results showed that treatments with fertilizer gave highly effected of fresh root yields , fresh stem yields and starch percentages of roots significantly, while the number of roots per rai gave no difference. The treatments with 500 kg of chicken manure per rai before planting and 25 kg of chemical fertilizer grade 15-15-15 per rai at one month after planting gave higher fresh root yields of cassava (10,419 kg/rai) than with 1000 kg of chicken manure per rai before planting only (8,726 kg/rai) or with 50 kg of chemical fertilizer grade 15-15-15 per rai at one month after planting only (6,514 kg/rai)too. Whereas, The used of only chicken manure 1000 kg per rai before planting (8,726 kg/rai) and chicken manure with all chemical fertilizer treatments gave no difference of fresh root yields. In addition, the treatments with 500 kg of chicken manure per rai before planting and 25 kg of chemical fertilizer grade 15-15-15 per rai at one month after planting also gave the highest fresh stem yields of cassava (5,283 kg/rai). Application with 25 kg chemical fertilizer grade 46-0-0 per rai at one month after planting and 25 kg of chemical fertilizer grade 15-15-15 per rai at two month after planting caused the highest starch percentages of roots (25%). As for mean of roots number gave 16,878 roots per rai.

Nitrogen Rates For Meadowfoam Based On N Uptake Dynamics And Mineralizable Soil N

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Meadowfoam *(Limnanthes alba)* is a low-growing winter annual native to northern California and southern Oregon, USA. Meadowfoam seed oil is prized because it consists of long-chain fatty acids with more than 18 carbons. Meadowfoam is adapted to Mediterranean climates characterized by mild, wet winters and warm, dry summers. In the Pacific Northwest USA, it is a rotation crop with cool-season grasses grown for seed on well- and poorly-drained soils. Fertilizer requirements are low and N fertilizer rates in excess of 50 kg N ha^{-1} often reduce seed yield. Despite a modest N requirement, Meadowfoam responds profitably to small quantities of spring-applied N when soil-supplied N is low. Objectives were to characterize N uptake dynamics and use this information along with a soil test for mineralizable soil N to improve fertilizer recommendations. Experimental treatments included N fertilizer rates (0, 22.5 and 45 kg N ha^{-1}) and cultivars (7) in replicated field trials. Above-ground biomass and N uptake were measured at two-week intervals from early March through mid-June in plots receiving 45 kg N ha^{-1}. Nitrogen uptake reached a plateau by April 1st but maximum biomass accumulation was not reached until mid-May. Cultivars responded to N fertilization and differed in biomass accumulation and seed yield, but not N uptake. Soil samples collected from 40 Meadowfoam fields in late winter were analyzed for inorganic soil N (NH_4-N and NO_3-N) and readily mineralizable soil N (Nmin). One-half of the 40 fields surveyed had Nmin soil tests >40 mg kg^{-1} and positive responses to N fertilization were not expected. Nitrogen fertilization significantly increased seed yield at sites testing <35 mg kg^{-1} Nmin in large-scale, on-farm replicated field trials.

Soil Properties And Phosphorus Isotopic Exchangeability In Cropped Temperate Soils

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Isotopically exchangeable phosphate (P) is the main source of P for most crops. The amount of P that is located on the solid phase of a soil and that can exchange with P in the soil solution can be calculated knowing the concentration of water extractable P *(C_P)* and two kinetic parameters i) the ratio between the total introduced radioactivity added as ^{33}P in a soil water system and the radioactivity remaining after 1 minute in this solution *($R/r_{1minute}$)*, and ii) the rate of disappearance of ^{33}P from the solution with time *(n)*. The aim of this paper was to propose statistical models describing $R/r_{1minute}$ and *n* as a function of C_P and other soil properties. By doing so, we made the hypothesis that it is possible to calculate the amount of P located on the solid phase of the soil that remains isotopically exchangeable after 1 minute and 60 minutes *($P_{r1minute}$, $P_{r60minutes}$)* using C_P and selected soil properties as explanatory variables. This work was done in two steps. First isotopic exchange kinetic experiments were carried on 9 soil samples (set A) sampled in 1998 from cropped sites that had been incubated in the presence of increasing concentrations of water soluble P. Results from these experiments allowed developing models to calculate $R/r_{1minute}$ as a function of C_P, soil pH, and dithionite extractable Fe *(Fed)* and n as a function of C_P. In the second step, we compared $R/r_{1minute}$, *n*, $P_{r1minute}$ and $P_{r60minutes}$ values obtained from the isotopic exchange kinetic experiments conducted on an independent set of 27 soil samples (set B) also taken from cropped sites to the values computed from our statistical models. Modelled and experimental values were highly significantly correlated to each other, showing that the 3 parameters C_P, soil *pH* and *Fed* explained more than 75% of the variability of the experimental results. Experimental and modelled values of $R/r_{1minute}$ and $P_{r1minute}$ were not different from each other, whereas experimental values of n and $P_{r60minutes}$ were statistically significantly different from the modelled values. Finally the limits and applicability of our approach for the development of a pedo-transfer function to predict P_r are discussed.

Silicon Effect On The Plant Iron Deficiency Tolerance

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Iron (Fe) deficiency is a common nutritional disorder affecting vegetal crops grown in calcareous soils. The lack of this micronutrient is commonly corrected by the application of chelates. Moreover, Si fertilization has been described as an improvement in the tolerance to biotic and abiotic stress. Although, the role of Si on plant tolerance to stress has scarcely been investigated. Hence, the main objective of this work is to analyze the Si effect on the tolerance to iron chlorosis, the major symptom of iron deficiency.

Soybean plants (Glycine max L.) grown in hydroponic culture under iron partial deficiency (5μM Fe-EDTA) were treated with three Si doses (0 Si, 0,1mM Si and 1.0 mM Si). Samples of leaves, shoots and roots of the plants were collected at 10, 15 and 25 days after the treatments implementation. Si mobile forms were determined spectrophotometrically by the blue silico-molybdate procedure from fresh plant material. Samples digested with nitric acid were evaluated for their mineral content. Total Si content was calculated by ICP-MS and the rest of micronutrients (Fe, Zn, Cu and Mn) were analyzed by atomic absorption.

Soluble silicon content showed significant differences in plants submitted to high Si concentration after small periods of time. Significant differences in total Si content were observed in plants submitted to the three treatments. The highest values were reached in plants grown with 1mM Si. However, iron concentration decreased in these plants, suggesting the precipitation of Fe in presence of Si. That would explain the severe chlorosis symptoms observed. Thus, the tolerance to iron chlorosis in soybean seems to be not affected by Si addition under our work conditions. Therefore, new experiments have been carried out by our group in order to clarify if the Si has a positive effect in the iron deficiency tolerance.

Cu And Zn Seed-dressing, As A Possible Way Of Nutrient Supply Improvement

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Several methods are available for micronutrient fertilization but the utilization, bioavailability of nutrients applied these ways can be different. Many references examined the effect of foliar fertilization as a possible way and the metal-ammonium-phosphate based soil fertilizers are also widely used. The main problems of these methods are that their utilization is relatively low (large amount of them are not available for the plants) and their redistribution in the developing plant is often limited. The third not examined way is to increase the mineral element content close to the seed and the roots of growing plant. It may provide the required amount and easily accessible nutrients for the germinating and developing plant.

To examine the effect of micronutrients applied directly by the seed we set up a small plot field experiment. Cu, Zn and their combination in citric acid solution were examined in corn production as seed-dressers. Samples were taken in three growing stages (3-4 leaves and 8-10 leaves stages and during flowering) and after harvest (stalk, leaf, tassel, cob and grain samples were also examined). Element composition of plant samples were analyzed by ICP-OES. We found that the seed-dressing application of micronutrients influenced the element content of growing plant both in younger development stage and – in the case of some plant parts - in harvest.

Effects Of Nitrogen Form And Application Rates On The Growth Of Petunia x hybrida And Nitrogen Level Of The Substrate

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Fertigation practices have been proposed for decreasing N leaching losses and for the nutrient efficiency increase, including the use of nutrient solutions with low concentration of N and the application of nitrification inhibitors with ammonium NH_4^+–N fertilizers. The effects of N form, application rates and use of an inhibitor of nitrification (DMPP 3, 4- Dimetilpirazol phosphate) on the growth and the nutritional status of Petunia x hybrida and the nitrogen content in the substrate were tested. Plants were placed in a venlo-glass greenhouse. Five treatments were established, changing N-form, application rates and with or without the inhibitor of nitrification : T1-120 mg L^{-1} of NO_3^--N, T2-120 mg L^{-1} of NH_4^+-N, T3- 120 mg L^{-1} of NH_4^+-N with ENTEC, T4- 160 mg L^{-1} of NH_4^+-N with ENTEC and T5-80 mg L^{-1} of NH_4^+-N with ENTEC. Nitrogen form did not have an effect on plant dry weight and plant height; however, it reduced pH and nitrate concentration in the substrate solution and nitrogen losses. The use of DMPP achieved significant reduction in nitrate leaching. Tissue nitrogen concentration was not affected by N-form, whereas the leaves of the plants treated with ammonium show an increase on colour, due an increase of iron concentration. Ammonium fertilization increases dark storage duration.

Assessment Of Phosphorus Status In A Long-term Tillage And Phosphorus Placement Experiment

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A long-term experiment to examine the impact of nitrogen (N) and phosphorus (P) on the yield of crops in a wheat-canola-triticale-pea-barley rotation under conventional and no-till/direct seeding conditions was established in 1979 at the Breton and Ellerslie experimental farms of the University of Alberta. A number of treatments, replicated four times, were employed, however, they were subsequently modified to accommodate added treatments; tillage treatments were not replicated. Consistent throughout the 30 years of this experiment for both cultivation systems were three treatments, namely, control, in-row and mid-row banded application of 17 to 20 kg P/ha with application of 74 kg N/ha. Detailed soil analyses, including both chemical and anion resin (PRS probes) techniques were carried out on the three permanent treatments described above in 2007. Yield data for a complete rotation of crops covering the period of 1997 to 2007 only are included in this study. Total grain production (all crops) over the period was 15 to 27% greater under the tilled system. In general, placement of P after 18 years of initiating this experiment did not result in significantly different difference on yield (41 of 44 site-years). The agronomic efficiency of in-row application of P was consistently higher in wheat and consistently lower in triticale compared to the mid-row one. PRS 28 day burial or 24 hour equilibration in the laboratory provided a better estimated of P availability (r=0.87 and 0.89, respectively) to bicarbonate extractable P (r=0.55).

Foliar Analysis As A Tool To Evaluate Chelates To Supply Fe, Mn, Zn And Cu To Strawberry Plants

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Strawberry production is usually obtained in Spain in sand substrate and fertigated cultures. Micronutrients are frequently applied as sulfate salts or EDTA chelates. Metals from sulfates precipitate even at low-neutral pH, reducing their availability. EDTA is recalcitrant, so the concern about the environmental fate of EDTA applied in agriculture has risen. In this work, it has been evaluated the efficacy of two alternative chelates of EDTA: the biodegradable IDHA, with similar structure, and a combination of regioisomers o,o-EDDHA and o,p-EDDHA to provide iron, manganese, zinc and copper. Doses were split according to the chelates stability in three or six weekly applications. Experiment started the second of January. The foliar analyses were done at 31, 64 and 121 days after the first application. Foliar analysis, in comparison with chlorophyll indices based on SPAD measurement, was used to evaluate chelate efficacy. SPAD values did not show differences among treatments while SPAD increment was higher in IDHA treatment during the whole assay. However, differences were found among the three chelates based on foliar analysis. The treatment based on EDDHA isomers showed a better Fe content on the first period while IDHA showed better results at the end. No differences were found on Mn analyses among treatments. Zn nutrition was higher in EDDHA and EDTA treated plants and in the case of Cu for EDTA followed by EDDHA and IDHA. SPAD index was insufficient to evaluate the treatments while the foliar analysis was the most adequate test to evaluate differences among the three chelates. Based on it, we can conclude that EDDHA mix isomers is the better alternative to EDTA in strawberry in the studied conditions, although the biodegradable chelate IDHA showed good results in general and specially in Fe nutrition and a long lasting effect, as showed the SPAD increment values. IDHA and EDDHA are good alternatives for recalcitrant EDTA chelates.

Optimizing N Fertilizer Rates For Yield, Seed Quality And N Uptake In Camelina sativa And Brassica carinata

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Field experiments were conducted at Scott, Melfort, Lethbridge (University of Alberta) and Swift Current (Wheatlands Conservation Area Inc.) in 2008; at Scott, Melfort, Lethbridge and Indian Head in 2009 and 2010, to determine optimum N fertilizer requirements for yield, seed quality, N uptake and N fertilizer use efficiency (NFUE – seed yield in kg ha^{-1} produced per unit fertilizer N) of camelina *(Camelina sativa L.)* and carinata *(Brassica carinata L.)*. In Experiment 1, camelina responded markedly to N rates and seed yields began to level off at 116 kg N ha^{-1}) (which is the join point), reaching a plateau of 2035 kg ha^{-1}. In Experiment 2, there was also a substantial seed yield response to applied N and a yield plateau of 2460 kg ha^{-1} was achieved at a rate of 111 kg N ha^{-1}. In Experiment 1, *B. carinata* responded to N rates dramatically and seed yields began to level off at 108 kg N ha^{-1}. Seed yield reached a plateau of 2158 kg ha^{-1}. In Experiment 2, a yield plateau of 2054 kg ha^{-1} was achieved at a rate of 139 kg N ha^{-1}. Previous studies in Saskatchewan have shown that other *Brassica* crops reached a plateau at about 100 kg N ha^{-1}. Our studies indicate that respective N requirements for camelina and *B. carinata* are similar to and slightly higher than *Brassica napus* canola, *Sinapis alba*, and *Brassica juncea*, depending on the soil climatic zone. In conclusion, seed yields of camelina were very consistent over years with seed yields reaching a plateau at 111 to 116 kg ha^{-1}. *B. carinata* was a bit more inconsistent with seed yields reaching a plateau at 108 to 139 kg ha^{-1}.

Reference Levels For Leaf Nutrient Diagnosis Of Cv. Tempranillo Tinto Grapevine *(Vitis vinifera L.)* In The Rioja Apellation

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Plant nutritional diagnosis requires specific reference levels for each variety which faithfully reflect the nutritional status of the crop. A vine nutritional survey was undertaken in the Rioja appellation in north-eastern Spain. The survey method was used to establish preliminary Reference Levels to be applied to the nutritional diagnosis of blade and petiole tissues of Vitis vinifera L., cv. Tempranillo tinto on Richter-110 rootstock. These References were generated from data obtained throughout twelve years (2000-11) from 166 vineyards. The obtained database includes data from different altitudes, soil types, cultural practices, and climatic conditions within the Rioja appellation. The training systems were Goblet, Guyot, and Double Cordon Royat espalier pruning. In general, vineyards had a dry farming irrigation regime and a homogeneous mechanical tilling. Nitrogen, P, K, Ca, Mg, Fe, Mn, Zn, Cu, and B were analyzed in blade and petiole dry tissues sampled at flowering and veraison.

Data were statistically analyzed to obtain the Normal average values considering the ($\mu \pm 0{,}25\sigma$) of the central data as optimal levels and the tails values ($\mu \pm 0{,}84\sigma$) of the population as excessive or deficient levels. Vineyards with phytosanitary damages or troubles at flowering, and data with extreme nutrient values were ruled out. The statistical procedure included the Kolmogorov-Smirnov non-parametric test for normality, mathematic transformations for normality and the calculation of percentiles when those transformations to Normal distributions become unlikely (P20, P40, P60, and P80). Finally, Reference Levels for blade and petiole at flowering and veraison are proposed for Tempranillo tinto grapevine in the Rioja appellation.

Methodology For Iron Translocation Rate Assessment In Cv. Tempranillo Tinto Grapevine *(Vitis vinifera L.)* Fertilized With Both Chelated And Complexed Iron Foliar Suppliers.

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Iron-deficiency-induced chlorosis is a widespread nutritional disorder in grapevine, in particular on calcareous soils. A solution of the problem could be the utilization of Fe-fertilizers directly supplied through foliar spray because it might be more efficient than soil application in increasing yield and improving Fe status of vines.

Two iron chelates (Fe-EDTA and Fe-EDDS), an iron complex (Fe-Lignosulphonate) and an iron salt (Fe-Sulfate) were foliarly applied on a mature Tempranillo tinto *(Vitis vinifera L.)*, grown on a soil with a large active limestone content (9.25% at the 30-60 cm deep), and compared to a control treatment. Five vines per treatment were chosen. A hundred milliliters of each iron treatment (5 mM) was spray on adult leaves (treated), while young leaves (untreated) were covered so iron translocation could be studied. Treatments were repeated once after two weeks.

Treated and untreated leaf samples were taken just before treatments application and after four weeks. Micronutrient content (Fe, Mn, Cu and Zn) were determined by AAS and Fe/Mn ratio calculated as iron nutrition index. SPAD index was measured weekly throughout field trial on both treated and untreated leaves.

No differences were found on Fe(III) concentration before the iron fertilizer application. All iron treatments supplied significantly more Fe(III) than control treatment when Fe(III) concentration from treated leaves was determined. Fe/Mn ratio from all iron treatments was significantly higher than that of control treatment . Similarly, untreated young leaves from vines treated with Fe-EDTA and Fe-Sulfate shown significantly higher Fe(III) concentration (61.1 and 60.1 mg Kg^{-1}) than that of control treatment (48.3 mg Kg^{-1}). Fe/Mn ratio was higher from Fe-EDTA treatment (0.44) that for the rest of the iron treatments ($p = 0.07$). The proposed methodology is valid to assess the Iron translocation rate from adult to young leaves when foliar fertilization is applied.

Effects Of Crop Production Factors On Maize Production With Bioenergetic Purposes On Lowland Calcareous Chernozem Soil

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In the recent years the production of fuel alcohol from renewable energy resources has received remarkable interest. The crop production factors influencing the quality of maize hybrids have to be examined to a more detailed extent. It is important to be able to extract the highest amount of ethanol possible from the obtained grain yield. Several research results have been published about the quality of maize hybrids. Starch production is critical to both the grain yield and quality.

