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Building Sustainable Agricultural Development through Home-Grown School Feeding - The African Approach

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– an impossible match?

Building Sustainable Agricultural Development through Home-Grown School Feeding Programmes – The African Approach
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Proper nutrition is critical for optimal growth, cognitive development, general well-being and academic performance of children. Access to good nutrition either at home or through the educational system can contribute to the elimination of malnutrition and its associated health and developmental problems. In this regard, The 2005 UN World Summit recommended the expansion of local school feeding programmes, using home-grown foods where possible as one of the “Quick impact initiatives” to achieve the Millennium Development Goals, especially for rural areas facing the dual challenge of high chronic malnutrition and low agricultural productivity. Further to this, the New Partnership for Africa’s Development (NEPAD) Secretariat and UN Millennium Project Task Force on Hunger proposed that school feeding be linked with agricultural development through the purchase of locally/domestically produced food, school gardens and the incorporation of agriculture into school curricula, to stimulate demand for locally produced food and trigger market mechanisms, particularly in marginal rural areas where these mechanisms do not exist. These developments show increasing recognition by the world community, and particularly by African governments, for the importance of school feeding. Given that most poor people in developing countries live in rural areas and earn livelihoods in the agricultural sector, school feeding is now being seen as a promising synergistic entry point to not only improve educational outcomes, along with nutrition and health status of poor and undernourished children, but also to jump-start local agricultural development in Africa. This presentation provides an overview of the state of school feeding programmes in Africa, current developments on its usefulness as a tool for sustainable agricultural development and the challenges being faced. It presents the framework of activities being used to maximise the educational, agricultural, and market benefits as well as the conventional health/nutritional impacts. It also addresses ways of facilitating the synergistic actions to provide nutritional assistance to school-going children, improving school enrolment and attendance (especially for girls), stimulating domestic food demand, and providing income generation opportunities for smallholder farmers to maximise the wider development potential of school feeding on multiple dimensions.

Keywords: School feeding; sustainable agriculture; rural development; food security; child nutrition
Threatening tree disease in East Africa

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Severe and extensive outbreaks of a dieback and canker disease have recently been observed on Grevillea robusta in Kenya, Uganda and to a lesser extent in Ethiopia. Grevillea is an excellent agroforestry tree species grown intensively in east Africa to improve agricultural land use and rural livelihoods, and provide food security. Our recent studies on the disease indicate that 50-80% tree mortality occurs on severely infected farms. It is caused by Botryosphaeria spp., a fungal genus containing many species and more than one pathogenic species can occur in diseased trees. Samples were taken from Grevillea trees growing in different agroecological zones and from some other tree species with similar symptoms. Morphological and molecular methods were used to identify species and to study differences between populations in different agroecological zones as well as countries.

The disease is more severe in dry areas than wet ones, emphasizing the need for proper species-site matching. Several other tree species, including indigenous and exotics, were found infected by Botryosphaeria in the region. Especially alarming is the attack on different Eucalyptus species. Such disease outbreaks may be attributed to increased tree planting in agroforestry and commercial tree plantations in the region. Increased acreage and number of trees/ha leads to an enlarged number of potential hosts, and a larger population size for pathogens to evolve genetically into more aggressive genotypes. Moreover, complex threats can arise when previously isolated fungal species brought together by human interference hybridize posing threats to tree hosts previously immune from their effects. Implications of the dieback and canker disease on the scaling up of agroforestry technologies and commercial forestry in the region are discussed.

Kewords: Grevillea robusta, Eucalyptus spp. Botryosphaeria, dieback and canker disease

References:

Plant and Pheromone odor lures for environmentally sustainable control of the sorghum chafer, Pachnoda interrupta

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Sorghum is one of the most important staple crops in Ethiopia. In some areas, however, the sorghum chafer beetle poses a serious problem to sorghum production. Crop loss of up to 70% has
been reported in severely infested areas. With support from Sida/SAREC, a project on environmentally sustainable control of the sorghum chafer was initiated in 2003. Laboratory and field studies have identified volatile compounds originating from sorghum and other host plants that are highly attractive to the beetles. When these compounds – alone or in mixtures – are deployed as lures in traps, high numbers of beetles are caught. Field experiments also indicate that a combination of pheromones and plant compounds constitutes an even more powerful attractant to the sorghum chafer. Current work focuses on the chemical identification of the pheromones used by the beetle. In the future, a plant-pheromone combination lure could form the basis of an environmentally sustainable management system.

