مقالات کلیدی

The German-Uzbek Khorezm project – a sustainable approach to agricultural and ecological innovation in Central Asia

Christopher Martius[1, 2], Johannes P.A. Lamers[1], Paul L.G. Vlek[1], Ahmad Mossadegh-Manschadi[1], Ruzumboy Echchanov[3]

[1] Center for Development Research, University of Bonn, Germany
[2] International Center for Agricultural Research in the Dry Areas (ICARDA), Program for Sustainable Agriculture in Central Asia and the Caucasus (CAC), Tashkent, Uzbekistan
[3] State University of Urgench, Urgench, Khorezm District, Uzbekistan

Khorezm, a district of Uzbekistan, is a model case for irrigated agriculture in the Aral Sea Basin - a showcase for the “Aral Sea Syndrome” that allows studying the complex human-nature relations in the context of strong government control during economic transformation from a planned to a market-driven economy after the collapse of the Soviet Union. Agricultural production and rural livelihood in Khorezm, located in the Aral Sea Basin, rely entirely on irrigation. However, the previous “water plenitude” which since ancient times had maintained a high agricultural productivity and rich cultural life in the middle of the Kyzylkum desert, is threatened now by increasing water unavailability due to climate change. This is exacerbated by the inefficient use of land and water resources, the often inappropriate institutional settings and policy frameworks, and underdeveloped agro-processing and service sectors which cannot provide the necessary support to farmers. These key issues, which threaten the economic and ecological sustainability of the entire region became the main objective of the interdisciplinary German-Uzbek project initiated by the Center for Development Research (ZEF) of Bonn University in Germany. The aim is to develop, in close collaboration with their partners UNESCO, ICARDA, the State University of Urgench and other national key organizations, science-based concepts and tools for the restructuring of land use and agricultural production. These concepts are being developed in a long-term research and capacity-building project in a way that allows for (i) more efficient and sustainable use of land and water resources, and (ii) for developing recommendations for shifts in policies and institutions to enable economic viability and environmental sustainability of the region. As Khorezm is representative for the irrigated lowlands in the Aral Sea Basin, innovative concepts and technologies developed in the project will have the potential for up-scaling to other similar environments.

DMPP (ENTEC)- A NEW NITRIFICATION INHIBITOR FOR IMPROVING N-EFFICIENCE

An overview

Zerulla, W.; Pasda, G.; Hahndel, R.; Wissemeier, A.; Kummer, K.-F.
BASF Agricultural Center, 67114 Limburgerhof, Germany

Abstract:
DMPP (ENTEC = 3,4-dimethylpyrazole phosphate) is a new nitrification inhibitor developed by BASF SE, Germany with high favourable properties. It could be used either on solid or in liquid fertilizers, on water soluble nutrient salts or in slurry. Already application rates of 0.5 to 1.5 kg ha^{-1} are sufficient to delay the transformation of ammonium to nitrite by *Nitrosomonas spp* for 4- 10 weeks. DMPP can significantly reduse nitrate leaching without being liable to leaching itself. DMPP clearly reduces N_2O emission, without a negative effect on the methane sorption capacity in the soil. The use of DMPP-containing fertilizers can improve fertilizer-N- efficiency. Farmers and vegetable growers benefit from its use by either reduced nitrogen rates or increased yield, by a lower number or fertilizer applications and often improved quality.

Global Warming and Draught

Ahmet R. Mermut

University of Saskatchewan, Department of Soil Science, Saskatoon, Sask, CANADA

Scientific evidences suggest that the Earth is getting warmer. The main cause is believed to be carbon dioxide emissions from cars, power generation, factories, etc. Drought is a normal, recurring feature of the climate in most parts of the world. Having adequate drought mitigation strategies in place can greatly reduce the impact. Recurring or long-term drought can bring about desertification. Biomass burning has had a devastating effect on the earth's forest and the global warming. The burning of fossil fuels is responsible for about 98% of all CO_2 emissions released into the atmosphere. Biomass burning has been occurring since the beginning of the existence of forests. But recently it has been occurring on a much greater scale. It is believed that more then 90% of all biomass burning is human related. Advances in technology have increased the human population, thus resulting in damaging Earth’s resources.

Global Warming International Center (GWIC), founded in 1989 in Chicago, is a non-profit organization of scientists, policy makers, and scholars committed to driving scientific research and innovative policy development on climate change science. GWIC takes an interdisciplinary approach to evaluating climate impacts across a range of areas: With members in more than 145 countries, the GWIC sponsors research supporting the understanding and mitigation of global warming.