Theobjective of this study was to evaluate the effects ofcrop production factors (hybrid, fertilization) on the main components of maize grown for bio-ethanol production. Yield, starch content and starch yield per hectare of maize hybrids were examined on lowland calcareous chernozem soil. This study was conducted at the Experimental Station of the Centre for Agricultural and Applied Economics Sciences, University of Debrecen located in the north-eastern part of the Great Plain. Starch content of maize hybrids were evaluated by Foss Infratec™ 1241 Grain Analyzer.

During our examinations, we established that the productivity and the starch content of the involved maize hybrids are significantly different as a function of their genetic potential, but starch content is independent of productivity. Based on the obtained results, our hypothesis is that starch yield primarily depends on productivity that is only slightly affected by the potential starch content based on genetic endowments. As a result of nitrogen fertilisation, the correlation between starch yield and grain yield became slightly weaker with increasing doses due to the fact that the starch content decreased with higher nitrogen doses.

Estimating Plant-available K In K-fixing Soils

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Soil tests commonly used to develop K fertilizer recommendations, such as extraction by 1 M NH_4OAc at pH 7, measure both soluble and exchangeable K. Such methods are inadequate for soils that have a significant amount of fixed (non-exchangeable) K, a portion of which may be available to plants. The sodium tetraphenyl boron (TPB) method has been shown in some studies to provide a better measure of plant-available, non-exchangeable K. Cox et al. (1999) have published a simplified version of this procedure. A 5-min incubation with TPB allows the BPh_4 ion to combine with K+ in solution, causing precipitation of $KBPh_4$. This procedure extracts 1.5 to 6 times more K than NH_4OAc extraction. We are investigating the use of this test for predicting availability of fertilizer K applied to strongly K-fixing soils in California. These soils, formed in granitic alluvium from the Sierra Nevada, are found on the east side of the San Joaquin Valley. They contain vermiculite in the fine sand and silt size fractions. We have found extensive areas of such soils in cotton fields and wine grape vineyards. Four soil profiles, representing a range of K-fixation potential (Kfix), were chosen for this study. Kfix was measured by the procedure of Murashkina et al., in which 3 g soil is saturated (10:1) with 2 mM K and shaken for 1 hr. To evaluate K fertilizer requirement, KCl in solution was added in amounts equal to the Kfix of each sample. Samples were incubated moist for 1 to 7 days; then half were air-dried and half were maintained in the moist condition. K availability was estimated by both the NH_4OAc and TPB methods. The results of this work will be useful for determining K fertilizer application requirements for K-fixing soils.

Soil And Plant Indexes Of Soil Depleting From Phosphorus, Potassium And Magnesium

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Mineral fertilizer production and distribution in Poland prior to 1991 were subsidized by the State. Demand for low-cost products exceeded substantially their production. During the transformation to market oriented economy the subsidy on fertilizers was removed and the demand from agriculture dropped dramatically. In 2008/2009 mineral fertilizers consumption reached only 122 kg NPK per 1 ha and the N:P:K ratio remained 1: 0,3: 0,4. This tendency is disturbing because of the soils in Poland are commonly acid and poor in available potassium and magnesium. Nitrogen fertilization and high yielding crops compound the process of soil depleting. The objective of presented paper was an evaluation of soil and plant indexes sensibility for soil exhausting from P, K and Mg.

Two factorial experiments were carried on in 2003 - 2009 in four – crop rotation: winter rape - winter wheat – maize – spring barley. The first factor was treatment without P or K or Mg and control treatment fertilized with all the macronutrients and the second one five levels of nitrogen. For determination of plant fertilizer recommendations official methods have been used. (Egner DL, Schachtschabel). The nutrient requirements of crops were evaluated by concentration of N, P, K, Mg in plant dry matter and nitrogen status of cereals by application NNI and SPAD test. Seven - year period of soil depleting from analyzed macronutrients led a decrease of available forms of phosphorus, potassium and magnesium but slightly in crop reduction. Only maize and rape - crops with high nutritional requirements responded on yield decreasing pursuant to long-term lacking of fertilization with P, Ka and Mg. There was finding the close correlation between K_2O exhausting and nitrogen rates. Soil indexes have been more sensitive that plant indexes.

Dry Matter Allocation And Nutrient Uptake Dynamic In Pepper Plant Irrigated With Regenerated Water By Different Nitrogen And Potassium Rate

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The use of high amounts of fertilizers in the greenhouse crops in southeastern of Spain leads to important environmental problems due to the leaching of elements. The knowledge on plant nutritional requirements is necessary to attain and develop a technical efficiency. The experience was development in a polyethylene greenhouse 'Aifos' pepper crop, on a sand-mulched sandy loam soil and fertigation with regenerated water. The experimental design was randomized blocks with four blocks. The treatments were N0K0, N_1K_1, $N_1K_{1.5}$, $N_{1.5}K_1$ and $N_{1.5}K_{1.5}$, being N_1K_1 the recommended rate (125 kg ha^{-2} of N and 193 kg ha^{-2} of K and average nutrient concentrations of 9.8 mM N (NO_{3-}+ NH_4+) and 5.4 mM K). Eight plants per treatment were collected at five growth stage (0, 56, 84, 113 and 155 days after the seedling transplant, DAT). Dry matter and content of nutrients (N, P, K, Ca and Mg) were monitored for different plant parts (pinch rest, fruit, leaf, and stem). The increase of NK doses produced a significant greater extraction of nutrient by plant from 113 to 155 DAT, corresponding to harvesting period. For all treatments, the period of largest extraction of nutrient by plant occurred from 113 to 155 DAT, which coincides with the highest accumulation of dry matter. This period includes extraction of 57 to 64% of the total accumulated for N according to treatment and 57 to 63% for K. Plant nutrient distribution showed that fruit is the largest sink of N, K and P. After the results obtained show that the harvest period is the most impact show in the production of dry matter and nutrient uptake by the plant. Under conditions of development experience, NK levels showed no effect on dry matter and nutrient uptake in the periods of vegetative growth, fruiting, ripening and early harvesting.

Keywords: sand-mulch, NK rates, growth, greenhouse, fertirrigation

Relationship Between Chlorophyll Content And Nitrogen Fertilizer In Wheat

Ilze Skudra, Anda Linina

For economical wheat production very important role is effective nitrogen fertilizer application. Insufficient or excessive nitrogen levels reduce profit and yield. Split topdressing of nitrogen fertilizer improves nitrogen efficiency. Plant leaves tests and chlorophyll meters can be used to help make the decision. The aim of experiments was to determine releationship between nitrogen and chlorophyll content in four winter wheat (Triticum aestivum L.) leaves duration of vegetative period. The experiment was carried out on brown lessive medium loam soil, in Latvia for two years. The plant material for nitrogen analyses and chlorophyll a/b ratio determine were collected at the Zadoks Growth Stage (ZGS) 32 (beginning of shooting into stalk), at the ZGS 51 (beginning of shooting into ears), at the ZGS 69 (end of flowering). The results of the experiment on nitrogen content in the plant leaves testify that nitrogen dynamic changes depend not only on the duration of the vegetation period, but also on the background of nitrogen fertilisers. Diverse winter wheat varieties under different fertilizer treatments essentially affected leaf N concentration. There were observed that nitrogen content closely correlates with chlorophyll content in leaves. Correlation depends from meteorological conditions and variety.

Organic Fertilization And Soil Tillage Effects On Nutrients And Heavy Metal Contents On A Soil Rich In Organic Matter

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Intensive soil fertilization with slurry/manure raise questions concerning nutrient surplus and heavy metal accumulation on the topsoil. We evaluate the effect of livestock slurry on nutrient and heavy metal accumulation at the surface layer of an acid, rich-in-organic matter soil in the Lugo province, Galicia, north-western of Spain from 2004 to 2006. Reduced tillage systems, no-tillage (NT) and minimum tillage (MT) were tested, which were factorially combined with four fertilizer treatments, i. e. mineral fertilizer as a control and livestock manure, at 30, 60 and 90 Mg ha^{-1} rates. Fertilization was applied two times per year. The crop rotation was maize-winter cereal.Soil samples were collected at the 0-5 cm three times during the field trial and at four depths, until 40 cm, at the end of the experiment. Organic matter content, N and P were analyzed following routine methods and Zn, Cu, Pb, Cr, Ni and Cd after Mehlich-3 extraction. Slurry significantly increased organic matter, N and P contents at the 0-5 cm depth. Both, mineral fertilizer and slurry application contributed to significantly increase Zn levels in the topsoil, but Zn content also increased with increasing slurry dose. Cu, Pb, Cd, Cr and Ni were not significantly affected by fertilizer treatment, but the showed different trends. At the 0-5 cm depth, P contents were significantly higher in the NT than in the MT treatment. There was no significant influence of tillage system on heavy metals levels. Stratification of the studied elements was assessed from its distribution in depth.

Improving Effectiveness Of Seedrow-placed N With Polymer-coated Urea (ESN) And Agrotaintm-treated Urea For Emergence, Yield And N Uptake Of Canola And Wheat

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Two 3-year (2007 to 2009) field experiments were conducted on canola *(Brassica napus L.)* and wheat *(Triticum turgidum L.)* at Melfort Research Farm, Saskatchewan, Canada, to determine the influence of different combinations of three N rates (40, 80 and 120 kg N ha^{-1}), three urea coatings [(non-coated/treated urea (urea), urea coated with polymer (called ESN), and urea treated with Dicyandiamide (DCD) and N-(n-butyl) thiophosphoric triamide (NBPT or Agrotain™) called SuperU in 2007, or with NBPT or Agrotain™ called AgrotainU in 2008 and 2009], and two methods of placement (side-banded N and seedrow-placed N, with knives), plus a zero-N control, on seedling emergence, seed and straw yield, protein concentration (PC) in seed and N uptake in seed and straw. Side-banded N had no detrimental effect on seedling emergence for both crops. Seedling emergence was decreased with increasing N rate of seedrow-placed N for urea and SuperU or AgrotainU, especially for canola where reduction was noticed even at 40 kg N ha^{-1} rate. Seedling emergence was lower with seedrow-placed N compared to side-banded N for urea and SuperU or AgrotainU, but usually little or no detrimental effect of seedrow-placed N on emergence for ESN. Seedling emergence, seed yield and N uptake were all generally greater with ESN than urea and SuperU or AgrotainU, when the fertilizers were seedrow-placed at high N rates. Protein concentration in seed increased with increasing N rate, but there was no effect of N source and N placement method on PC. The higher total N uptake in seed + straw but lower seed yield of canola with seed-placed N than side-banded N for urea and AgrotainU in 2008 suggested that N taken up by canola plants during the growing season from applied urea and AgrotainU did not translate into seed yield as effectively as from ESN.

Assessment Of Phosphorous Supply Rate To Common Vetch *(Vicia sativa L.)* By Using Ion Exchange Membranes

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In the present study we examined the suitability of resin membranes (PRS™ = Plant Root Simulator™) to estimate phosphorous (P) supply rate. For this purpose in a pot experiment common vetch *(Viciasativa L.)* was gown with no (P_0= 0 kg P /ha) and with P fertilization (P_1= 87 kg P /ha) and P supply rate was assessed using, a specially pre-treated anion exchange membrane encased in a plastic applicator buried in the soil for two-week intervals. Cumulative P supply rate was also calculated at the end of the growing season. Soil moisture content was kept at field capacity while soil temperature was recorded daily throughout the growing season. Results showed that resin membranes assessed considerably higher soil P supply rate in the treatments including P fertilization compared to control either in pots planted with common vetch or in bare soil. The assessed values ranged from 1.37 to 4.67 and from 1.33 to 7.00 μg ion/10 cm^2/2 week in the treatments including vetch with no P fertilization and in the treatment including bare soil respectively. In the treatments where P was applied in all samplings the values of P supply rates did not differ significantly. In the treatment including vetch *(roots competition)* and no P fertilization, supply rates of PO_4-P ranged from 1.37 to 4.67 μg ion/10 cm^2/ 2 week while in the treatment including bare soil from 1.33 to 7.00 μg ion/10 cm^2/ 2 week.

Cumulative supply rate of PO_4-P for the no crop - no fertilizer treatment was 43% higher compared to the same fertilizer treatment with crop present. Respectively, in fertilized bare soil cumulative supply rate of PO_4-P was higher by 32%. Yield related parameters were comparable to those referred in the literature and significantly correlated with the estimated P supply rate by resin membranes. The relationship of P supply rate and P uptake by plants was found to be the strongest which is considered a strong evidence that this method of availability estimation is effective and may be used for this purpose. PRS™ – probes under controlled soil conditions with respect to temperature and moisture may estimate P supply rates to vetch plants successfully. They seem to be capable to differentiate P supply in fertilized soils and give results significantly correlated to yield parameters of this crop. However, it is not recommended to use it for making fertilizer recommendations before they be tested under natural conditions especially in dry environments.

Preliminary Dris Norms For Leaf Nutrient Diagnosis Of Tempranillo Tinto Grapevine *(Vitis vinifera L.)* In The Rioja Apellation

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Plant nutritional diagnosis requires specific reference levels for each variety which faithfully reflect the nutritional status of the crop. A vine nutritional survey was undertaken in the Rioja appellation, in north-eastern Spain. The survey method was used to establish Preliminary norms for its use in the diagnosis and recommendation integrated system (DRIS) to be applied to the nutritional diagnosis of blade and petiole tissues of Vitis vinifera L., cv. Tempranillo tinto on Richter-110 rootstock. These DRIS norms were generated from data obtained throughout twelve years (2000-11) from 166 vineyards. The obtained database includes data from the different altitudes, soil types, cultural practices, and climatic conditions within the Rioja appellation. The training systems were Goblet, Guyot, and Double Cordon Royat espalier pruning. In general, vineyards had a dry farming irrigation regime and a homogeneous mechanical tilling. Nitrogen, P, K, Ca, and Mg were analyzed in blade and petiole dry tissues sampled at flowering and veraison. Vineyards with phytosanitary damages or troubles at flowering were ruled out. Ratios among nutrients were established for blade and petiole at flowering and veraison comparing high and low quality populations, both selected from production and must quality criteria, by mean of Student's t-test for the comparison of means.

Finally, DRIS norms for blade and petiole at flowering and veraison are proposed for Tempranillo tinto grapevine in the Rioja appellation.

Importance Of Nitrogen And Potassium Fertigation On Nutrient Uptake, Production And Quality Of Pepper Irrigated With Disinfected Urban Wastewater

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The use of disinfected urban wastewater (RW) for horticultural crops irrigation in Mediterranean area, could contribute to reduce the fertilizer input, water resources consume and also the contamination. The high nutrient content of water RW requires the determination of nutrient demand for development a technical efficiency. This work studies the influence of different levels of NK fertigation with purified wastewater obtained from the Almería city (Spain), on yield, fruit quality and macronutrient uptake in pepper. The experiment was conducted in a polyethylene greenhouse 'Aifos' pepper crop, on a sand-mulched sandy loam soil and trickle irrigation. The experimental design was randomized blocks with four blocks. There were six treatments: two non-fertilized controls (RW and ground water, GW) and four NK levels (N_1K_1, $N_1K_{1.5}$, $N_{1.5}K_1$ and $N_{1.5}K_{1.5}$). N_1K_1 is the recommended rate corresponding to 125 kg. ha^{-1} of N and 193 kg. ha^{-1} of K and average nutrient concentrations: 9.8 mM of N (NO_3-+ NH_4+) and 5.4 mM of K. The results show that production parameters were equal in non-fertilized RW irrigated plants than in those irrigated with GW water, resulting in low commercial production. The fertigation with N_1K_1 had given yield parameters similar to RW control. Significant increase of marketable yields, number and weigh of fruit was recorded with $N_{1.5}K_{1.5}$, $N_1K_{1.5}$ and $N_{1.5}K_1$ levels compared to RW control. The NK level had no effect on fruit quality attributes (pH, fruit firmness, total soluble solids and tritable acidity of juice). Nutrients uptake by plant followed the same order in all treatments K> N> Ca> Mg> P. The treatment $N_{1.5}K_{1.5}$ showed the highest uptake of N and P, being the K uptake similar to $N_1K_{1.5}$ and $N_{1.5}K_1$ treatments. Absorption efficiency of N and K was higher than 90% in $N_{1.5}K_{1.5}$, $N_1K_{1.5}$ and $N_{1.5}K_1$ treatments.

Keywords: sand-mulch, NK rates, pH, fruit firmness, total soluble solids and tritable acidity, N, P, K, Ca and Mg uptake.

The Effects Of Sprinkling Water Containing Arsenic Pollution On The Arsenic Content Of Some Parts Of Lettuce Grown In Hydro-culture

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The arsenic polluted drinking and sprinkling water might appear in the southern regions of Hungary. Arsenic levels sometimes exceed the 200 µg/l limit, allowed in underground water in Hungary.

In the teamwork of Soil and Plant Testing Laboratory and the Institute of Ornament and Vegetable Growing (Kecskemét College, Faculty of Horticulture) we studied some of the effects of sprinkling water containing arsenic pollution on different vegetables since 2006. In this work, lettuce in hydro-culture was used as an indicator plant.

The aim of our examination was to clear up the effect of arsenic on the development of the plant and the degree of arsenic accumulation. We used 25, 50, 75, 100, 200, 400 and 600 µg/l arsenic pollution doses. The two highest concentrations can be present only in extreme sprinkling conditions, and can be important in plant-physiological aspect. Our experiments were carried out in 2009 and repeated in 2010.

Arsenic concentrations in roots and leaves of lettuce were analyzed by ICP-AES spectrometer (HORIBA Jobin Yvon) after microwave digestion of dried homogenized plant parts.

The results in both years show that each applied arsenic doses caused detectable arsenic accumulation in leaves and roots as well. Increasing doses resulted increasing ordinary arsenic contents. With increasing arsenic doses the determined As levels in leave dry matter were the follows: 0,363; 0,448; 0,553; 1,07; 1,44 mg/kg. The observed accumulation of arsenic in plant parts is parallel with other author's opinion.

It is important to emphasize our result that the highest arsenic concentration, three times higher than the allowed limit value in sprinkling waters, didn't cause elevation of As level in lettuce to the allowed medical limit value (500 µg/kg in fresh leave). We can declare that the consumers cannot get dangerously polluted lettuce in the endangered Hungarian areas.