Two Sida/SAREC supported PhD students, one based at Addis Ababa University (AAU) and one at SLU, have been working on different areas within this project. The AAU student has been part of a “sandwich” program, but for both students mobility between the department of Biology at AAU and the department of Plant Protection Biology at SLU Alnarp, has been high. The networking between the departments has also been enhanced by frequent reciprocal visits by the senior scientists in project. As part of the project, a state of the art laboratory for insect chemical ecology work has been established at AAU. Furthermore, competence training for chemical ecology research at AAU for others than the PhD students has been conducted both within the framework of this project, but also within a Linnaeus Palme exchange program that has been established between the departments as a result of the current collaboration.

Keywords: Environmentally sustainable control, sorghum, sorghum chafer, capacity building, networking

Potato moth challenges potato growing in Latin America. I. Building a network for research and development cooperation

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The potato moth *Tecia solanivora* has become a serious obstacle for potato production in Central America and adjacent countries in South America. The larvae are protected inside potato tubers, and frequent sprays with all available insecticides in the field and in storage are not sufficient to control this insect. The overuse of insecticides leads to contamination of food, drinking water and air, and creates a serious health problem in rural areas.

New insect control techniques become available through research in chemical ecology (1). Insects use pheromones and other messenger chemicals to communicate for sex and food. Synthetic copies of these compounds can be used to manipulate the reproductive behaviour of selected species for efficient and environmentally sustainable control. We envisage a dual strategy for control of potato moth, using pheromone-mediated disruption of matings in the field, and plant volatiles to intercept egg-laying females in potato storage (2). Beyond the research on behaviourally active compounds done within the Chemical Ecology Group, we try to build a network to enable widespread practical application of our research.

Corpoica (Bogota, Colombia), our main partner, complements the project with field work including government extension and grower organisations, plant protection and food industries. We currently build a chemical ecology research unit at Corpoica.

ChemTica (Costa Rica), is an industry specialized in synthesis and formulation of semiochemicals for insect control. ChemTica contributes with large-scale pheromone synthesis to field experiments and may become a partner for commercialization of mature technology.

*T. solanivora* is an invasive species and gained only recently importance. Knowledge of its population genetics, particularly in view of a possible host shift from a native solanaceous plant to potato, will greatly aid the establishment of viable population control. This work is done in collaboration with a French team (IRD, L'Institut de recherche pour le développement). A
colleague from IRD will be positioned at CIAT (Cali, Colombia) to work on *T. solanivora*. This is an opportunity to interface research at CIAT and the national research institute Corpoica.


(2) Karlsson MF, Bosa F, Bengtsson M, Witzgall P. 2008. Potato moth challenges potato growing in Latin America. 2. Designing efficient and environmentally safe control methods. (This meeting)


Key words: Colombia, potato moth, semiochemicals, insect control, research network