Drought is a normal, recurring feature of the climate in most parts of the world. Generally, this occurs when a region receives consistently below average precipitation. Recurring or long-term drought can bring about desertification. It can have a substantial impact on the ecosystem and agriculture of the affected region. Although droughts can persist for several years, even a short, intense drought can cause significant damage and harm the local economy. Having adequate drought mitigation strategies in place can greatly reduce the impact. Lengthy periods of drought have long been a key trigger for mass migration and played a key role in a number of ongoing migrations and other humanitarian crises

Research in Habur plain in Northern Syria suggest that 2200 B:C. There has been drought that lasted for 300 years and this was followed by 200 years of flood. Evidences of this processes can be observed in South-eastern Turkey. It seems that drought occurances are natural and cyclic mostly related to natural processes rather than a human induced process. We can effectively mitigate much of the impact of drought through irrigation and crop rotation. Failure to develop adequate drought mitigation strategies may result in grave human cost and this is exacerbated by ever-increasing population.

Digital soil mapping and soil resource management

An extended abstract, by: Abbas Farshad, ITC, Enschede, The Netherlands (farshad@itc.nl)

Abstract

The growth in world population since 1950 exceeds that during the preceding 4 million years. This, plus the six fold expanded world economy during the same period, has led to an abnormal overuse of the planet's natural capacities (Brown, 2005). It is not difficult to notice that vegetation cover is shrinking in surface area (due to deforestation, deteriorating grasslands), soils are eroding, and/or salt- affected, water table is falling, ….., all affecting food production.

Two measures are thought of to tackle the problem of food shortage: i) increasing the surface area under cultivation and ii) intensification by means of using chemicals, high yield seed varieties, and machineries; the assumption in both cases is that the required water is available!

While water tables are steadily falling, suitable soils become scarce too. Of even more concern, soil degradation is increasing, for a great part, due to the misuse of pumped groundwater, often leading to salinization and/or compaction, and the use of marginally suitable sloping areas, which results in more flooding and erosion.

Fortunately we now have the technologies to do things that can help to better manage and consequently conserve resources. In 'natural resource management' data availability is the issue. To manage anything one has to properly know the object to be managed; here the soil resources.

Soil properties are crucial inputs for models of carbon balance, nitrogen fluxes, hydrological cycle, land suitability for irrigation projects, crop forecasting, landslide risk, and infrastructure construction, which are required in various fields of disaster management, food security and environmental sustainability (Farshad and Rossiter, 2008).

Conventional soil survey becomes time demanding and expensive. Besides, techniques for mapping dynamic soil properties, mainly remotely-sensed and/or model-based (Ben-Dor, 2002; Bui, 2004), have been developing. Thanks to the advances in the broad field of geographic information system (GIS), a new trend, often called digital soil mapping, is emerging which will have a positive impact on the soil survey.

The introduction of space-technology advances in Information and Communication Technology (ICT), coupled with the derived facilities in automation, urged many scientific fields to go for adaptation. It is remarkable to witness that the pioneer Jenny's equation (Jenny, 1941) receives more and more attention (McBratney et al., 2003, Moonjun et al., 2008). Soil Survey Manual was revised and issued in 1993, after almost half a century. Soil Taxonomy (USDA, 1975) was regularly revised; with its tenth edition issued in 2006. At the same time adapted concepts were used to introduce a more applicable soil classification system, the World Reference Base for soil resources (as World Soil Resources Reports No. 103-- FAO 2006).

Shortcoming of the Boolean logic in soil mapping is a known fact. Soil surveyors were always trained about the fuzziness of soil boundaries, map unit composition, transitional map unit between soil bodies and the issue of soil variability. Depending on scale, the transitional units were either cartographically shown on the map, or by a different series name, or were described under the flag of "range of characteristics", in the soil survey reports.
With the introduction of some new techniques and tools, for instance, geostatistics, more advanced computers, and the increasing GIS facilities, to make use of interpolation became a common practice in soil survey.
Above all, the introduction of the digital terrain surface modeling was a revolutionary step (Hengl et al., 2009). A digital terrain model is a mathematical (or digital) model of the terrain surface (Li et al, 2005). The mathematics takes care of the interpolation process, which has progressively developed with increasingly efficient and cheap computation power and storage, availability of digital contour, stream, and ortho-photographic data (www.ffp.csiro.au/nfm/mdp/softdem.htm), not to forget the LIDAR (Light Detection and Ranging). This is an optical remote sensing technology that helps measure differential height leading to register the terrain surface topography (www.csc.noaa.gov/products/sccoasts/html/tutlid.htm). To stay with less sophisticated technology, the required data for the digital terrain modeling may come either from field survey (e.g., use of conventional surveying instrument or GPS), from stereo pairs of aerial (or space) images using photogrammetric techniques, or from digitization of the existing topographic maps. The latter source is the most commonly used technique, although more and more use is made of the freely available DEM's, down loadable from SRTM (Shuttle Radar Topography Mission) at http://srtm.usgs.gov/. This product (with 90m resolution, except for the USA, with 30m resolution) won't satisfy those who need higher resolution data.
Almost all well known GIS packages are equipped with a sub module for generating DTM. ARCINFO, for instance, is equipped with ANUDEM (http://fennerschool.anu.edu.au/), a program developed in the Australian National University in Canberra, which supports production of grid-based DEMs using contour line map. Or in ENVI software, the sub module "topography" supports generating DTM using ASTER images. GRASS GIS software and a few freely available packages, such as TARDEM and TauDEM (of Utah Water Research Laboratory) can also be named here.