AgroAqua: A Computerized Decision Support System for Crop Irrigation Management

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Based on the most recent climate change predictions referring to the Carpathian basin, the probability of the occurrence of drought periods will increase in the future. Therefore, the examination of irrigation strategies adjusted to local environmental conditions is especially important today. The aim of our examinations was to develop a computerized irrigation decision support system (CIDSS) capable of modeling the water balance of maize and soil and climatic drought simulation that is frequent in Hungary. The modeling of temporary water deficit was performed by further developing the idea of Doorenbos et al. (1978). A new drought tolerance algorithm was applied to describe the plant adaptation in climatic drought. The essence of this method is the determination of critical soil water content, under the plant starts closing his stomata, taking soil water characteristics into consideration. This value is not permanent, depends on potential evapotranspiration (PET) and drought tolerance of plant. The results of the CIDSS can be accessed via the web. The most important information for users are provided by the daily values (water balance, PET, actual evaporation, transpiration of the soil and vegetation, LAI, critical water content, water deficit, etc.) calculated and modeled by the irrigation recommendation. Knowing these, one can decide about the necessity of irrigation, its starting date and the extent of irrigation. Even questions starting like "What would have happened if…" can be answered with this system. One can carry out analyses that are interesting from the aspect of practical production, whereas scientific propositions (e.g. climate change, sowing date, effect of edaphic factors on the water balance of the given crop, etc.) can also be examined.

Species Richness And Density Of Earthworms In Relation To Soil Factors In Olive Orchard Production Systems In Central Greece

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In this study selected soil properties and earthworms dynamic under olive groves were studied in Pteleos region (Magnesia Prefecture) of Central Greece. The research was conducted in conventional and organic olive groves. Earthworms were extracted during the rainy season (March) of 2009 by using formaldehyde solution. The soil sampling was conducted by using a cylindrical sampler in depth of 0-30 cm. General Linear Modelling was used to evaluate the impact of farming system (organic and conventional) on species richness and density of earthworms (individuals per m^2), and selected soil factors (pH, organic matter, soil moisture, sand, silt and clay). Correlation among species richness, abundance and soil factors was tested using Pearson correlation coefficients. Principal Components Analysis (PCA) was used to investigate the relationships between the density of earthworms and the soil factors. The highest values of species richness and density of earthworms, and soil organic matter and moisture were estimated in the organic olive groves and the lowest ones in the conventional olive groves ($p < 0.05$). Earthworms abundance correlated positively with soil moisture ($r=0.63$, $p<0.05$) and organic matter ($r=0.67$, $p<0.05$). Organic matter was correlated positively with soil humidity ($r=0.77$, $p<0.01$) and sand with clay ($r=-0.85$, $p<0.01$). The eigenvalues for PCA axes 1 and 2 was 0.39 and 0.33 respectively, thus capturing 72% of the total variance in the data. Three groups were identified. The first group consisted of variables: density of earthworms-soil humidity-organic matter. This was strongly positively correlated to PCA axis 1. The second and third group were highly positively and negatively correlated to PCA axes 2 respectively and comprised of variables: pH-silt-clay and sand-pH-silt-clay respectively. It can be concluded that species richness and density of earthworms in olive groves may be considered as sensitive indicators of management practices applied, as these variables were influenced by farming system.

Herbaceous Plant Diversity And Identification Of Indicator Species In Olive Groves In Central Greece

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Olive groves are characterized by rich flora and fauna and host a strong biological activity. Aim of the present study was based on diversity and the identification of specific herbaceous plants related to different management systems in olive grove ecosystems in two sites (Nies and Pteleos) of Magnesia Prefecture (Central Greece). Vegetation analysis was conducted in May 2007 by using 50x50cm sampling plot. The study examined: 1) five diversity indices, plant species richness (S), Margalef, Brilluin, McIntosh and Menhinick indexes, 2) the classification of the plant community diversity for specific types of management systems of olive groves (organic in Pteleos – organic in Nies – conventional non-sprayed in Pteleos – conventional non-sprayed in Nies – conventional sprayed in Pteleos – conventional sprayed in Nies) on the basis of the diagram of Renyi, 3) the similarity of the two management systems (organic and conventional) on the basis of plant species they host with Cluster Analysis and 4) species-system relationships using the Indicator Value Analysis (IndVal) in order to provide species-indices for specific types of management systems of olive groves. The results showed that the organic system in Pteleos favored the plant species richness (0.67), Margalef (6.06), Brilluin (2.92), McIntosh (0.83) and Menhinick indexes (2.62) more than the other types of management systems ($p<0.05$). Diagram of Renyi showed higher plant diversity in the organic system in Pteleos. According to Cluster Analysis the organic olive groves in Pteleos and the conventional non-sprayed ones in Pteleos showed a strong similarity as regards the plant diversity. The same was detected in the pairs: conventional non-sprayed in Nies– organic in Nies and conventional sprayed in Nies – conventional sprayed in Pteleos. IndVal analysis revealed two “characteristic” types of indices, Chenopodium album (81,2%) in the organic olive groves in Pteleos and Sinapis arvensis (76,6%) in the organic ones in Nies.

The Study On Effects Of Vetiver Grass And Green Manure Management On Properties Of Map Bon, Coarse-loamy Variant

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The study on effects of vetiver grass and green manure management on properties of Map Bon, coarse-loamy variant was conducted at Khao Hin Son Research Station, Chachoengsao, Thailand. The experiment was carried on split plot design in RCBD with 3 replications. There were 2 main plots: with and without vetiver grass; 4 sub plots: without green manure, Vigna sinensis, Canavalia ensiformis, Dolichos lablab. The experiment was carried on during March 2001 to April 2003. The results showed that treatments with vetiver grass caused the increment of organic matter, and also saturated hydraulic conductivity. On the other hand, bulk density of topsoil and subsoil and soil hardness were decreased, while total porosity and available water capacity were not affected. The use of green manure effects on soil hardness and saturated hydraulic conductivity that were better. The treatments with vetiver grass and green manure also gave an increment of available water capacity of soil.

The Effect Of Management Of Plant Residues And N Fertilization On Swards Productivity And On Total Carbon And Nitrogen Content In Soil

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The goal of our research was to study the impact of management of plant residues on the productivity of swards and on the total carbon (totC) and total nitrogen (totN) content in soil.

The experiment was carried out during 2004-2008. The factors of the experiment were as follows: (i) sward type: turfgrass sward *(Festuca rubra rubra* and *Poa pratensis)* and grasses-clover sward *(Phleum pratense, Lolium perenne* and *Trifolium repens)*; (ii)residues treatment: the plant residues were returned (RRT) to the plots or removed (RRM) after the mowing. The fertilizer treatments were as follows: $N_0P_0K_0$, $N_{80}P_{11}K_{48}$, $N_{160}P_{22}K_{96}$ and $N_{400}P_{56}K_{240}$ kg ha^{-1} for turfgrass sward and $N_0P_0K_0$ and $N_{80}P_{26}K_{50}$ kg ha^{-1} for grasses-clover sward. In 2007 the totN content of each cut of both swards were determined and according to the results the N amount removed by cutting or returned by residues were calculated. TotC and totN content in the soil (depth 0-5 cm) were measured at the start and in the end of the experiment.

Nitrogen was returned as plant residues to the grasses-clover sward in variant $N_0P_0K_0$ 190 kg ha^{-1} and $N_{80}P_{26}K_{50}$ 204 kg ha^{-1} by increasing the yield by 74% and 48%, respectively. Depending on the fertilization to the turfgrass sward the amount of nitrogen returned as residues was 31-236 kg ha^{-1}. The residues management had no significant ($P>0.05$) influence to the turfgrass sward productivity.

During 5 years the soil totC and totN content in grasses-clover sward in treatment $N_0P_0K_0$ with RRT increased by 26% and 38% and with RRM by 17% and 22%, respectively. In treatment $N_{80}P_{26}K_{50}$ with RRT the totC and totN increased by 28% and 47% and with RRM by 18% and 30%. Residues return to turfgarss sward increased soil totC content by 0.6-11.7% ($P<0.05$) depending on the applied N rate. TotN content was not influenced by residue management. In treatment RRM, the totC and totN content in soil decreased during experiment by 3.6% and 28%.

We concluded that the effect of returned plant residues depends on the species in the sward as well as on the intensity of managing the grassland.

Relation Between Soil N-NO_3^- And N Nutritional Status, Yield Components And Must Quality In Semiarid Vineyards From D.O. Ca. La Rioja

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Nitrogen is considered as the main nutrient that affects to vine vigour and must and wine quality. However, exits scarce information about the N-NO_3^- adequate levels for vineyard soils in semiarid climatic conditions. The aim of this study is realized a first evaluation of the relationship between the soil N-NO_3^- availability and vines N nutritional status, yield components, and must quality.

We selected 14 vineyards of Tempranillo *(Vitis vinifera L.)* cultivar grafted on Richter 110, with an age ranging from 10 to 25 years and situated in platforms of the Lower Najerilla area (D.O.Ca. Rioja). The plots are located in an area that covers approximately 1200 ha of vineyards; therefore there are not climatic variations between the plots selected. The vineyard soils have pH>8, with low to medium carbonate content, loamy texture and organic matter contents <2 %.

The vineyards soils were sampled at 0-15 and 15-45 cm soil depth at vineyards flowering stage (June 29, 2010) (when the vines nutrient demand is highest) and the N-NO_3^- extractable was determined. Leaves were sampled from the opposite position to the 2nd clusters at veraison stage (August 23, 2010). The N content was determined in blade and petiole tissues with a CNS analyzer elemental. One day before harvest, 1500 berries were collected in each vineyard and anthocyanins and polifenols content were determined in the must. The grape yield per vine and weight bunch were determined at harvest (October 2010) and the shoot weight per vine was determined at mid-November as vigour parameters.

The soil N-NO_3^- was correlated with the N content in blade and petiole tissues. Also the soil N-NO_3^- had correlations with yield parameters. Respect to the must, the soil N-NO_3^- was negatively correlated with anthocyanins and polifenols content, so high soil N-NO_3^- content could decrease the must quality.

Therefore, in our conditions, the determination of the soil N-NO_3^- available at vine flowering could be an indicator of vine N nutritional status, potential yield and must quality. These preliminary results indicate that further study is required to establish adequate soil N-NO_3^- levels to obtain must of higher quality.

Non-invasive Water Stress Assessment Methods In An Apple Orchard

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In large orchards up-to-date information is needed on water capacity and possible water stress of the fruit trees. The reason for this is that the physiological reactions against the changing water capacity appear much earlier than the water stress. These physiological changes cannot be observed visually in the early period of water stress. Combining airborne remote sensing technology and reflectance measurements of leaves can be the solution for detection of changing water content. With the use of remote sensing technology large amount of agro-ecologic information can be achieved on sites, such as orchards. The examined intensive apple orchard is situated on the North Eastern part in Hungary, was established on sandy soil and has microirrigation system. Hyperspectral image was taken by AISA DUAL airborne hyperspectral cam system which was installed and operated in cooperation the University of Debrecen, AMTC, Department of Water and Environmental Management with the Mechanization Institute of Agricultural Ministry in Gödöllő. The full spectra range of this system is 400-2450 nm, which was set to the maximum 498 spectral channels in 2.25 m^2 spatial resolution. Parallel to the flight campaign, leaf samples were also taken. Samples of different kind of apple species were analyzed by ALTA II and AvaSpec 2048 hand portable spectrometer. Based on the hyperspectral image, vegetation indices were also calculated to detect the effect of water stress. Normalized Difference Vegetation Index (NDVI) that is sensitive to changes in biomass and Water Band Index – WBI that is sensitive to changes in canopy water status, were calculated to measure the watersupply of the leaves. As a result, the reflectance of 886 and 937 nm can result more accurate WBI (WBI= $\partial_{886}/\partial_{937}$) in the case of pear trees. The water stressed samples shows higher reflectance in near infra red, and shows lower reflectance in red spectrum.

Evaluation Of Precision Nutrient Management And Plant Protection Technologies Under Large-Scale Farm Conditions

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The objectives of this study were to evaluate precision nutrient management and plant protection technologies and to analyze the profitability of related machinery investments. Examinations were done on the 7878 ha-sized area of a four farm consortium in Northern Hungary (47˚ 36-55' N, 19˚ 29-41' E) during the 2010 growing season. Conventional, precision and precision block-based technological methods were evaluated. In the "block-based" technology, crop production districts were developed, i.e. a significant part of the production area was concentrated into contiguous blocks. In the return on investment analyses, the returns reduced by machinery subsidization (25%) and the economically "clean" (no subsidization) returns were considered. In each technological version the internal rate of return (IRR) and net present value (NPV) were calculated. The consorium's ammonium nitrate use was identical in all three technological versions (1941 t). 547.3 tons of phosphorus fertilizer was used in the conventional method, compared to the precision (8.3% lower) and the precision block-based methods (18.6% lower). 506.7 tons of potassium fertilizer was applied in the conventional technological method. 13.8% and 34.8% could be saved in the precision and the precision block-based methods, respectively. IRR showed great variability between each technological version. In cases solely based on nutrient management, IRR changed between 32-66%. Considering plant protection and nutrient management, IRR is more favorable (48-79%). The utilization of a self-propelled machine capable of plant protection activities can be increased by performing service outside the consortium's fields, increasing IRR (54-89%). If every partner farm acquires suspended fertilizer spreaders for precision farming, IRR will slightly decrease (45-76%) due to higher investment costs (around 20 million HUF), but the investment remains substantiated. No extra pesticides were applied by the satellite-controlled self-propelled sprayers. The lack of double doses had a favorable effect on crops, saving the consortium 18 million HUF annually.

Spatial Variability Of Available Phosphorus On A Field With Excessive Application Of Organic Manure

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In agricultural areas with high cattle manure and/or slurry inputs over a period of several years, soil phosphorus (P) can accumulate to levels in excess of crop needs. Phosphorus overloading in soil has the potential to enrich surface runoff causing eutrophication of water bodies. Different extraction methods are used to measure available P in soils. Differences in soil P concentrations measured by various techniques may have implications for agronomic and environmental testing. The aims of this study were: 1) to compare available P concentrations measured by various methods and 2) to assess variability of P accumulated on a field with a long-term history of manure application. Forty soil samples were taken at the 0-30 cm depth on a 6 ha field with mean slope of 2%, located in Castro de Ribeira de Lea, Lugo province, Spain. Available soil P was extracted by anion-exchange resin (AER) and by Mehlich 3 (M3). Moreover, two determination methods of P contents extracted by Mehlich 3, namely molybdic acid colorimetric standard procedure (M3-COL) and inductively coupled plasma emission spectroscopy or ICP-MS (M3-ICP) were compared. Mean values for AER-P, M3-COL-P, M3-ICP-P in mg kg^{-1}, were 160.0, 397.6, and 498.2, respectively. Therefore a marked accumulation of P in the top soil occurred following long-term manure application. Geostatistical analysis showed spatial dependence of the studied P forms. Kriging maps showed the highest P accumulations at the lowest border of the field, suggesting sheet erosion and tillage erosion as main factors responsible for P spatial distribution. Most overload patches within the field exhibited three to four times more P than those with the lowest accumulation. This study also confirms that Mehlich 3 soil tests are a rapid and effective means for evaluating the phosphorus status of agricultural soils with excess levels and high inputs of organic fertilizers.

Geostatistical Analysis Of Macronutrients In Cultivated Areas At Two Different Scales

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Soil spatial variability is a naturally occurring and/or management induced feature, that is important for site-specific management practices such as variable rate fertilization. The aim of this study was to assess the spatial variability of macronutrients (N, P, K, Ca and Mg) at two different landscape scales in a Coruña province (Northwest of Spain). Soil samples were taken from the topsoil of a 2.1-ha hillslope and a 24.9-ha agricultural catchment. Soil N, P and K availability were routinely determined, whereas Ca and Mg were determined after Mehlich-3 extraction. The statistical variability was significant with coefficients of variation ranging from 0.28 to 0.37 within the field at the hillslope and from 0.38 to 0.77 within the agricultural catchment. At the 2.1 ha field scale, N, P nd K showed spatial dependence, whereas Ca and Mg didn't show it. At 24.9 small catchment scale all five elements analyzed showed spatial dependence, so that spherical semivariograms were adjusted to the experimental data. The strength of the spatial variability was assessed by the nugget effect and the ranges of spatial dependence. When spatial dependence was evidenced, kriging maps were constructed. Kriging maps and maps made by conventional techniques were used to analyze similarities in the spatial distribution of the study nutrients.

Modeling The Contribution Of Salts To The Electrical Conductivity Of Fertigation Solutions Used In Greenhouses In The Mediterranean Area

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Soluble salts composition and concentration in the root-zone medium solution have an influence on plant growth, both by creating osmotic imbalance and via specific physiological toxicity of ions. Osmotic potential can be related with electrical conductivity (EC) by models. The knowledge of the contribution of ions to the electrical EC by means of theoretical estimations or regression models could link both effects of salts on nutrient uptake by plants and the development of new strategies of managing fertility and irrigation of horticultural crops.

Solutions were obtained in nine commercial greenhouses, planting tomato plants var. Daniela along the crop. There were 273 samples, including irrigation water (IW), nutrient solutions (NS) and soil solutions (SS) obtained by suction cup. Solutions showed a wide range of EC and nutrient concentrations.

Attending to nutrient concentration (NO_3^-, K^+, Ca^{2+}, Mg^{2+}, Na^+, Cl^- and SO_4^{2-}) the individual contribution of EC (Ω^{-1} cm^2 mol^{-1}) was estimated by means of the theoretical Debye-Hückel-Onsager equation, obtaining 71.4 NO_3^-, 73.5 K^+, 118.9 Ca^{2+}, 106.1 Mg^{2+}, 50.1 Na^+, 76.3 Cl^- and 160 SO_4^{2-} coefficients. On the other hand, the contribution coefficient for each parameter of EC (dS m^{-1}) estimated by means of multilinear regression, present the following coefficients: 0.033 NO_3^-, 0.072 K^+, 0.124 Ca^{2+}, 0.068 Mg^{2+}, 0.038 Na^+, 0.046 Cl^- and 0.026 SO_4^{2-}. The determination coefficient of the model was 0.93. To validate both models, 194 samples of solutions (IW, NS and SS) obtained from different horticultural crops cultivated in greenhouses under fertigation in the Mediterranean area were used. Determination coefficients of validated simple regressions were 0.83 and 0.89 to theoretical and multilinear models.