The Iwokrama Rain Forest Research and Development programme in Amazonian Guyana

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Established by an Act of the Parliament of Guyana in 1996, the Iwokrama International Centre for Rain Forest Conservation and Development is Guyana's first sustainable development “gift to the world.” The concept of the Centre is premised on the wise and sustainable use of forest resources and in demonstrating “how tropical forests can provide economic, social, and ecological benefits while conserving biodiversity.” The Iwokrama Centre is entrusted with the sustainable management of the Iwokrama Rain Forest which occupies 371,000 hectares in central Guyana. The Iwokrama concept and its linkages with forest management, research and development principles which provide a framework for a model ecosystem health initiative will be described in detail. The Centre's core thematic programme areas are: 1) sustainable management of forests; 2) conservation and utilization of biodiversity; 3) sustainable human development; 4) forest research, and 5) information and communication. A number of activities are carried out to achieve the objectives of each of these core thematic areas. An overview of the activities within the core thematic areas which provide enabling mechanisms for achieving ecosystem health will be provided. These include a number of non-timber forest products projects – aquarium fish, liana extraction, ecotourism, honey processing, wildlife management and frog breeding. There has been a major focus on the use of a large fraction of this forest reserve as a model for climate change mitigation via the clean development mechanism recently. Biodiversity prospecting, integrated health for communities and traditional knowledge IPR are other examples of activities which provide an enabling mechanism for Guyana's bold contribution to the maintenance of global ecosystem health through the Iwokrama Rain Forest model.

Keywords:
Amazonian Guyana; Iwokrama rain forest; biodiversity conservation; sustainable forest management.

Wild relatives of cassava as genetic sources for improved cassava farmers' varieties and sustainable farming communities

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Cassava (*Manihot esculenta* spp. *esculenta*) is a tropical crop and produces starch-containing tuberous roots of world-wide importance as food. About 70% of this production is in Africa, Latin America and Asia by small-scale farmers. They live in marginal areas, which are some of the poorest and most difficult areas of the tropics. Cassava gives reasonable yields in dry and poor
soils and does not require high management level and cost compared to other major food crops. It is therefore an attractive crop for poor resource farmers, particular in communities with a weakened labor force as the result of HIV/AIDS. To secure the role of cassava as a food crop and to ensure that cassava will be an important source of income for rural farmers the research and breeding have to emphasize improved root quality, higher root yield and, resistance to pest and diseases. In addition, to reduce malnutrition emphasis has to be towards improving the content of proteins, minerals and vitamins. It is of major importance that these traits will be introduced into a large number of varieties that satisfy the diverse needs and preferences of the small-scale farmers and consumers (Balyejusa Kizito et al. 2007). Many of these traits were lost during the domestication of cassava. The wild relatives of cassava are therefore the only genetic sources for introgression of favorable traits such as high protein content and pathogen resistance into farmers’ varieties.

The main goal of our research is to develop molecular marker tools for introgression of wild genes into cassava through marker-assisted selection. The very first step towards this goal is to identify the genes that control trait differences between cassava and its wild relatives. To do that we are using quantitative trait loci (QTL) mapping, a method that combines molecular marker, trait and statistical analyses. The next step is to identify molecular marker loci linked to the QTLs that control trait differences. These markers will be used in marker-assisted selection where the breeders take advantage of the linkage between a molecular marker allele and a QTL that controls the trait of interest. In order to identify the genes that control trait differences between domesticated and wild cassava we have crossed a cassava variety with the wild relative M. esculenta ssp. flabellifolia. The progenies in the second (F2) generation are analyzed for their genotypes at a number of molecular markers and for their phenotypes in various traits such as, stem and root weight, root morphology, and root content and quality of protein and starch. The F2 progenies show large phenotypic variation in root and stem traits and F2 genotypes with much higher tuberous root weight than cassava have been observed. This project will help to increase productivity and enhance food security for sustainable farming in rural communities. The project is in collaboration with Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia which is one of the two centers within the Consultative Group on International Agricultural Research (CGIAR) system that carries out research on cassava.