Thinking of some of the definitions and concepts (van Wambeke and Forbs, 1986) concerning 'what is a soil?", "what is the content of a soil map unit?", "soils are 3-D natural bodies", and "soils of unmapped areas can be mapped using soil data from the neighboring areas" may lead to rise the questions on what is the 'digital soil mapping'?, and to what extent the shortcomings of the conventional approach can be recovered using the new trend?, does the new trend suggest changes in definitions and concepts (re-thinking soil survey)? Whatsoever the answers, digital soil mapping, also known as predictive soil mapping, must receive more attention in the steadily growing world of today. And at the same time, it must be said that it would be a great mistake if the emphasis is put on the term "digital", no! The emphasis must be put on "soil mapping" and that can only be done by experienced soil surveyors, as for mapping soils thorough understanding of soil spatial composition and the soil-landforms relations are absolutely 'a must'.

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Luminescence Dating of Sediments

Manfred Frechen

Leibniz Institute for Applied Geophysics, Section S3: Geochronology and Isotope Hydrology, Stilleweg 2, 30655 Hannover, Germany

Thermoluminescence (TL) dating was first proposed 50 years ago as a method for dating the time elapsed since the last heating of artifacts such as pottery and heated flint stone. In the 1980s, optically stimulated luminescence (OSL) and infrared optically stimulated luminescence (IRSL) were proposed as methods for dating the deposition age of sedimentary grains. Luminescence dating methods date the deposition age of common minerals like quartz and feldspar. Quartz and feldspar grains behave like dosimeters in the sediment. The natural radioactivity accumulate as equivalent dose (De) in the mineral grains and can be determined by comparing the luminescence signal from the natural sample with that of artificially induced dose by a radioactive source. The natural radioactivity of the sediment is measured separately in the field or in the laboratory, for example by gamma spectrometry. An important dating assumption is a sufficient long exposure to daylight prior to the deposition of quartz and feldspar grains.

Single-aliquot regenerative (SAR) protocols have been established successfully for measuring the equivalent dose (De) of the minerals with much greater precision than those using multiple aliquot protocols. All measurements for the SAR protocol are done on one aliquot. Each aliquot gives rise to a De value and these many De values are then combined in the final age determination. The SAR protocol includes a suite of internal checks on the behaviour of the luminescence signals. Sensitivity changes occurring within the measurements sequence are monitored and corrected. Thus, evidence is given for the reliability of the applied method increasing the confidence of the final OSL age and so gives us information on the suitability of the method for the application to each sample studied..

OSL dating is able to provide better chronologies for the past 350 years than radiocarbon dating, the latter one having large uncertainties when the ^{14}C ages are calibrated owing to fluctuations in the cosmic radiation and subsequently in the ^{14}C production. OSL ages covering the past decades and centuries have been obtained for coastal sand dunes, being in excellent agreement with the time ranges expected from local historical records.

The fast component of the OSL signal from quartz is suitable for dating sediments up to about 100 ka (ka = 1,000 years). OSL ages beyond 100 ka are currently studied using OSL signals with a higher saturation limit. However, these signals are much less sensitive to light and so are restricted to aeolian deposits. Several new luminescence dating approaches, such as isothermal thermoluminescence (ITL), thermally-transferred OSL (TT-OSL) or IRSL at elevated temperatures, are under investigation to extend the age range from about 100 ka to about 1 Ma (Ma = 1,000,000 years) but need further experimental testing.

Luminescence dating methods provide a reliable, precise and accurate dating method for sediments from aeolian, fluvial, coastal, periglacial and glacial environments, making a major contribution to Quaternary sciences.

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