Characterization Of Porous Cups And Modified Suction Probes For The Extraction Of The Soil Solution

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The techniques for the determination of nutrient parameters in the soil solution are a tool to evaluate crops nutritional state. A non destructive method that allows the continuous sampling of the soil solution, without dilution during the cultivation cycle. Nevertheless, getting a limited sample size can be difficult and contaminations can be generated. In this work, the porous cup was characterized from the chemical point of view, identifying the crystalline structures that compose it, via X-ray fluorescence, dispersion of the wave longitudes, using certified reference patterns to guarantee the traceability of the measures. From the physical point of view, total porosity and pores distribution in function of its size was been determined by means of the mercury intrusion technique. On the other hand, suction cups design was studied, in order to obtain a robust easy-handling sampler, with an affordable price and able to obtain an adequate size of samples for its use in commercial horticultural greenhouses. A description of suction cups design was made. This method of measuring water and salt content in the root environment has potential applications in the pot plants production under greenhouse. The measurements obtained with this method permit to obtain new information about plants nutrient uptake, as well as the development of new fertility and irrigation strategies for horticultural crops.

P Levels Influence In Plasma Membrane H+-ATPase Activity And K, Ca And Mg Assimilation In Green Bean *(phaseolus Vulgaris L.)* v. Strike

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Few studies have been fulfilled about the change in nutrient input in response to the availability of other nutrients, particularly cations (K, Mg and Ca). In this way, the objective of the present work was to determine the effect of P deficiency, adequate or excessive level on Plasma membrane H^+-ATPase activity and K, Ca and Mg assimilation in green bean plants (*Phaseolus vulgaris L.* cv. Strike). Different P levels were applied to the nutrient solution: P_1: 0.5 mM; P_2: 1 mM; P_3: 2 mM; P_4: 4 mM; P_5: 6 mM and P_6: 8 mM. Cations analyzed forms were Total and Soluble K^+, Ca^{2+} and Mg^{2+} and plasma membrane H+-ATPase (EC 3.6.1.35) activity, basal or induced with K (K^+-ATPase), Ca (Ca^{2+}-ATPase) and Mg (Mg^{2+}-ATPase). P treatments caused a significant and progressive increase on Total and Soluble, K^+, Ca^{2+} and Mg^{2+}, with P_6 registering the highest concentrations and P_1 the lowest. Also P doses were the source of differences with statistical significance on plasma membrane H+-ATPase activity, both basal-ATPase and that induced with K, Ca and Mg. Therefore, P was the key factor to enhance plasma membrane H+-ATPase activity and improve K, Ca and Mg uptake. Cations always were present in the nutritive solution, however, only P rise made possible augment it uptake. The knowledge about the change in nutrient input in response to the availability of other nutrients could enhance minimise fertiliser input and develop better practices. Our results show that P is an important element on plasma membrane H^+-ATPase activity and K, Mg and Ca uptake.

Proline, Beatine And Choline Answer To Different P Levels In Green Bean *(phaseolus Vulgaris L.)* cv. Strike

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Av. Fuente Nueva s/n, 18071, Granada, Spain.Drought affects many physiological and biochemical processes and thus reduces plant growth, however P improves tolerance to drought stress in many plants. Frequently defoliated plants with adequate P supply show minimum wilting symptoms and maintain higher leaf water potential and continue grow in very dry soil, extracting considerably more water than the P-deficient plants. On the other hand, proline, betaine and choline are osmoprotectant molecules present in many organisms, including bacteria, fungi, and plants, in response to low water stress, salinity or availability of essential nutrients. In this way, the objective of the present work was to determine the effect of P deficiency, adequate or high level on proline, betaine and choline osmoprotectantors in green bean plants (Phaseolus vulgaris L. cv. Strike). Different P levels were applied to the nutrient solution: P_1: 0.5 mM; P_2: 1 mM; P_3: 2 mM; P_4: 4 mM; P_5: 6 mM and P_6: 8 mM, being P_3 considered the optimal. Treatment P_3 caused the most important and significant increase on proline, betaine and choline, with P_6 and P_1, insufficient and toxic levels, respectively, registering the lowest osmoprotectant concentrations. The optimal P level (P_3) enhanced the osmoprotectant stage, which could act elevating the water potential (yw), raising the possibility of best water content as regards the lowest and toxic P treatments. Subsequently, an adequate P level enhances presence of osmoprotectors in green bean plants and, consequently, tolerance to drought stress.

Effects Of Treated And Untreated Wastewater From Municipal Solid Waste (MSW) Leachates On The Nutritional State Of Viola spp.: Sodium, Potassium, Calcium And Magnesium

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The scarcity of water for different uses (civil, industrial, agricultural, recreational,…) creates a need for using non-conventional water resources, such as wastewater and saline water. Their use could contribute to reduce water resources consumption in aridic areas and biosphere contamination. Wastewaters are normally unbalanced solutions rich in Na^+, Ca^{2+}, Mg^{2+}, SO_4^{2-} and Cl^-, which can cause damages to crops; but if they are treated, its quality can be improved. The aim of this trial was to study the effects of pure, diluted, sand-filter depurated and fitodepurated wastewater from Municipal Solid Waste (MSW) leachates, compared with groundwater on the nutritional state of the ornamental plant Viola spp. Five treatments were tested: R9.0 (wastewater, EC 9.0 dS m^{-1}), R4.5 (wastewater, EC 4.5 dS m^{-1}), D4.5 (depurated water, EC 4.5 dS m^{-1}), FD4.5 (fitodepurated water, EC 4.5 dS m^{-1}), P (groundwater, EC 1.5 dS m^{-1}). The experimental design was unifactorial (Irrigation Water) with four replications per treatment. Nutrient (Na, K, Ca and Mg) concentrations and partitioning per organ (flowers, stems and roots) were studied. Similar total Na extractions were found in the 4.5 dS m^{-1} treatments, being higher than in the 9.0 dS m^{-1} treatment, all of the surpassing the control. Nevertheless, there were Na partitioning per organ differences depending on Na concentration. Total K extraction in FD4.5 was the highest, related with their greater root concentration. Potassium was mainly located in stems, followed by flowers. Calcium and Mg showed a similar behaviour. The highest Ca extraction was noticed in control plants, which is related with Ca accumulation in roots.

Comparative Study Of Organic And Integrated Apple Growing: Differences In Fruit Nutrition

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Nowadays, the most frequently applied environmentally-benign fruit management system is the integrated system. Moreover, recent interest to avoid use of agrochemicals in fruit growing to safeguard environmental and human health has stimulated an increasing interest in organic fruit production all over the world. Integrated and organic apple management systems differ from one another in some, mostly in chemical requirements, that address environmental issues. Despite of this, there are only a few comparative publications about the nutritional aspects of organic versus integrated fruit growing systems. It is especially true in East and Central Europe.

Therefore, the aim of this study is to compare nutritional aspects of an integrated and organic apple orchard to point out the environmental impacts of natural and artificial fertilizations.

In our three-year study, the macro- and micronutrient status of soil, leaves and fruits was compared in an integrated and an organic apple management system to determine the differences in nutrient uptake and utilization to improve and harmonize nutrient supply in environmentally-benign apple orchards.

Groundcover As A Useful Tool For The Purpose Of Efficient Resource Management And Sustainable Production

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The importance of groundcover has increased in the last few decades owing to their application in organic farming and it is regarded as excellent water saving and nutrient supply method simultaneously.

Despite of this fact the influences of cover materials in the row area ofpeach trees on soil temperature, fertility and plant nutrition arelargely unknown. A field trial has been conducted on five years old 'Sweet Lady' and 'Royal Glory'peach on a sandy loam soil at Siófok, West Hungary, since 2009.

Four in-rowground management systems (pine bark mulch, cow manure,black fabric cover, and no cover with herbicide applications)were evaluated in a plot design with three replicates.

Differences in soil-available N, P, K, Ca, Mg, B, Zn, Mn, Cu,pH, and organic matter were negligible among the four groundcover treatments.

Moreover soil temperature and macro and micro nutrient contents of leaves were significantly affected by the treatments.

Results pointed out that the used surfacing applications affected the nutrient uptake and give a chance to correct the unfavourable ratio of nutrients.

Effects of site oriented, quality improved foliar spraying on nutrient uptake and quality of pear in West Hungary

To achieve adequate fruit nutrition, proper fertilization management is required. In this, we should focus on plant demand, environmental aspects and right timing simultaneously for the purpose of efficient resource management, sustainable production and the environment.

In our trial mono boron and combinated treatments were made to study their effects on plant uptake and fruit quality.

The experiment was conducted during 2008–2010 in West Hungary on three pear cultivars grafted on quince rootstock.

Pear trees planted on a loamy brown forest soil. Trees were foliar-fertilized with B and Foliar B sprays were performed: (1) in the spring, at the stage of white bud, (2) beginning of flowering, and (3) in the intensive shoot growing period. Combinated treatment was used: (1) beginning of flowering, (2) at fruit appearance and (3) before ripening.

In each of spring spray treatments, B was applied at a rate of 0.15 kg ha^{-1}. Trees untreated served as a control.

The results showed that B fertilization had effect on B concentration in leaf tissues, mostly after ripening. Mean fruit weight was slightly increased by B fertilization. Fruit sensitivity to cracking was not influenced by B fertilization. Nevertheless, from our data it can be conclude that the sensitivity of fruit to cracking is improved when the fruit is riper, the fruit density and fruit weight are higher. The soluble solids varied between 15.0 and 15.9% according to the treatments. Our results for the monosaccharides investigated varied between 7.6 and 8.0 as glucose and fructose as well.

It is concluded that under conditions of this experiment, B fertilization can be recommended in sweet cherry culture to improve fruit quality and their appearance.

Nowadays, beside minimalised chemical management have to produce maximal yield and quality. This is possible if

Készítmények	*Kijuttatási időpont*	*Dózis*
B-készítmény	*Bimbós állapot* *Virágzás* *Hajtásnövekedés*	*2-4 l/ha*
BIOPLASMA	*Lemosó permetezés* *Virágzáskor* *Termés megjelenéskor* *Termés beérés előtt* *(100x-os hígításban)*	*8-10 l/ha*

Short-term Effects Of Cover Crop On Soil N-NO_3^- Availability, Grape N Nutritional Status, Yield And Must Quality Of A Calcareous Vineyard From D.O.Ca. Rioja

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The utilization of cover crops in vineyards soils, can affect to the vine vigour and to must and wine quality due to the competition by soil nutrients and water. The aim of this work was studied in a vineyard with a cover crop of barley, the short-term effects (in the first year after the cover crop sow) in N-NO_3^- soil availability along the grape cycle vegetative, the N uptake by grapes and cover crop, the grape yield and the must quality.

The experiment was set up in 2009, in a vineyard of Tempranillo *(Vitis vinifera L.)*. The soil was classified as Haploxerepts. Two types of soil management were studied: (1) conventional tillage (CT); (2) barley (Hordeum vulgare L.) cover crop (B). The soil no received any N fertilization since 2000. Soil samples were collected in March (budbreak), June (bloom), July (setting) and August (verasion) of 2009, and N-NO_3^- extractable was determined. At bloom stage and at verasion, blade and petiole tissues were sampled, and the N content was determined. At bloom the grapevine N uptake was estimated in the aerial parts (leaves, shoots and bunches) and also N uptake by cover crop was determined in 0.5 m2 area. In the must were determined anthocyanins and polifenols content. The grape yield and weight of bunch were determined at harvest (Octuber) and the vigour parameter (shoot weight) was determined at mid-November.

The soil N-NO_3^- availability decreased with cover crop from June to August. The soil N-NO_3^- reduction was similar to the N uptake by the cover crop. N contents in petiole and blade decreased with the cover crop at verasion. Respect to the must quality the cover crop increased the anthocyanins content.

Therefore, the reduction of soil N-NO_3^- availability along vegetative cycle of grape caused a reduction in the N status nutritional and the grape vigour, and this could affect to the must quality in the first vintage after cover crop sow.

Soil Nitrate And Ammonium Status Of An Irrigated Land In The Mediterranean Area Of Turkey.

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Nitrogen (N) is one of the major plant nutrients and is extensively used in plant production, mainly as inorganic fertilizers. Fertilizer N is either taken up by the plant or lost by leaching, volatilization and immobilization. While soil nitrate and ammonium (mineral N) are readily available for plant uptake, residual N in the profile is important in fertilizer recommendations. Management of N is particularly crucial in irrigated areas. Part of the research in the Akarsu Irrigation District in southern Turkey in 2010 aimed to determine mineral N level in the effective rooting depth. Representative soil samples were collected from 107 points of the research area, and analyzed for nitrate and ammonium. Nitrate concentrations were the highest in the surface horizons (57.8 mg kg^{-1}) and decreased by the depth. However, ammonium concentrations were far much lower than the nitrate concentrations (2.1 mg kg^{-1}) throughout the profile. Nitrate concentration in the surface varied regardless of the soil type, but influenced by the fertilizer practices. Therefore, systematic monitoring and determination of mineral N analysis within any irrigation system is imperative from the economical and environmental standpoints.

The Effects Of Organic Farming On Winter Plant Composition, Cover And Diversity In Olive Grove Ecosystems In Central Greece

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Plant cover, species composition and diversity are commonly used indicators in many terrestrial ecosystems which are used to monitor biodiversity and ecosystem functioning. Aim of the present study was the assessment of the effects of organic farming on plant composition, cover and diversity in olive grove ecosystems during the winter. The study was conducted in conventional and organic olive groves, situated in Nies region of Magnesia Prefecture (Central Greece). The inventory of herbaceous plants was carried out with the Line point method during the period of January-February of 2009. General Linear Modelling was used to evaluate the impact of farming system (organic and conventional) on plant cover and diversity (species richness, Shannon, Simpson and Pielou indexes). Correlation among various variables such as cover, species richness, Shannon, Simpson and Pielou indexes was tested using Pearson correlation coefficients. Principal Component Analysis (PCA) was used to investigate and describe the relationships between species richness and the above variables. The highest values of cover, species richness, Shannon, Simpson indexes were estimated for the organic olive groves and the lowest ones for the conventional olive groves ($p < 0.05$). Plant species richness correlated positively with cover ($r=0.25$, $p<0.01$), Shannon ($r=0.85$, $p<0.01$) and Simpson indexes ($r=0.80$, $p<0.01$) while correlated negatively with Pielou index ($r=-0.19$, $p<0.05$). Finally, cover was correlated with the Shannon ($r=0.40$, $p<0.01$) and Simpson indexes ($r=0.32$, $p<0.01$). The eigenvalues for PCA axes 1 and 2 was 0.65 and 0.20 respectively, thus capturing 85% of total variance in the data. Axis 1 was mainly connected with the species richness, Shannon and Simpson indexes. Axis 2 was mainly related with Pielou index. It can be concluded that organic agriculture is a production management system that enhances herbaceous plant cover and diversity (species richness, Shannon and Simpson indexes) in olive grove ecosystems during the winter.

Deficiency Of Fe In Vineyards Of Cemovsko Polje (Montenegro)

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Generally, the occurrence of Fe deficiency symptoms (depressed growth and leaf chlorosis) in plants is known to be related to the contents in calcium carbonate and available Fe forms of soil. The results of investigation of the calcareous soils of Cemovsko polje under vineyards as well as petioles (taken at full flowering) are shown in this paper. Beside basic soil parameters such as pH, total carbonates, active carbonates and humus (organic matter), the content of exchangeable Ca (NH4CH3COO-Ca) and available Fe (DTPA-Fe) were determined in upper (0-30 cm) and underlying soil layer (30-60 cm). As expected the both of soil layer had very high concentration of exchangeable Ca (ranged 1131 – 1698 with average 1484±192 mg/100g for upper, and 1520 – 1820 with average 1665±84 mg/100g for underlying layer). From the aspect of available Fe (ranged 7.3 – 22.3 with average 10.7±4.8 mg/kg for upper, and 3.1 – 7.8 with average 5.6±1.5 mg/kg for underlying layer) ones were relatively poorly supplied according to Ankerman.

The concentration of Ca in petiole was in optimal range 1.67 – 2.70% (2.16±0.33) level, but of Fe was in range of low concentrations 19.32 – 25.80 mg/kg (22.86±2.40), corresponding to soil results. The obtained results are spatially represented by means of GIS technology.

Potassium Nutrition Optimization For Enhanced Quality And Bulb Yield Of Irrigated Onion In Western India

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Onion *(Allium cepa L.)* is one of the most important vegetable crops grown in India and India is the second largest producer in the world. Recently, onion assumed much importance as its retail prices sky rocketed (nearly 2 US$/kg) in India due to production shortages hit by unseasonal rains in Maharashtra state. Maharashtra is the largest producer in the country with an out put of 1.2-1.5 million t production from about 0.1 million ha area.

Field experiments were conducted continuously for three years (2007-08, 2008-09 and 2009-10) on Rabi season irrigated onion at research station of MPKV, Rahuri in Maharashtra for working out potassium nutrition management strategies. The field soil was a Vertic Inceptisol clay having pH 8.5, Organic C (0.62%), low in available N and medium in available P and K (260 kg K_2O ha^{-1}). There were 8 different treatments of K used as MOP with N and P applied uniformly. The yield data indicated that the application of potassium significantly increased bulb yield over absolute control as well as fertilizer recommendation as per soil testing. The highest bulb yield of onion was obtained with applied K @ 100 kg ha-1(52.06 t ha-1) and it was at par with 125 kg K_2O ha^{-1}. This increase in bulb yield was contributed mainly through improvement in polar and equatorial diameter and neck thickness of bulbs with K application. Even the onion quality parameters like TSS and sugar content were also improved significantly with 100 kg K_2O ha^{-1} application. N,P,K and S content and uptake in onion bulbs and leaves at harvest were also significantly increased with K application. The soil available potassium showed significant correlation with the quality parameters of onion viz., total soluble solids, reducing sugar and non-reducing sugar content. Application of 100 kg K_2O ha^{-1} was found to be highly economical with a B:C ratio of 3.0 and a net return of Rs. 2,16,000/ha (~4,500 US$). It was concluded that 100 kg K_2O ha^{-1} application is the most optimum dose of K fertilizer for getting the optimum and most economical onion yields under irrigated conditions.