Key words: cassava, farmers’ varieties, Manihot esculenta, quantitative trait loci, wild relatives


Employment of molecular markers to support breeding programmes on sorghum in East Africa

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Maize and sorghum are the most important staple cereals for sub-Saharan Africa. Sorghum is important for communities dependent on it for supply of basal energy for human and livestock and the crop is being extremely important for resource poor farmers. The yields of sorghum are very low. This is because sorghum cultivation is still mainly characterised by traditional farming practices. The purpose of our work is to develop biotechnology-based tools to support sorghum improvement programs related to plant stress particularly in East Africa and beyond. Much fundamental knowledge both on sorghum and the two fungal diseases turcicum leaf blight and sorghum antrachnose in focus is lacking. Thus this gap must be reasonably covered in order to develop sustainable breeding material. We are taking several strategies including sorghum and the fungal pathogens to accomplish this immense challenge. The work is divided in following areas: 1) Collect sorghum germplasm. 2) Phenotype and genotype a sorghum core collection. 3) Identify unique parental material. 4) Develop mapping population(s). In parallel, 5) conduct disease surveys 6) characterise the pathogen populations using molecular tools. 7) Combine genetic knowledge on pathogen and plants in order to identify loci linked to plant defence. This includes development of DNA-markers to assess both background and foreground selection to
monitor introgression of novel traits. 8) Implement gained knowledge in breeding programmes i.e. in locally adapted lines. This project was initiated 2006 and the current statues is that sub-areas 1 to 6 more or less are finalized. We are now switching from collection and evaluation of various materials, and field surveys into much more massive genetic analyses to shed light on plant genetic mechanisms regulating defence to these two fungal diseases.

Keywords: Colletotrichum sublineolum, DNA-based diagnostic tools, Exserohilum turcicum, genetic diversity, Sorghum bicolor

Disease Resistance and Disease Management – Cooperative Research Projects with the CGIAR System and Other Institutes

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Increased production of agricultural and forestry products depends not only on suitable cultivars, inputs such as fertilizers and water, and proper cultivation methods, but it also needs suitable management of pests and diseases. For the resource poor farmers, dependency on chemicals for pest and disease control carries with it costs that make them unavailable for most farmers, even if we ignore the environmental consequences of dependence on chemicals.

Host plant resistance is one way in which diseases can be controlled without the use of chemicals. Incorporation of host plant resistance into suitable cultivars is not a trivial task, nor is the management of host plant resistance within the larger context of the cropping system. At SLU, we have been cooperating with CIMMYT and CIP to facilitate the incorporation of host plant resistance as well as exploring ways to best utilize the resistance in existing plant material. Efforts at CIMMYT have led to the identification of resistance genes to new and old leaf rust races in durum wheat and we have explored methods for screening for disease resistance to leaf spot pathogens. At CIP we have focused more on methods for measuring host plant resistance, and management techniques for utilizing this resistance against potato late blight, caused by Phytophthora infestans.

Host plant resistance is dependent on co-evolution with the specific pathogen. That means risks with moving tree species (between continents or shorter distances) to an exotic environment. An exotic tree species introduced to a new environment often develops well in beginning. Later on, however, the introduced tree risks attacks by existing pathogens in the new location or by pathogens brought from the place of origin. In the new environment the exotic pathogen can develop to a major pathogen on the exotic species but it is also a risk for the indigenous trees. Increased tree planting in East Africa has led to disease problems and we started co-operation at World Agroforestry Centre to increase the understanding of tree health in agroforestry. We are now co-operating with Hawassa University in Ethiopia, Makerere University in Uganda and Kenya Forest Research Institute to specifically study recent attacks by Botryosphaeria species of both exotic and indigenous trees in the region. The research will be used for development of tree disease management.

Research is often done via 'sandwich programs' which have led to 5 PhD degrees in plant or forest pathology over the last 10 years.

System for Rice Intensification – saving water and producing more?