Kinetics Of Soil Potassium Sorption-desorption

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Though the potassium (K) status of the soil often relies only on its exchangeable K content, release from non-exchangeable K always contributes to plant nutrition. This process, as well as the opposite one, K fixation, are diffusion-controlled and thus depend on time. This study was conducted (i) to assess the influence of time (2 hours, 1 and 8 days) on soil K dynamics and (ii) to compare the soil ability for K release and fixation (β) estimated from sorption-desorption experiments with the soil fixation capacity estimated at two different K doses. The studied soil samples came from a long-term fertilizer experiment established in 1976 by the Swiss Research Station Agroscope-ACW in a Gleyic Cambisol. They correspond to two extreme K-treatments (i) no K applied, P applied in quantities equivalent to the off-take by the crops and (ii) K and P applied in quantities equivalent to the off-take with an additional supply of 166 kg K ha^{-1} y^{-1} and 26.2 kg P ha^{-1} y^{-1}.

The equilibrium K concentration decreased and, conversely, the soil K buffer power (i.e. the soil capacity to resist a change in soil solution K concentration following a removal of K from, or an input of K into, the soil–plant system), β, and fixation capacity increased when the soil K content decreased. Time significantly influenced only the sorption-desorption curve and the release–fixation of the poorest soil sample. In this case, K buffer power, β, and fixation capacity increased with time. Fixation capacity and β were linearly related ($r=0.92$, $P<0.01$), but fixation capacity systematically overestimated β. A first-order model enabled to describe the time-series of exchangeable K during fixation capacity experiments. However, a parabolic diffusion model gave a better description.

Monitoring Change In Carbon And Soil Fertility In Agricultural Soils In Tasmania, Australia

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Twenty-four sites in northern Tasmania on Oxisols formed on Tertiary basalt were sampled in 1997, 2005 and 2010. During this time the sites were farmed in a variety of ways. Until 1997, 9 sites had been under pasture and 9 had been continuously cropped to a mix of vegetable, cereal and other cash crops for at least the previous 10 years. Six sites had a pre-1997 history of mixed cropping and pasture. By 2010 only 3 sites remained under continuous pasture, the other 6 having had at least one crop since 1997. Four sites which were previously continuously cropped had some pasture between 1997 and 2010, while an equal number of previously mixed cropping and pasture sites were cropped for at least 11 of those 13 years. Average organic carbon (OC) concentrations across all sites and both sample depths (0-150 mm and 150-300 mm) decreased from 4.0% in 1997 to 3.5% in 2005 and 3.3% in 2010 ($P<0.001$). Average OC was higher at 0-150 mm (4.1%) than at 150-300 mm (3.1%) ($P<0.001$), but there was no interaction between year and depth. Soil pH in water showed the opposite trend to OC, increasing with time ($P<0.001$) from 6.0 in 1997 to 6.2 in 2010. This reflects the consistent use of calcite and dolomite lime in Tasmanian farming because the natural pH of these soils is less than 5.5. Exchangeable calcium and magnesium were also higher ($P<0.02$) in 2010 compared with 1997. Bicarbonate-extractable phosphorus (P) averaged across both depths increased ($P<0.001$) steadily from 77 mg/kg in 1997 to 95 mg/kg in 2005 to 126 mg/kg in 2010. The average topsoil concentration (130 mg/kg) was significantly ($P<0.001$) higher than the concentration at 150-300 mm (69 mg/kg). There was no year by depth interaction. At the 5 sites that remained under cropping throughout the study, average 2010 OC in the topsoil was 3.2%, a decrease of 0.5% since 1997; pH was unchanged at 6.4; while bicarbonate-extractable P increased by an average of 73 mg/kg, to 211 mg/kg. For the 3 sites that remained in pasture the corresponding topsoil changes were 0.3% less OC to an average of 4.8%; pH 0.4 units higher at 6.0; and 41 mg/kg more extractable P to an average of 99 mg/kg. At the 6 sites converted from continuous pasture to mixed cropping and pasture the average 2010 topsoil OC was 4.5%, a loss of 1.3%; pH increased by 0.5 units to 6.1; and extractable P increased by 35 mg/kg to 97 mg/kg. Similar trends were evident in the subsoils. There was a highly significant ($R^2=0.82$) exponential relationship between topsoil OC in 2010 and the number of years each site had been cropped during the 38 years, 1972-2010, for which reliable records were available ($OC = 4.933e^{-0.018years}$). This contrasts with a corresponding linear relationship between the 1997 topsoil OC data and cropping frequency to 1997, and suggests the rate of decline in OC decreases as cropping history increases beyond 30 years. Further monitoring is needed to see whether OC equilibrium will establish. These results indicate that Tasmanian farmers continue to increase the pH and P fertility of their soils, regardless of land use, and that the increasing economic pressure to crop these soils comes at the expense of soil carbon.

Susbtitution Of Peat In Horticultural Seedlings: Suitability Of Digestate-derived Compost From Cattle Manure And Silage Of Maize Co-digestion

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The increasing demand for growing media for greenhouse horticultural uses, the increasing new uses of substrates and the scarcity and high price of the traditional sources like peat in Mediterranean countries drive the research into the use of new materials as soil-less substrates. In the last decades, intensification in the animal production and an increase in the size of the animal production units have been produced in the developed countries. This fact implies a great generation of animal manures that can constitute an environmental risk, if not managed properly. Nowadays, anaerobic digestion is one of the methods that are gaining interest to manage the wastes generated by livestock production. This treatment transforms organic wastes into two products: a source of renewable energy (biogas) and a potential fertiliser, the digested material (digestate). With the separation of the digestate into a liquid and a solid fraction, the latter can be composted in order to obtain valuable and marketable end-products for agriculture.

This work was conducted to study the feasibility of using a compost elaborated with the solid fraction of a digestate obtained after the co-digestion of cattle manure and maize-oat silage (SDM) as component in the formulation of growing media in horticultural seedlings, replacing part of the commercial peat. Three different vegetable species were selected in relation to their salt-sensitivity: the less sensitive being tomato (Lycopersicon esculentum Mill.), the moderately salt-sensitive being melon (Cucumis melo L.) and the most salt-sensitive being pepper (Capsicum annum L.). The proportions of compost substitution in the mixtures elaborated with peat were 25%, 50% and 75% v/v compost. Pure peat was tested as control treatment (P). The treatments (growing media) of this experiment were established in a fully-randomised design with three replicates per treatment (one tray per replication). Germination was performed in an air-conditioned chamber at 27 ± 1 °C and 90-95% relative humidity during different periods of time depending on the species. The percentage of germination was determined by counting the number of germinated seeds after 48 h from seeding. Then, the trays were placed on rails in an unheated polyethylene-covered greenhouse with natural daylight conditions until commercial transplanting size. Physical, physico-chemical and chemical analyses of the different mixtures were carried out. Parameters such as plant height, fresh and dry weight of seedling, root morphology, seed germination, macronutrient (N, P, K, Ca, Mg), and micronutrient (Fe, Cu, Mn, Zn) contents were also determined. In general, the addition of SDM to the growing media produced an increase in the pH values, salt contents, macro and micronutrient concentrations and in the air capacity, as well as a decrease in the water holding capacity and in the organic matter contents in comparison to control treatment.

Keywords: digestate, compost growing media, seedling production, tomato, melon, pepper

Green Bean Under Organic And Integral Crop System In Mediterranean Area Greenhouse: I. Effects On Production And Fruit Quality

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The experiment was conducted in 2 polyethylene greenhouses located in Almeria (Spain) with 'Mantra' green bean crop (Phaseolus vulgaris ssp. volubilis), on a sand-mulched loam soil with trickle irrigation. The experimental design was a two-factorial with four replication per treatment. The treatments consisted of two Organic Matter levels (0.58% and 1.65%) and two System Crops (Organic and Integral). Fertigation levels were: 6.8 gm^{-2} N, 1.4 gm^{-2} P and 10.7 gm^{-2} K following Regulation (CEE) Nº 2092/91 (Organic Crop System) and Specific Regulation of Green Beans Integrated Crop Production (BOJA) Nº 10/01. Treatments established were: E_1: Organic Crop System (OCS) under Low Organic Matter Soil (LOMS). I_1: Integrated Crop System (ICS) under LOMS. E_2: OCS under High Organic Matter Soil (HOMS). I_2: ICS under HOMS.

Five samplings were made during the harvest from 56, 63, 73, 79 to 84 Days Afters Sowing (DAS). Each sampling includes 8 samples per treatment. Green bean fruit production was evaluated through the crop by the following parameters: Marketable production (category I and II), total marketable production, unmarketable fruit and total production. Quality was evaluated by the following parameters: Dry matter content of fruit (g) (DMC), total soluble solids (ºBrix) (TSS), pH and tritable acidity (mmolc citric acid L^{-1} of juice). E1 shows lower total marketable production, unmarketable fruit and total production, than other treatments. E_2, I_1 and I_2 show similar production parameters. Nevertheless, the distribution between categories was similar for all treatments. Dry matter content of fruit (DMC) has been similar in all treatments.

Along harvest period, average total soluble solids were similar for each treatment, with values around 5.3. ICS shows significant higher values in the second, fourth and fifth sampling. Average pH value, along harvest period was similar, with values around 5.9. Nevertheless, acidity increased during the harvest period. Non remarkable pH tendencies were found between treatments. Acidity does not show significant differences between treatments, except in the fifth sampling, where OCS were higher than ICS treatments.

Key words: Fertigation, marketable fruit, dry matter content of fruit, total soluble solids, pH and tritable acidity.

Green Bean Under Organic And Integral Crop System In Mediterranean Area Greenhouse: II. Effects On Dry Matter And Nutrient Extraction Distribution Pattern

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The experiment was conducted in 2 polyethylene greenhouses located in Almería (Spain) with 'Mantra' green bean crop (Phaseolus vulgaris ssp. volubilis), on a sand-mulched loam soil with trickle irrigation. The experimental design was a two-factorial with four replications per treatment. The treatments applied were two Organic Matter levels (0.58% and 1.65%) and two System Crops (Organic and Integral). Fertigation levels were: 6.8 gm^{-2} N, 1.4 gm^{-2} P and 10.7 gm^{-2} K following Regulation (CEE) Nº 2092/91 (Organic Crop System) and Specific Regulation of Green Beans Integrated Crop Production (BOJA) Nº 10/01. Treatments established were: E_1: Organic Crop System (OCS) under Low Organic Matter Soil (LOMS). I_1: Integrated Crop System (ICS) under LOMS. E_2: OCS under High Organic Matter Soil (HOMS). I_2: ICS under HOMS.

Plant extraction was analysed in different plant fractions (fruits, leaves and stems). The nutrients analysed were Total N, P, K, Ca and Mg. Nutrient extraction was significantly higher under ICS (11.1 gm-2 N, 3.6 gm-2 P, 13.0 gm-2 K, 9.6 gm-2 Ca and 3.0 gm^{-2} Mg) than OCS (7.8 gm^{-2} N, 2.2 gm^{-2} P, 8.3 gm^{-2} K, 7.1 gm^{-2} Ca and 2.2 gm^{-2} Mg).

Extracted nutrient levels do not show significant differences between Organic Matter treatments. Nutrient Use Efficiency was similar under all treatments. Also the N, P, Ca and Mg patterns between organs were unaffected by treatments. In general, N fruits and leaves extractions were similar (around 40%), and higher than N stems. P leaves extraction was higher than in stems and fruits. Ca and Mg extractions were the highest in leaves (70% and 50%), intermediate in stems (20% and 30%) and the lowest in fruits (10% and 20%). K distribution pattern between organs were affected by treatments. K fruit extraction under ICS was significantly higher (39%) than OCS (35%), while K stem extraction under OCS was higher (40%). Similar distribution pattern were found related to Organic Matter Level. K fruit extraction under HOMS was higher, while K stems extraction was higher under LOM.

Response Of Spring Oilseed Rape Seed Yield And Quality To Nitrogen And Sulphur Fertilization

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Field experiments were carried out to determine the effect of N and S fertilization on seed yield (SY) of spring oilseed rape (Brassica napus L. var. napus),crude protein (CP), fat (CF), glucosinolates (GSL) concentration in seed, and quality components yields (CPY, CFY, GSLY) per ha. This study determined also the N and S fertilizer use efficiency (NFUE, SUFE) to produce SY, CFY, CPY and GSLY per unit of respective fertilizer under different conditions of growing years. A spring rape double low variety Mascot was grown at three rates of N fertilizer (0, 90 and 150 kg N ha^{-1}) and at rates of S fertilizer (0, 20 and 40 kg S ha^{-1}) on an Endocalcari – Epihypogleyic Cambisol of Middle Lithuanian Lowland from 2003 to 2005.

Year (Y) and N rate positively (at $P \leq 0.01$) interacted with all tested parameters (except CF and GSL). CF concentration significantly depends on N rate (at $P \leq 0.01$) and does not depend on experimental year and S rate. Conversely, the effect of the harvest year and S rate was significant at $P \leq 0.01$ on GSL concentration. The highest seed yield (2975 kg ha^{-1} on average) was harvested in the moderately cool and wet year with the longest growing and seed ripening period in comparison with the rest of the study years. The maximum NFUE-s for SY and seed yield quality components were obtained in 2004 and 2005 harvest years with N fertilizer rate 90 kg N ha^{-1} when combined with 20 kg S ha^{-1} S rate. NFUE for SY was 8.22 and 10.11 kg seed per kg N fertilizer used, respectively. Contribution of one kg of S fertilizerwas very variable: from negative to twice higher values than those related to NFUE.

Molecular Analysis Of Four Allium Species Based On Alliinase And 18s rRNA Genes

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Plants of the genus Allium gain their characteristic taste and odor from a group of volatile compounds containing several sulfur atoms. The key enzymatic reaction preceding the generation of the smells is the production of a chemically reactive sulfenic acid which then spontaneously reacts to form all these interesting substances. Alliinase is the enzyme involved, with full name S-alk(en)yl-L-cysteine sulfoxide lyase. So far, the nucleotide sequences of the alliinase genes from most of the Allium species are known, with two exceptions: Allium obliquum (twisted-leaf garlic) and Allium senescens ssp. montanum (German garlic). Here we present a comprehensive investigation of the genes encoding alliinase in four Allium species, including the two mentioned above. Furthermore, a phylogenetic study of the four species was accomplished, based on the nucleotide sequences of the 18S rRNA genes.

The study material used here was represented by plants belonging to four Allium species, sampled from various locations in Transylvania, Romania. Total RNA isolated from leaves and bulbs was used for cDNA synthesis, with specific commercial kits. Alliinase-specific primers were designed using information from the GenBank database. With these primers, fragments of the alliinase genes were amplified by PCR, and further sequenced. The 18S rRNA genes were also amplified and sequenced using specific primers. Next, the alliinase fragments were multiple aligned with other related fragments from GenBank, in order to identify similarities/differences between them. Furthermore, the 18S rRNA fragments were used in a phylogenetic study, with specific bioinformatics tools.

The comparison involving the alliinase genes from Allium obliquum, Allium senescens ssp. montanum and other related nucleotide sequences from public databases allowed us to identify both similarities and certain differences between these fragments. Several differences in the amino acid sequence of these enzymes are emphasized, suggesting some particularities when compared with other molecules of this family of enzymes.

This work was supported by CNCSIS –UEFISCSU, project number PNII – IDEI code 2272/2008.

The Effect Of Nitrogen Fertilizer And Cattle Manure Application On Growth Characteristics Of Potato

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In order to study the effects of Nitrogen fertilizer and Cattle manure application on growth characteristics of potato (plant height and shoot dry matter), a field experiment was conducted in April 2008 in Iran, with factorial arrangement based on randomized complete block (RCB) design with three replications. Treatments were consisted of N fertilizer in three levels (50, 100 and 150 Kg h^{-1}) and Cattle manure in four levels (5, 10, 15 and 20 ton h^{-1}). From the 45th until the 105th day after emergence (DAE), plant height and shoot dry matter were measured every 15 days. Results showed that, in all times, plant height and shoot dry matter were increased significantly by increasing N fertilizer. Also, in all times shoot dry matter showed significant differences in relation to manure. Results nearly showed that, shoot dry matter was increased by increasing manure. In the same way, plant heights were risen significantly by increasing manure at the 45th, 60th, 75th, 90th DAE. Furthermore, the interaction between manure and N fertilizer on shoot dry maters were significant at 90th and 105th DAE. Maximum shoot dry matter at the 90th DAE (87.118 g) was obtained by using manure at 20 Ton ha^{-1} + N fertilizer at 150 kg ha^{-1}, while, at the 105th DAE, it (106.998 g) was obtained by using manure at 15 Ton ha^{-1} + N fertilizer at 150 kg ha^{-1}. Also, the interaction between manure and N fertilizer on plant heights were significant at 60th, 75th, 90th and 105th DAE. Maximum plant heights at the 60th and 90th DAE were obtained by using manure at 20 Ton ha^{-1} + N fertilizer at 150 kg ha^{1}, whereas, at 75th and 105th DAE the maximum plant heights were obtained by using manure at 15 Ton ha^{-1} + N fertilizer at 150 kg ha^{-1}.

Utilization Of Biosolids In Production Of Bioenergy Crops. I: Impact On Canola Biomass, Soil Properties And Nutrient Availability

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Amendment of agricultural soils with municipal sewage sludge (SS) provides a valuable source of plant nutrients and organic matter. Utilization of SS in cultivation of biofuels producing crops such as canola may be a sound management of biosolids. The aim of this study was to compare the influence of biosolids application on biomass production of canola and soil properties including available phosphorus (P) and potassium (K). For this purpose a green house pot experiments was established in a Typic Xerfluvent from central Greece amended with various rates of sewage sludge [0 Mg ha^{-1}(C), 20 Mg ha^{-1} (SS1), 50 Mg ha^{-1} (SS2) and 100 Mg ha^{-1} (SS3) cultivated with canola. After two months the plants were removed from the pots and the soil was cultivated again with the same plant for two more months. Bioavailability of P and K was estimated by using the conventional methods (Olsen for P and ammonium acetate for K) as well as plant root simulator (PRS™) probes method. PRS™ probes were inserted in soil at the planting time and removed seven weeks in both planting periods. Bioavailability of P and K was estimated by using the conventional Olsen for P and ammonium acetate for K methods respectively as well as PRS™ method. Soil and plant samples were selected after two months planting period and analyzed for the basic soil properties and tissue P and K content respectively.

Results showed that, application of SS significantly increased canola biomass only in SS1 compared to control in the first planting period. However in the second period canola biomass increased in SS2 and SS3 compared to control and SS1. Soil pH decreased significantly from 7.87 in C to 6.9 in SS3 while soil electric conductivity increased significantly from 0.19 in C to 1.27 dSm^{-1} in SS3. Soil organic matter, nitrate nitrogen and hot water extractable boron were increased significantly with increasing biosolid application rate. Olsen-P increased from 16.3 to 95.7 mg kg^{-1}. PRS™ probes extractable P increased from 217.7 in control to 746.7 microgram /10 cm2/7 weeks in SS3 and similar increasing trend showed plant tissues P concentration P. A strong relationship was recorded between P extracted by PRS™ and Olsen-P while plant tissue P concentration was strongly correlated with both available P estimating procedures (R^2 0.95 for Olsen-P and 0.99 for PRS™) indicating that probes method estimates better plant P availability than Olsen method. Application of SS did not influence significantly available K but decreased PRS™ probes extracted K compared to control especially in the second planting period. Probes K decreased significantly in the second period compared to the first one. No relationships were recorded between K extracted by PRS™, ammonium acetate-K and plant tissues K concentration.

Macronutrient Content Of Viola x Wittrockiana Over Different Substrates

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Production of ornamental plants became more ad more important in the northwest of the Iberian Peninsula in the last decade. The objective of this study was to assess macroelement (N. P, K, Ca and Mg) content of Viola witrockiana grown on different commercial substrates in Galicia and Castilla and Leon (Spain) and North of Portugal and Castilla. A set of 480 plants, sampled from 13 producers, was analyzed. Harvest was performed from January to May 2009. A wide questionnaire allowed to determine the technological level of the nurseries (production infrastructure, irrigation systems, climatic control, technical capacity of workers and mainly used materials). Several morphological analyses were carried out: diameter of flowers and plants, root formation and general observations and these semiquantitative data were emplotef for assessing quality level of each producer. Chemical analyses of total N. P, K, Ca and Mg were performed on roots, shoots and flowers of the collected plants. Water extractable initial and final substrates were also analyzed following the standard UNE- EN 13652 European protocol. For all the studied macronutrients the highest concentrations were recorded on shoots, whereas lowest concentrations were on roots or on flowers, depending on the element. An statistical study was performed to assess the variability of nutrient concentration on plant and substrate.

The Connection Between Soil, Geomorfology, Hydrology And Vegetation In The Dorozsma-Majsaian Sandlands

Áron József Deák, Edina Nagy

The Dorozsma-Majsaian Sandlands is situated in the southeastern part of the sand-ridge of Danube-Tisza Interfluve, where the connection between soils, geomorfology, hydrology and vegetation was studied. The matrix of the landscape is formed by *yardangs* and *sand-sheets* covered with *humous sandy soils*, where mainly *sand steppe-grasslands* exist. The near-to-surface meadow dolomite and meadow limestone layers improving the water balance of sandy soils help the closure of these grasslands. The *deflation hollows* are filled with silt, silty sand, meadow limestone or dolomite. Their northwest parts covered by gleysols are dominated by moor-type vegetation, whereas their southeast parts by saline habitats and soils. This local habitat-pattern is named as *fen-head – saline foot pattern* which includes soil-gradients too. The vegetation of *meadow soils* covered *fen-heads* consists of *Molinia fens, sedgefields, Deschampsia meadows, fen tall-stalk vegetation, Salix cinerea wet shrubs,* while *tussock meadows, peat-producing reeds, willow-, alder-, ash-fen-woodlands* appear on *peaty meadow soils*. These habitats are followed in the same depressions by *salt meadows* of on *solonetzic meadow soils* (calcisols), then by *Puccinellia* and *annual salt pioneer vegetation* on *solonchak soils* going southeastwards. The pH- and salt-content increases, the humus-content decreases from the Molinia fens to the most saline habitats in the surface soil-layers. Approaching the saline feet the ratio of the coarse-, medium- and small-grain sand decreases too, whereas the proportion of silt and clay increases. These vegetation and soil-patterns show a landscape-level gradient too. Towards the eastern edge of the microregion the proportion of saline habitats and soils increases in the depressions, while the proportion of fen-heads and meadow soils increases towards the western part of the microregion. These gradients can be explained by the interaction between local and landscape-level (from northwest to southeast heading) groundwater-flows appearing on surface and the evapotranspiration, but the near-to-surface aquicludes have also an important role.

Trace Elements Content In Soil And Plants Under The Copper Surplus

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Soil pollution with copper (Cu) in Moldova is caused mostly by the horticulture plantations in the agricultural structure. The plantations are repeatedly treated with different pesticides along with Cu- and Zn-containing products during the whole agricultural year. Accumulation of Cu in the superficial soil strata leads to a dynamic disbalance in the soil-plant-atmosphere system, to multiple deviations in the nutritive system, aggravation of population's health. The aim of the research was to study the influence of Cu surplus on the growth and mineral status in different plants that present an interest for monitoring soil conditions and development of efficient techniques and procedures of their improvement, prevention and avoidance of pollutant penetration in the human's alimentary chain. The experimental work was conducted in the vegetative complex of the Institute of Genetics and Plant Physiology ASM. Trace element content has been determined in soil and in the plants of vine, clover, alfalfa, mixture of cereal grass crops, growing under Cu excess. It has been shown that Cu surplus in soil contributes to decrease in the content of the accessible forms of some elements in soil (Fe and Zn), to Cu excessive accumulation in the roots of annual plants and grape, which inhibits plant growth and some metabolic processes, retards the transport of trace elements to the above-ground organs of plants. Cu impedes Fe transport to above-ground organs, decreases Fe content in grape shoots and leaves. Such deviations contributes to appearance of visual chlorosis symptoms and decrease of vine resistance to low temperature in winter. Utilization of Cu-accumulating plants (alfalfa, cereal grass crops) after uprooting of perennial plantation may serve as one of the promising elements in the technology of Cu phytoextraction from soil.

Recycling Of Agro-food Wastes Into Vineyards By Composting: Agronomic Validation In Field Conditions

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One of the most important fruit crops of the world is grape, with an annual production of more than 60 million metric tons, Europe representing 44% of this worldwide production. The European Union (EU-27) has an important presence in the worldwide market of wine, with approximately 49.1% of the vine growing area of the world and 60 % of the wine production. Mediterranean vineyards are subject to elevated risks of soil erosion primarily due to the complex pattern of spatial and seasonal variability of the Mediterranean climate, which is characterised by wide and unpredictable rainfall fluctuations from year to year and with frequent high-intensity rainfall events. The addition of organic wastes or composts to soils can constitute a feasible option to increase soil organic matter levels and thus, to improve soil properties. The incorporation of organic materials into soils results in an important supply of plant nutrients, such as N and P, as well as other elements, which can reduce the amount of mineral fertilisers employed. The intensification of the agro-food industry has led to a significant increase of the organic wastes derived from food production and transformation. Wastes from the winery-distillery sector, fruit juice production, livestock, etc. could be directly recycled using composting or after its anaerobic digestion using the solid fraction of the digestate.

The objective of this work was to study the agronomic effects produced by the application of agro-food composts in vineyards *(Vitis vinifera L.)* in field conditions. To carry out this objective, yield, nutrient contents and quality of fruit, as well as different physico-chemical, chemical and biological properties of the soil at the beginning and end of campaign were studied. Three agro-food composts were used. The composts C1 and C2 were elaborated mainly using exhausted grape marc, and wastes from orange juice production (C1) and cattle manure (C2). Compost C3 was elaborated using the solid fraction of a digestate obtained after the anaerobic digestion of cattle slurry mixed with vine shoot pruning (C3). Three treatments were used as control treatments, one based on sheep manure, traditionally used in the studied area; a commercial pelletized sheep-derived compost; and a control treatment without any organic amendment. The winery-distillery derived composts C1 and C2 produced similar results to the commercial compost. In relation to the grape quality, few differences among treatments were observed.

Agricultural And Industrial Valorisation Of Arundo donax L.

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The giant reed (Arundo donax L.) is a perennial “gramineae”plant, which belongs to Poaceae Family. This plant is native to Asia and it has been widely planted and naturalised in the mild temperate, subtropical and tropical regions of both hemispheres, especially in the Mediterranean. It forms dense stands and can grow to 8-9 m, with hollow stems 2 to 3 cm and growth rate of 0.3-0.7 m/week during several months in ideal conditions. This vegetative species can grow in different habitats such as, disturbed sites, sand dunes, wetlands and riparian.

Arundo donax has been cultivated for thousands of years to make musical instruments, fishing rods, support for climbing plants, etc. Nowadays, the majority of these uses have been abandoned, this plant being considered as an “unwanted organism” in many countries. Therefore, the aim of this work was to carry out the characterization of some agricultural and industrial parameters in different parts of the giant reed, in order to evaluate their capacity for agricultural use and for the manufacturing of insulating boardemployed in the building sector.

In this experiment, three different particle sizes (> 0.25, 1-2 and 2-4 mm) of the stem and rhizome of Arundo donaxwere evaluated on total nitrogen; total organic carbon; bulk density; total pore space; air capacity; easily available water; water buffering capacity; total water holding capacity, shrinkage, macro and microelements. Moreover, thermal conductivity, bending strength, internal bonding strength and screw holding strength were determined in boards manufactured with three different particle sizes (> 0.25, 1-2 and 2-4 mm) of the stem of Arundo donax.

Respect to agricultural value of this vegetative species, the macro and microelement content was low, C/N ratios of the different particle sizes of the stem were higher than those of the same particle sizes of the rhizome (C/N> 75 and C/N> 20, respectively) and the physical properties were not inside the interval of values for an ideal substrate, except in the case of the shrinkage and easily available water in all materials studied, water buffering capacity in the stem with particle size of 2-4 mm and total water holding capacity in the stem with particle size of 1-2 mm. On the other hand, the physical and mechanical properties of the fibreboards from giant reed were comparable to those of the wood-based composites, as well as the thermal conductivity of these boards was similar to that of other environmentally-friendly fibreboards.

Keywords: Arundo donax L., Growing media, Manufacturing of fibreboard

Evaluation Of The Different Uses Of Washingtonia Robusta Pruning Waste

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Washingtonia robusta (Mexican Fan Palm or Mexican Washingtonia) belongs to Arecaceae Family. This palm tree is native to northwestern Mexico (western Sonora and Baja California Sur). It can grow to 30 m tall and its leaves have a petiole up to 1 m long, and a palmate fan of leaflets to 2 m long. It is grown as an ornamental tree and requires full sun for its growth and permeable soils with high nutrient content. However, this plant can also grow in poor soil and tolerates low temperatures (hardy to – 5ºC) and water deficit. Washingtonia robusta is often pruned every 3 to 4 months, which produces a higher growth rate. This agricultural practice generates a great volume of pruning waste, what is generally disposed of in landfills.

Therefore, the aim of this work was to carry out the characterization of some agricultural and industrial parameters in the Washingtonia robusta pruning waste, in order to evaluate their capacity for agricultural use and for the manufacturing of insulating board employed in the building sector.

In this experiment, three different particle sizes (> 0.25, 1-2 and 2-4 mm) of the Washingtonia robusta leaf petiole were evaluated on total nitrogen; total organic carbon; bulk density; total pore space; air capacity; easily available water; water buffering capacity; total water holding capacity, shrinkage, macro and microelements. Moreover, thermal conductivity, bending strength, internal bonding strength and screw holding strength were determined in boards manufactured with three different particle sizes (> 0.25, 1-2 and 2-4 mm) of this pruning waste.

Respect to agricultural value, the Washingtonia robusta pruning waste had low macro and microelement contents, high C/N ratio values (C/N ratio > 120) and the majority of the studied physical properties were not inside the interval of values for an ideal substrate. On the other hand, the physical and mechanical properties of the fibreboards from the Washingtonia robusta pruning waste were appropriate according to the EN standards for fibreboards. Also, these Washingtonia robusta fibreboards presented properties similar to those of the wood-based composites as well as a higher insulating capacity.

Keywords: Washingtonia robusta pruning waste, Growing media, Manufacturing of fibreboard

Utilization Of Biosolids In Production Of Bioenergy Crops. Ii: Impact On Bioavailability And Heavy Metals Uptake By Canola

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Amendment of agricultural soils with municipal sewage sludge (SS) besides its beneficial effect on soil fertility may create a risk of heavy metals pollution. Utilization of SS in cultivation of oil and bio fuels producing crops such as canola was found to be useful for safe management of biosolids. The aim of this study was to examine the influence of SS application rate on bioavailability and phytoextraction of heavy metals (HM) by canola (Brasica Napus). For this purpose a green house pot experiment was established in a Typic Xerfluvent from central Greece amended with various rates of sewage sludge [0 Mg ha^{-1} (C), 20 Mg ha^{-1} (SS1), 50 Mg ha^{-1} (SS2) and 100 Mg ha^{-1} (SS3) cultivated with canola. After two month planting period soil and plant samples were selected.Soil samples were analyzed for total and DTPA extractable Fe, Mn, Cu, Zn, Ni, Pb and Cd and the same elements in canola plant tissue.

The results showed that SS application rate significantly increased total concentration of all the heavy metals studied compared to control except for Ni but kept at lower than the critical concentrations in soils. DTPA extractable metals values were also increased significantly with the biosolids application rate especially in the case of SS3, but no significant differences were recorded between control and SS1 for Fe, Mn, Pb, Ni and Cd.

Plant tissue metal concentrations for all metals except for Fe increased significantly compared to control with SS rate especially in SS3 treatment, while no significant differences were reported between control and SS1 in the case of Cu, Zn and Pb. Plant tissues concentrations of all the studied metals were kept below the concentrations considered toxic.

Bio-concentration ratios (BCR) of canola (plant tissues concentration/DTPA-extractable metals) differed widely between the metals. Copper, Pb and Cd –BCR values did not differ significantly between the treatments applied. Iron and Zn-BCR decreased significantly from 29.6 and 19.2 in control to 14.5 and 6.6 in SS3 treatment respectively. Manganese and Ni-BCR increased significantly with SS rate. Data from this result supports the result that there is no risk from utilization of biosolids in production of non eaten plants like canola. 20 Mg ha^{-1} dry SS is the recommended rate.

Keywords: biosolids; heavy metals phytoextraction; canola; sewage sludge

How Can The Efficacy Of Synthetic Chelates To Correct Iron Chlorosis In Fruit Trees Be Evaluated?

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Synthetic chelates such as EDDHA have shown their efficacy to correct iron chlorosis on crops grown on calcareous soils. Several parameters, such as Fe(III) concentration, SPAD index, yield and size fruit, etc., are bibliographically described to be used to evaluate their efficacy however the relationships among themselves and the method variability are little known.

The aim of this study was to examine both coefficients of variation and coefficients of correlation when several nutritional status indexes are compared.

Three iron chelates plus additional treatment without any Fe(III) exogenous source were applied on commercial nectarine grove during two consecutive agronomic productive cycles. Data from 13 nutritional status indexes measured throughout field trial were compared (related to Fe(III) concentration in leaves and flowers, SPAD index, Fe/Mn ratio and yield and size fruit). Coefficients of variation (as dimensionless number) were statistically compared taking into account that all data from every nutritional status index were entered as repetition regardless Fe(III) source, sampling time, agronomic cycle. Additionally Pearson's correlation coefficient was analyzed by comparing mean values from all nutritional status indexes two a two.

Statistical analyses, ANOVA and Pearson´s correlation coefficient, were performed with SPSS statistical software.

Coefficients of variation of all nutritional status indexes were lower than 30% that is associated with increased experimental variability. Coefficient of variation from fruit caliber and SPAD index showed the lowest values. No differences between coefficients of variation from Fe(III) concentration in leaves and Fe in flowers are found. Positive, larges and significant correlations are found between Fe/Mn ratio, Fe content in leaves and flowers and SPAD index and among all yield parameters. Since a lot of methods are used for nutritional status assessment, statistical methodology is necessary to know the dispersion and relationship themselves.

Dry Matter Production Of Brachiaria Decumbens Grown On Degraded Soil Treated With Different Green Manures, Gypsum And Limestone

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The choice of species that accelerate the soil chemical and physical balance is an alternative to accelerate the recovery degraded soil. The Brachiaria decumbens pasture is used in virtually all of Brazil, because it adapts to various soil types and endure low levels of some nutrients from the soil. The use of pasture in the recovery of degraded areas has been used to promote coverage of the soil and provide nutrients to the soil. The objective this work was study the production of dry matter of B. decumbens tilled an Oxisol in process of recovery for 11 years using green manures, limestone and gypsum. The experimental design was a completely randomized with nine treatments and four repetitions. The treatments were: one control (tilled soil without culture) until 1999 after the implanted the B. decumbens; Stizolobium aterrium until 1999 after the implanted the B. decumbens; Cajanus cajan until 1994 and then substituted by Canavalia ensiformis and since 1999 was implanted B. decumbens; lime+S. aterrimum until 1999 after the implanted the B. decumbens; lime+C. cajan until 1994 and then substituted by C. ensiformis and since 1999 was implanted B. decumbens; lime+gypsum+S. aterrimum until 1999 after the implanted the B. decumbens; lime+gypsum+C. cajan until 1994 and then substituted by C. ensiformis and since 1999 was implanted B. decumbens. Were evaluated the dry mass of B. decumbens and the growth rate of tree species. The results were analyzed effectuating the analysis of variance, Scott-Knott to 5% of probability to compare averages. The production of B. decumbens obtained similar results when comparing the treatments.The production of dry matter of B. decumbens was influenced by the variation of water availability and photoperiod.

Effect Of Molybdenum And Selenium Treatment On Element Contents Of Wheat- And Pea-sprouts, As Well As Their Microbiological Analysese

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Although sprout consumption in Hungary is not as widespread as it is in the Far-East, due to its outstandingly high nutritional value, it would be recommendable to consume sprouts.

In our experiments the seed of a monocotyledon (Triticum aestivum) and a dicotyledon (Pisum sativum) was chosen as the two types of plants highly differ in nutrient intake.

The experiments can be divided into two major groups:

1. treatment of sprouts with molybdenum and selenium
2. microbiological analysis of sprouts

1. During the treatment of sprouts with molybdenum and selenium (selenite, selenate), the water used for the germination and soaking of the seeds have been supplied with increasing molybdenum, selenite and selenate concentrations.

   Element content of sprouts was analysed continuously during germination to examine changing of the concentrations.

2. During the microbiological analysis of the sprouts plate count, total coliform content, total yeast and mould content were determined before soaking of the seeds, after 12 hours of soaking, and on each day of germination.

As a result we can draw the conclusion that it is advisable to treat sprouts with molybdenum and selenium, since sprouts are able to intake these elements in high concentration and thus they can contribute to cover our daily molybdenum and selenium needs to a great extent. On the other hand, it has become apparent that microbiological load of the seeds is already high and it increases during germination. Therefore, decreasing microbiological infection of seeds is extremely important and initial microbiological load should also be controlled.

Investigation Of Molybdenum Treatment In A Long-term Field Experiment Influencing On The Element Uptake Of Food Crops

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Molybdenum as a constituent of several important enzymes is an essential microelement. It can be found in all kind of food naturally at low level. However, environmental pollution, from natural or anthropogenic sources, can lead to high level of the metal in plants.

Our study is based on the long-term field experiments of Nagyhörcsök (Hungary), where different levels of soil contamination conditions are simulated. Plant samples were collected from the experiment station to study the behaviour of elements: total concentration, available concentration, leaching, transformation, uptake by and transport within the plants, accumulation in different organs, phytotoxicity and effects on the quantity and quality of the crop.

In this work we present the effect of molybdenum treatment on the uptake of other elements. Molybdenum is proved to be in an antagonist relationship with copper and sulphur, while molybdenum-phosphorus is a synergist interaction. However, in most of the plants we studied increasing molybdenum-treatment enhanced cadmium-uptake. We have found the most significant cadmium-accumulation in the case of pea, spinach and red beet.

The most presumable reason for this phenomenon has been thought to be alteration of pH due to the treatment of soil by molybdenum, although results of pH determination haven't confirmed it.

There can be another likely explanation that assumes formation of dimeric adducts in the plasma of ICP-MS spectrometer. This possible reason is also studied in present work.

Improving Farming Practices In Region Of The Municipality Gazi, Crete, Greece.

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A soil survey and soil mapping project was carried out in the municipality of Gazi located in the Central part of Crete Island, Greece. Olive tree is the dominant cultivation in the mostly hilly area, which is subjected to different degree of land degradation. In addition erosion has caused loss of surface soil resulting in fertility decline. According to USDA classification, the examined soils at higher altitudes were classified as Entisols xerorthents and those at lower altitudes as Entisols xerofluvents. Using a geographical information system (GIS) all spatial data from the soil survey were organized in order to facilitate its storage, management and analysis. Based on topography maps, geological maps and aerial photographs, other derivative data layers were calculated. Following this, the sampling points were determined using GIS. This information, together with all results pertaining to the sample, was entered into the graphical database, which was specially designed to store all the relevant data for each point. Data layers describing the spatial distribution of key parameters such as soil texture, pH, $CaCO_3$ and nutrient status were produced on the basis of this sampling points data and interpolation using geostatistical methods. Soil classification and the evaluation of soil suitability for various activities were greatly facilitated, while the visualization of all the data collected and of the derived results in the form of various thematic maps demonstrate the ability of GIS not only to act as an important administrative tool but also to provide valuable support for farmers in improving farming practices. Proper fertilization according to the plant requirements and split applications are suggested while drip fertigation is recommended in crops where a irrigation system has been established. Protection measures for sloping land include terraces, supported by dry stonewalls taking into account the economical feasibility.

Effect Of Zn And N On Growth, Yield And Nutrient Composition Of Spinach

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A greenhouse pot experiment was made to determine the interactive effect of Zn and N application on growth, yield and chemical composition in spinach. A two by four complete factorial experiment with two rates of zinc (150 and 500 mg Zn/kg dry soil) and four rates of nitrogen (0.10, 0.20, 0.30, and 0.40 g N/kg dry soil) were arranged in a randomized complete block design with four replications. An additional treatment without fertilization was used as a baseline control. Phosphorus and K were applied at the rate of 0.20 g/kg dry soil in all treatment combinations. Main soil properties, concentrations of total and available Zn and N in soil, plant growth, yield and nutrient status in shoots and roots was determined. The results showed that highest yields achieved with treatment combination (150 g Zn/kg, 0.20 g N/kg) and further increase of N rates significantly reduced yields. Application of N in plants treated with 500 mg Zn/kg had no substantial effect on yields. In comparison to control, addition of N increased the availability of Zn while total Zn concentration was enhanced by the lower rate of N (0.10 g/kg). Nitrogen application had a significant negative effect on Zn accumulation in leaves and particularly in roots. Nitrates in both soil and plants were increased by N rates while total N was increased in plants only. The interactive effects of N and Zn on soil plant system are discussed.

The Effect Of Pisum Sativum Cultivation As Cover Crop On Nitrogen Use Efficiency And Uptake By A Subsequent Maize And Sunflower Crops In A Sandy Soil In Central Greece

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The long term positive effects of cropping systems involving rotation with cover crops on soil properties and the environment are well recognized.

The present work concerns a 3-year field experiment focusing on two cropping systems including two energy crops such as maize and sunflower cultivated (May - September) on an infertile sandy soil, and Pisum sativum cultivated as cover crop after the harvest of the energy crop (e.g. November - April). The cover crop was either harvested or incorporated in the soil before the sowing of the energy crop. The experiments were conducted in the vicinity of Trikala, western Thessaly (central Greece) in the years 2007 through 2009.

Soil samples from two soil layers, e.g. 0-20 cm and 20-40 cm, were collected at the onset and by the end of the experiments; they were analyzed for soil physical and chemical properties such as bulk density, soil moisture properties, aggregate stability, water infiltration rate, total N, P, K, pH, C_aCO_3, organic matter, organic C, and EC. All data were subjected to analysis of variance (ANOVA), using GENSTAT software.

The results demonstrated a paramount effect of pisum intercropping on the performance of the subsequent energy crop as reflected by the significant increase in nitrogen uptake, the nitrogen use efficiency (NUE) and finally the increase in yield and biomass production under similar or even lower fertilization rates. These results are particularly important for the cultivation of less fertile soils such as sandy soils, which can be put in use for the production of energy crops such as maize and sunflower that are characterized by high nutrients and particularly nitrogen demand.

Keywords: Organic C, total N, C:N ratio, cover crops, pisum, Greece

Effect Of Zeolite Application To Acidic And Limed Soil In Cu And Zn Availability To Ryegrass

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Trace element availability in acidic soils is high due to elevated H^+ activity in the soil solution, which leads to competition with cationic elements for the colloidal adsorption sites. As a result acidic soils contaminated with trace elements need to be remediated, either by addition of soil amendments with high cation exchange capacity (such as zeolite) so that metal retention may be increased, or by liming the soil. In this experiment we aimed at studying the role of zeolite and liming in reducing trace element availability, as assessed by soil extractions and test crop (ryegrass, *Lolium perenne L.*) uptake. For this reason in an acidic soil (with pH 3.8) we added lime to improve pH to the value of 6.5. We then added to both treatments 15.5 mg Zn kg^{-1} and 6.2 mg Cu kg^{-1} and we amended soils with zeolite at three rates (equivalent to 0, 2 and 5 t ha^{-1}). Each treatment was replicated three times and was sown with ryegrass in one-kg soil pots. This resulted in 36 pots (2 pH values x 2 trace element levels x 3 zeolite rates x 3 replicates), which were placed in a greenhouse for 100 days. We found that soil extractability of Zn (with DTPA) decreased significantly with lime and was further reduced with zeolite amendment. The same was observed with Zn concentrations in plant (above-ground plant biomass was measured). However, Zn levels in all treatments were significantly higher than the unamended control. DTPA-extractable Cu, although it decreased in limed soils, did not exhibit any further reduction with zeolite additions. Copper and Zn availability was also found significantly reduced with liming and zeolite addition, when assessed with the estimation of metal transfer coefficients (g of metal in plant per kg of metal in soil)

Study On The Competition For Nutrients Between Cold Tolerant Maize And Weeds

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Maize is a significant crop in the Hungarian plant production segment; its growing area is about 1.3-1.5 million hectares, which is approximately 25% of the total arable land.

The weed control is a fundamental parameter of the successful production of wide spacing crops, like corn. The dense weed infestation of corn can result significant yield reduction, due to the competition for water and nutrients.

The adequate fertilization is an important factor for the development of corn and weeds, so strong competition can be occurring between the crop and weeds for the nutrients. Corn can have some disadvantages in the competition to weeds, because weeds can grow faster and they can take nutrients more aggressively.

In the recent years new hybrids, which are tolerant to the cold weather, is grown in Hungary. The growing area of this specific hybrids is small at the moment; it is about a couple of thousand hectares.

In the field experiment, we assessed the weed cover, development of the weeds and the rate of the infestation on this early hybrid. Additionally, the biomass production of the corn and weeds were evaluated too. Experiment was carried out in 2010 in Hungary, Zala county, close to the town of Keszthely in field condition with plot size of 0.2 hectares in 4 replicates.

Sampling area was established (1 m^{-2}) and samples were taken from crop and weeds at different timings. The fresh weight, dry biomass and nutrient content of crop and weeds were measured. The weed species were identified, development of weeds monitored. The impact of weeds on the nutrient content and the yield of maize was measured too.

Study On The Spread, Biomass Quantity And Nutrient Content Of Ragweed *(Ambrosia artemisiifolia L.)* With High Precision GNSS And GIS Device System

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One of the most important issues in agro-environmental protection is today the decrease of the pollen emission of ragweed *(Ambrosia artemisiifolia L.)*. This aim can only be achieved if we have adequate knowledge of the ragweed's biology, its spread and the dynamic processes of the population. Its damage is not only important from a human health point of view, but also from that of plant production and plant protection. Winter wheat stubble fields are of great area, approximately 1.2-1.3 million hectares annually in Hungary, which is of high significance in its occurrence. The present research has been into the spread of ragweed in cereal stubble fields, and the examination of its nutrient content and water uptake.

The research was carried out near the town of Keszthely, Hungary, on 4 hectare sample area of 20 hectare field, using adequate soil examinations as well, on brown Ramann-type brown forest soil *(Eutric cambisol)*. For this kind of research today, IT and GPS background can be ensured. The most up to date GPS data collection and analysis system is available at the Georgikon Faculty of the University of Pannonia, Hungary. For the planning of terrain measurements, one of the most modern GPS basic software was used. Desktop application, a connecting GPS database and map server services have made it possible to use several formats of online, offline or analog source data when planning. Geodesic accuracy terrain measurements were carried out using the data of the Georgikon GNSS Base Station. The obtained data were also used to build a 3D terrain model. A field level terrain model was not only used for measurement planning, but also for GPS analysis. The GPS data obtained throughout the measurements and analysis were organized in a most up to date database structure, which was of great help while processing the data, and which makes it possible for other projects to access the data in an effective and simple way.

Effect Of Nutrient Supply On The Weeds In Maize

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The study was carried out in Keszthely, in the soil tillage experiment in 2006-2008. In this experiment are different cultivation methods: no-till drill, disk tillage, conventional tillage (ploughing) and five increasing N doses. The bi-factorial trial was arranged in split plot design with four replications. Crop rotation: winter wheat – winter wheat – maize – maize. There were no weed killing until our investigation. The weed survey was made with Balázs-Ujvárosi coenological method on the first days of June. We collected all plants of every weed species by plots. The sample area was $1m^2$. Furthermore five maize per plot were sampled. Maize were at 3-4 leaves stage. Aerial parts of plants were collected and fresh and dry matter weight was measured. We analyzed in detail the occurrence of weed species and biomass production of weeds compare with maize. We studied, whether the weeds have an effect on the maize in this early growth period.

The effect of the different cultivation methods demonstrated markedly the weed cover, the number of perennial and annual weeds in the weed flora and the number of occurring weed species.

Effect Of Storage Duration On Seed Viability And Oil Components Of Physic Nut Seed

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A study on effect of temperature and storage duration on quality and oil component of physic nut seed. The seed was kept in cloth bag and plastic bag, stored in room temperature (25°C + 2°C) and control room (13°C+2°C, 45% RH.) respectively. The determination was done at 0, 2, 4, 6, 8, 10 and 12 months after storage. The results showed that after storage physic nut seeds, KUBP 74 which were stored in control room had higher percent germination, especially when kept longer storage. Physic nut seed stored in cloth bag had higher percent germination than plastic bag. Germination at 12 months after storage seed kept in cloth bag and stored in ambient room was 72.3 percent and in control room was 78.3 percent. The seed kept in plastic bag had 69.5 and 71.5 percent when stored in ambient room and control room respectively. Seed oil content of physic nut found that seed kept in cloth bag stored in ambient room, oil content was reduced from 52.9 to 52.1 percent, acid content was increased from 2.7 to 7.1 percent and free fatty acid was increased from 1.6 to 5.1 percent respectively. The oil components of fatty acid before storage were palmitic 14.27 percent, stearic 6.23 percent, oleic 44.57 percent and linoleic 33.62 percent. After 12 month storage found that the components of fatty acid had reduced, there were palmitic 0 percent, staeric 2.66 percent, oleic 0 percent and linoleic 1.66 percent respectively. Physic nut seed stored in control room could have better quality than in ambient room. Seed which kept longer would have changed some fatty acid in seed to free fatty acid but the components of fatty acid were reduced.

Keyword: physic nut seed storability viability oil components

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Effect Of Land Use On Spatial Variability Of Organic Matter And Nutrients In An Oxisol

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Organic matter content (OMC) is a key attribute in the maintenance of a high quality soil.. Heterogeneity is now considered as an inherent soil property. Spatial variability of soil attributes in natural landscapes results mainly from soil formation factors. In cultivated soils much heterogeneity can additionally occur as a result of land use, agricultural systems and management practices. Neglecting spatial heterogeneity in soil nutrient status at the field scale might result in reduced yield and in environmental damage. We analyzed the impact of land use on the pattern of spatial variability of OMC and soil macronutrients at the stand scale. The study was conducted in São Paulo state, Brazil. Land uses were pasture, mango orchard and corn field. Soil samples were taken at 0-10 cm and 10-20 cm depth in 84 points, within 100 m x 100 m plots. Texture, pH, OMC, cation exchange capacity (CEC), exchangeable cations (Ca, Mg, K, H, Al) and resin extractable phosphorus were analyzed.. Statistical variability was found to be higher in parameters defining the soil nutrient status (resin extractable P, K, Ca and Mg) than in general soil properties (OMC, CEC, base saturation and pH). Geostatistical analysis showed contrasting patterns of spatial dependence for the different soil uses, sampling depths and studied properties. Most of the studied data sets collected at two different depths exhibited spatial dependence at the sampled scale and their semivariograms were modeled by a nugget effect plus a structure. The pattern of soil spatial variability was found to be different between the three study soil uses and at the two sampling depths, as far as model type, nugget effect or ranges of spatial dependence were concerned. Both statistical and geostatistical results pointed out the importance of OMC as a driver responsible for the spatial variability of soil nutrient status.

Effects Of Land Use On Spatial Variability Of Soil Micronutrients At The Plot Scale In An Acid Environment

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Land use practices affect soil properties and nutrient supply. Very limited data are available on the heavy metal extractability in northwest Spain. The aim of this study is to analyze long-term effects of land use on the supply, variability and spatial distribution of soil nutrients, which was undertaken by comparison of a forest and a cultivated stand, rich in organic matter content. The study was carried out in an acid, rich in organic matter soil developed over sediments at the province of Lugo, northwestern of Spain. Adjacent plots with were marked on regular square grids with 2-m spacing. Fe, Mn, Zn and Cu were extracted both by Mehlich-3 and DTPA solutions and determined by ICP-MS. General soil chemical and physical properties were routinely analyzed. In arable land microelement concentration ranges were as follows: Fe (100 and 135 mg/Kg), Mn (7.6 and 21.5 mg/Kg), Zn (0.6 and 3.7 mg/Kg), Cu (0.2 and 0.7 mg/Kg). In forest land, the limits for these concentration were: Fe (62 and 309 mg/Kg), Mn (0.2 and 2.1 mg/Kg), Zn (0.2 and 2.9 mg/Kg), Cu (0.1 and 0.2 mg/Kg), Microelement concentrations extracted both with DTPA and Mehlich-3 were higher in the cultivated than in the forest stand, being Fe-DTPA the exception. Coefficients of variation were higher for the microelement content of the soil under forest. Principal component analysis was performed to evaluate associations between extractable microelements and general physico-chemical properties. At the study scale, nutrient management is the main factor affecting the agricultural site, whereas soil-plant interactions are probably driving the higher variation within the forest site. Patterns of spatial variability of the study nutrients at the small plot scale were assessed by geostatistical techniques. Results are discussed in the frame of organic matter decline with conventional tillage and sustainable land use.

Potassium Contents In The Main Parts Of Spring Barley As Affected By Soil Properties And Nutrient Supply

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For balanced and efficient fertilization, adequate information on the main characteristics of soils as well as on the nutrient status of crops are essential. Literature data indicating the adequate and inadequate nutrient concentrations of spring barley is still not complete. With the proper use of potassium fertilizers, both yield levels and stability, and resistance to diseases as well as stem strength in cereals can be ensured.

The main objective of our study was to establish quantitative relationships between K fertilization and plant responses on two soil types.

Our pot experiment was carried out in the spring of 2006 under greenhouse conditions in two soils, a Haplic Luvisol and a Calcaric Gleysol (referred as soil „A" and soil „B") with low levels of available nutrients. Malting barley (Hordeum vulgare L., Scarlett variety) was used as a test plant. Four increasing rates of K were added at two NP levels for studying plant responses to nutrient supply and soil characteristics. Samples were taken at different growth stages from the main parts of barley considered as good indicators of nutrient status and crop yield.

Potassium deficient fertilization resulted in significant decreases in the K concentration of plants in both soils. Highest levels of K were found for the N2P2K3 treatment in soil „A" and for the N1P1K3 treatment in soil „B" at the stage of tillering. Except of K0 treatments, K concentrations of barley leaves were higher in soil „A" than in soil „B" at the stage of full bloom. However, K concentrations of blooming ears were lower in soil „A", except of N1P1K2 treatment. It was found that amounts of potassium taken up by whole barley plants were higher in soil „A" at each growth stages studied, due to the more favourable soil texture and nutrient supplying capacity of this soil.

WITHDRAWN

The Effect Of Nitrogen Application On The Yield And Quality Of Sunflower

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The effect of N and P fertilization on the yield and quality of sunflower (Helianthus annuus, L.) was studied in a pot experiment over a three years time period. The dry matter yield, its nutriet (N, P, K, Ca, Mg and S) concentration and uptake, yieldof seeds, diameter of inflorescence, weight of thousand seeds , its oil content, oil production, and the oil quality according to the fatty acids composition (palmitic, stearic, oleic, linoleic and linolenic acids).

Nitrogen application increased the dry matter yields and the nitrogen uptáme by plants at early stages of vegetation (the 4th leaf). Nitrogen application significantly increased the yield of seeds, the diameter of inflorescence, the weight of thousand seeds, its oil content and oil production. The nitrogen application increased the oleic acid content (18:1) and it decreased the linoleic acid content (18:2) in the seeds.

Effects of Acidification on the Soil and Water Sources

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Based on the results of project, which was applied in the frame of the Community Initiative program INTERREG IIIA and focused on environment protection ("Risk elements in the soil in relation to the environment"), critical loads for agricultural and forests soils are calculated. The critical loads calculation (mainly in forest soils) is the main task of the next project No 75 "Effects of acidification on the soil and water sources", supported and co-financed by structural EU funds in frame initiative European community "Aim 3".

Critical loads are determined as highest amount of contaminants, which don´t make chemical changes on the ecosystems, yet. It is quantitative estimate of an exposure to one or more pollutants which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge.

The results of the project are being compiled into well-arranged database giving freely accessible information about basic soil properties as well as risk elements in the soil. These results are important for next work – critical loads calculation. For critical loads calculation in relation to the others characteristics main and most important parameter is soil reaction (pH value), i.e. concentration of hydrogen ions in forests soils.

Long Term Effect Of Phosphorus Fertilization On Soil Phosphorus Status And Productivity Of A Permanent Meadow In The Swiss Jura

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Appropriate evaluation of phosphorus (P) availability in soil is a prerequisite for ensuring the productivity and long-term sustainable management of agroecosystems. This study examined the influence of four levels of P fertilization (0 to 26.2 kg P ha^{-1} $year^{-1}$) on soil-P status, P-uptake and dry matter (DM) production of an extensive permanent meadow (2 cuts $year^{-1}$) in the Swiss Jura. Soil (0–0.05, 0.05–0.10, 0.10–0.20 m) and plant samples were taken from a long-term fertilizer experiment established in 1992 by the Swiss Research Station Agroscope ACW in a Cambisol of low P content. Soil analyses included total-P, organic-P, inorganic-P, available-P (H_2O-P, $NaHCO_3$-P, AAE-P) and soil-P saturation (DPS). DM-yield and plant-P concentration were analyzed in July and September. The P balance between P-uptake and P-input and P nutrition index (PNI) were evaluated as well. The 15-years P-balance was positive only in the treatment receiving 26.2 kg P ha^{-1} $year^{-1}$. The DM-yield was significantly lower in the no-P treatment where the amounts of soil available-P extracted by H_2O, $NaHCO_3$ and AAE (acetate ammonium EDTA) were, in 2008, respectively 1.9, 12.5 and 8.9 mg P kg soil-1 . Correspondingly, the estimated values for optimal-P, using an quadratic-plus-plateau model, were 2.5, 17.2 and 19.2 mg P kg $soil^{-1}$. The plant-P concentration was 1.4 g P kg DM^{-1} lower in the treatment receiving no P compared to the highest P treatment, whereas PNI were respectively 51 and 100%. This study provides useful results to optimize P fertilization of mountain permanent meadows.

Variation Of Quality Characteristics Of Greek Carobs *(Ceratonia siliqua)* During One Period Of Harvesting

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The carob has several uses in food and especially in medicine. The present study reports the composition of carob pods (Ceratonia siliqua L.) sampled in two types of Greek carobs during one period of harvesting. Determination of moisture, sugars, total polyphenols and fatty acids was monitored in fleshy and wild types of Greek carob pods, in three stages of maturity. The results were compared with data from the literature. Principal sugars are glucose, fructose, sucrose. Saturated and unsaturated fatty acids were found and the major of them is linoleic acid following by oleic, palmitic and then linolenic fatty acids. During the fruit ripening a decrease in moisture, in glucose, in linoleic and in a-linolenic acid was noticed while oleic fatty acid content increased. The total unsaturated fatty acids content was 2 times higher than the content of total saturated fatty acids in mature carob pod. The ratio n-6/n-3 was under 5, showing a good equilibrium between the two essential fatty acids. The carob pods, possessing a high level of sugars, fatty acids of n-6 and n-3 type and of natural phenolics can be used as significant cheap sources of these substances for industry.There were not been noticed significant differences in the most cases between the two carob types.

Pomegranate: A Valuable Fruit

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The pomegranate (PG) (Punica granatum L.) belongs to the oldest woody cultivations with edible fruits that prosper in the extensive area of Mediterranean Sea. The chemical composition of the fruit differs depending on the cultivar, growing region, climate, maturity, cultural practice and storage conditions. The edible parts of the pomegranate fruit comprise 80% juice and 20% seed and are very rich in polyphenolic flavonoids. The high level of antioxidant compounds of pomegranate juice and especially anthocyanins and ellagitannins has been proved to protect from the danger of athirosclirosis.The edible part of PG is consumed as fresh juice, jams or it is used to provide colour and aroma in beverages and it has a significant content of sugars, vitamins, polysaccharides, polyphenols and minerals. Pomegranate, due to its predominance in nutritive value and to the increased interest of scientific community for the beneficial effects on human health, gained rapidly the consumers' confidence and encouraged many producers to turn to its intensive cultivation as both biological and conventional cultivars are of high price. According to them, the pomegranate cultivation has a high raw value and in the same time low cost per acre locating the pomegranate cultivation among the most significant. The pomegranate has been revered through the ages for its medicinal properties. Preparations of different parts of the plant –flower, fruit juice, rind and bark- have been traditionally used to treat a wide variety of conditions, although most commonly for gastroenterological ailments. In folk medicine, PG preparations, especially of dried pericarp and the roots, barks of the tree and the juice of the fruit, are used in the treatment of cilic, colitis and dysentery. The PG juice has been found to have anticancer and antioxidant activities and it contribute to the decrease of cardiovascular diseases danger. Internationally, the PG fruit and its juice and its seed (after the remove of juice) have been extensively investigated and their significance on human health has been proved. It has been reported that pomegranate shows antioxidant activity, resulting in beneficial health effects such as inhibition of low density lipoprotein oxidation and decreased risk of cardiovascular diseases. It also elicits anti-flammatory and anticarcinogenic effects have precipitating its use worldwide, although several other fruits have also been reported to cause food – drug interactions. The present study is a review on the composition and the significance of pomegranate fruit on human health.

Research Concerning The Impact Of Conservation Agriculture System Upon Wheat Yield

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Conservation agriculture is an alternative to conventional agriculture and the one of the most efficient systems durable agriculture development. Based on no-tillage or minimal tillage, it assures a good production and less costing performance. A bifactorial experiment in wheat crop, based on slit-plot model has been organized in order to evaluate the impact of conservation agriculture-no tillage on wheat yield during the period 2008-2010 at Agriculture Research Development Station Turda, Romania. Two factors have been considered: A Factor- Fertilization with two variants: A1- $N_{40}P_{40}$ kg/ha and A2- $N_{40}P_{40}$ kg/ha $N_{50}P_{30}$ kg/ha; B Factor-Vegetation complex control and crop protection with four variants: B1- 4 treatments, B2-3 treatments, B3- 2 treatments and B4- 2 treatment. In comparison with conventional agriculture, no tillage system determined higher wheat yields under a higher fertilization doses. Treatments for pest and disease control have no significant influence on wheat yield. In case of the both agriculture systems, fertilization is the key factor for increasing yield. The combination of the two factors:fertilization and crop protection pointed out that wheat yield is higher when fertilization is applied in higher doses. The A2B1 variant, that is the largest amount of fertilizer combined with the highest number of treatments assured the highest wheat yield, 5,669.33 kg/ha by 27.7% more than in case of the lower fertilization level. Taking into account other advantages such as: a reduction of production costs (less fuel and labor consumption), positive effects on soil physical and biological properties, the benefic impact on environment quality, conservation agriculture system experienced in wheat crop in Romania has proved to be an efficient alternative to conventional agriculture. It is recommend to be applied crop farming mainly in small sized agricultural holdings, existing at a large scale in Romania, in order to assure a balanced resource preservation, higher crop productions at lower production costs.

Survey Of Soil Properties Of Representative Vine, Olive, And Citrus Cultivations In Peloponnese, South Greece.

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The cultivation of citrus, olives, and vines are among the crops that dominates agriculture in South Greece. A soil sampling campaign was carried out in 30 different representative sites of Peloponnese, dominated by vineyards, olive and citrus orchards. In each site, composite topsoil samples were taken from at least 3 different crop fields (160 fields in total). Slope and other geophysical parameters were recorded in each sampling point. Soil samples were analyzed for pH, $CaCO_3$,organic matter, total N, available P, K, Mg, Ca and Mn. Overall the soil data, the 55% of the pH data have alkaline values, (>7.4). Carbonate content was high in the 20% of the data (> 20% $CaCO_3$). The 35 % and 10% of data have low to very low values for organic matter (<2.00 % and <1.00 % respectively). Similar trend was observed for total N since 20% of fields have total organic content less than 0.10 %. The antagonism effects of Mg to other cations were indicated by the high availability of Mg (>2.12 meq/100g) in the 20% of soil data. Low levels of K and P were restricted to 20% and 25% of data respectively. The 60 % of Mn values determined were below 5.6 mg kg^{-1} indicating deficiency problems. A comparison between the mean values (mean ± std) for the three crops showed that soils in citrus orrhards had substantially higher pH (7.5 ±0.28), $CaCO_3$ (15.0 % ± 5.81), organic matter (2.7 % ±1.27), total N (0.18 % ± 0.06), available P (37 mg kg^{-1} ± 8.2), Ca (46 meq/100g ± 9.35) and Mg (2.0 meq/100g ± 0.74) compared with olive orchards and vineyards. Available K varied in sufficient levels (0.45-0.50 meq/100g) while DTPA extractable Mn showed low levels (4.1-6.2 mg kg^{-1}).

The Effect Of Zeolite-Bentonite Mixture On Soil Quality And Crop Productivity

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In the present work the effect of Zeolite-Bentonite mixture on the improvement of soil quality and the biomass production of energy crops was investigated. For the purpose of the study two different soil types, e.g. peat and sandy loam were used in a pot experiment, receiving NO^-_3 –N up to a concentration of 44 ppm. Half of the pots received the zeolite-bentonite mixture at range 3:1. Two different energy plants such as switchgrass *(Panicum virgatum L.)* and sunflower *(Helianthus annuus L.)* were sown in each pot on June 28th (2010) and a nutrient solution of ammonium nitrate at three levels was supplied to correspond to N dressings of 0, 80 and 200 kg N/ha.

The results showed that the zeolite-bentonite mixture performs a positive effect on soil denitrification as well as on the crop biomass production. However, more efforts are required before the proper ratio of the mixture can be established, so that both satisfactory crop yields along together with denitrification and soil improvement may be realized.

Keywords: Zeolite-Bentonite, Switchgrass, Sunflower, denitrification, soil improvement.

$N\text{-}NO_3$ Uptake By Switchgrass And Sunflower As A Peat Soil Quality Improvement Index

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Switchgrass *(Panicum virgatum L.)* and sunflower *(Helianthus annuus L.)* are important energy crops (perennial and annual, respectively).

In this work, the uptake of $N\text{-}NO_3$ by switchgrass and sunflower plants as an index of soil quality improvement was studied in a pot experiment. A peat-soil substratum was used, receiving NO^-_3–N up to a concentration of 44 ppm. Switchgrass variety Alamo and sunflower variety turbo were sown in each pot on June 28th (2010) and a nutrient solution of ammonium nitrate at three levels was supplied to correspond to N dressings of 0, 80 and 200 kg N/ha. Upon harvest the average height of switchgrass and sunflower was 75 and 59 cm, respectively. Fresh weights reached 85 g for sunflower versus 36 g for switchgrass. The amount of NO^-_3 – N remained in the soil was lower in the switchgrass vs. sunflower pots, fluctuating at levels lower than 16.8 mg $N\text{-}NO_3$/kg soil. More detailed results presented in the paper demonstrate that switchgrass can be considered as a particularly environmental-friendly crop for biofuel production characterized by a great $N\text{-}NO_3$ adsorption rate and soil improvement characteristics.

WITHDRAWN

Comparative Analysis of Organic and Conventional Farming in Hungary

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Since the 1990s, organic farming has been gradually come to the front in Hungary, however, there is still no database providing information on the profitability factors of this farming system. Considering this fact, our study was based on primer data collection. First, organic and conventional production technology data of four main crops in Hungary (winter wheat, corn, rapeseed and sunflower) were compared on the basis of detailed technological and financial data of a large scale agricultural company, and secondly, farm models were developed and analyzed in order to obtain information on the profitability factors of organic and conventional farming.

According to data of the large scale company, differences in the cost structure were variable by the crop but this phenomenon could be explained by differences in the technologies, first of all, in nutrient management and plant protection. Each of the analyzed four organic cultures can be characterized by a lower level of direct cost per hectare; in case of three cultures indicators were also favourable.

There were no significant differences between the farming systems, highlighting the indicator of costs per hectare. Yield levels were lower in organic farming; however, the cost per product unit and the market price were higher. None of the cropping systems proved to be viable without subsidies, the gross profit variations are primarily the results of the differences in the yields and market prices gut not that of the subsidies. In most of the models, organic farming seemed to be more profitable; however, the amount of organic extra price – with parallel of the reference literature – is not enough to achieve a higher profit level in each year. As the price advantage of organic farming is decreasing, the profitability of organic farming is basically affected by increased and balanced yields compared to conventional farming.

Comparison of Soil Physical and Chemical Properties In Grassland and Shrubland Communities (Case Study: Vavsar Rangelands, Iran)

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Composition and construction of each plant community is largely under the control and influence of edaphic factors and these factors help to identify growing plant of their own region. Grasslands are often considered as a model of ecosystems for research on ecosystem function and biodiversity also have effects on variability of living and non living factors and ecological processes. Shrub species of rangelands also cause more protection plants under its canopy against grazing and enable provide favorable conditions for the establishment of other plants under its canopy cover. Determination the scientific relationship between soil factors and vegetation in each region and its expansion to other similar region will be important achievements in the management of . Then aim of the study is comparison of the physical and chemical of soil in the two communities of shrub land and Grassland. For this purpose two sites of Grassland and shrub land were selected in rangeland of Vavsar Kiasar. Vavsar is located in longitude “45 ‘43 ˚ 53 -” 35 ‘37 ˚ 53 and in latitude “13 ‘10 ˚ 36 -” 40 ‘5 ˚ 36. Climate is semi-arid to semi-humid and Mediterranean on the Domartin method. Dominant plant species in shrub land were *Artemisia aucheri, Astragalus caspicus, Acantholimon bodeamun, Stachys in flata*; and also species *Festuca ovina, Stachys inflate, Noea mucronata, Ephorbia Cheiradenia* were dominance in grassland. 60 soil samples from each site were taken from two depths 0-15 and 15-30 cm. In the laboratory, Soil properties including organic carbon (OC), total nitrogen (TN), electrical conductivity (EC), $CaCO_3$ percentage, moisture content and percentage of clay, silt and sand percentage were measured. The comparison of mean soil properties was performed between the two communities and two depths by using T-test in statistical package SPSS 16. The results showed that percent between electrical conductivity, moisture content and clay percentages at two depths of soil in the shrub land site but there were no significant differences in none of the two depths soil factors in grassland site. There was significant difference in first depth of soil between Shrubland and Grassland communities according to percentage sand, silt, electrical conductivity, and $CaCO_3$ and Organic matter percentage also between the electrical conductivity, $CaCO_3$ percentage, and clay percentage of second depth of two communities.

Effects of Land Use Change on Soil Organic Carbon and Nitrogen Stocks, (Case Study: Mohammad Abad, Iran)

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Although the literature is full of references to soil degradation under forest cultivation, very little information is available on deforested soil properties changes of the Hyrcanian forest area in the northern parts of Iran. Also, within the literature, there is much less information available on the effects of a conversion from deforested cropland to grazing, although this is currently a likely direction of land use change in Northern parts of Iran. The objective of this study was to assess the effect of conversion of native forests into farmlands and/or grazing lands on soil properties and nutrients in the Hyrcanian forest. The dominant land uses are native forest, dry land farming of barely and wheat and grazing. Three transects, typical land use changes resulted from changes detection analysis, were selected on the hillslopes of the study area. These transects represent three land use change occurred in the study area from 1967 to 2004 including mature forest (*fagus orientalis* and *acer velotinom*) to dry land farming (barely and wheat converted in 1979s) dry land farming to released area converted in 1986 and dry land farming to rice irrigated farming converted in mid 1980s. The average slope gradients range between 23¢ª (T_1), 15¢ª (T_2) and 4¢ª (T_3). Three different positions from top, middle and bottom of hillslope were selected in each land use type. Therefore six sites were selected to analyze land use change effects on soil properties. 20 meters vertical transect set on main transect in cross position. At each vertical transect, three surface soil samples (0-25 cm) gathered to measure soil properties. Total nitrogen was determined by the kjeldahl method the organic carbon content was measured using the modified Walkley-Black wet oxidation procedure. Data were analyzed using Minitab (Version 14). Comparisons of mean differences among land uses revealed soils under native forest with 4.73 SOC and 0.474 total N had higher than the contents in under grazing with 1.76 SOC and 0.323 total N and dry land with 1.37 SOC and 0.248 total N ($p<0.01$) while no significant difference was observed between the soils under grazing and dry land.

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