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Rice is the staple food for a large fraction of the global population. Wetland rice requires about 1 200-1 400 mm of water per crop. However, in the early 1990s Father Henri de Laulanie, engaged in rice cultivation on Madagascar, published his experiences from a drought period when the lowland rice could not be kept flooded (Laulanie, 1993). He found that the yield increased
although the applied irrigation water was only about half the conventional amount. This interesting finding has initiated experiments especially in Asia, in China and India notably. There has been harsh criticism against the practice (Sheehy et al., 2005) using words such as nonsense and no science. The growing experience in the practise both supports the claim that yields are higher (Sinha & Talati, 2007; Kabir & Uphoff, 2007; Satyanarayana et al., 2007) and denies it (McDonald et al., 2006). Several advantages are registered like a better nitrogen economy as denitrification decreases (Cheng et al., 2002). Further, emissions of greenhouse gases like dinitrogen oxide and methane decrease (Ghosh et al., 2003). What has further been debated is the labour requirement. SRI uses a different planting pattern and requires more frequent mechanical weeding (Haden et al., 2007). Adopting the practise requires considerable extension work and regard to seasonal financial constraints for poor farmers (Moser & Barrett, 2006). The advantages documented regarding water efficiency, nitrogen economy, environmental impact and returns for the farmers (Sinha & Talati, 2007) indicate that SRI is a promising practise especially where water is a constraint. It seems that a successful adoption requires a considerable extension work (Kabir & Uphoff, 2007; Moser & Barrett, 2006).

References

From buckets to swimming pools: An essay on how an exiting idea to increase production and decrease ecological impacts, by research efforts was tested, investigated and evaluated and finally was successfully implemented.

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The importance of aquaculture production as a protein source has increased steadily as the world fishing areas have reached their maximal potential. During the last decades production has increased rapidly and today aquaculture supply almost 50% of the seafood consumed worldwide. However, to meet future demand and food security, there is an urge to develop ecological and economic viable cultivation systems that are highly productive, especially in developing countries. Such systems should be based on low trophic-level species demanding a minimum of resource inputs and generating negligible ecological impacts.

In South Africa the cultivation of abalone (Haliotis midae), a high-valued herbivorous marine gastropod, has been expanding and successful, generating high export earnings and providing employment and economic growth in poor rural coastal communities. Its high dependency on the limited supply of wild kelp (Ecklonia maxima) is, however, considered to restrict further
expansion. One suggested way to meet the growing demand of abalone feed is on-farm seaweed cultivation.

In 2001 a Swedish – South African joint project was initiated aiming to test the possibilities to integrate seaweed and abalone cultivation. In addition to high production of seaweeds for feeding the abalone, the idea was to use seaweed biofiltration and decrease nutritious farm releases and facilitate water and nutrient recirculation.

Starting up with a number of small experiments, testing different parameters in buckets and small-containers, the project and its studies evolved into a pilot semi-scale using large cultivation tanks during long term studies on farm recirculation. The results were highly promising. The economical (and perhaps also the socio-economic) benefits that could be estimated out from the studies encouraged a abalone farming company to invest in such system and constructed a full-scale commercial recirculating system based on the research results. This large system has until now been running for two years and the preliminary results are very promising.

Different kind of seaweed integrated and recirculated aquaculture systems have been scientifically evaluated and recommended for increased sustainability world wide. These are, however, generally based on studies on small- or semi-scale. This indicates a lack of knowledge and a risk of overestimations when it comes to full-scale implementation, as there is a potential decrease in system efficiency and productivity due to scale effects. However, commercial scale implementation of sustainable practices is of high importance towards decreased ecological impact within aquaculture.

Key words: aquaculture research, integrated aquaculture, seaweed, abalone, scale

References:

Cultivating the Past: Towards an Applied Archaeology for Rural Development in the Bolivian Yungas
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Akin to discursive currents in historical ecology and parallel to a growing concern for sustainable management of natural resources, scholars recognize that archaeology can play a significant role applied in rural development, particularly in projects focusing on improving the long-term sustainability and resilience of local agrosystems in developing countries (Erickson 1998). This contribution discusses the potential of applied archaeology for rural development on the basis of a recently inaugurated field project in the Central Andes. Enjoying initial financial support from Sida-SAREC over the period 2007–2009, Cultivating the Past is co-directed by the author and Walter Sanchez, Universidad Mayor de San Simón, Cochabamba. Previous research in the Yungas of Tablas Monte indicates a complex local prehispanic agrosystem including a range of technological solutions of slope, soil, and water management that has not been reported in a similar configuration from elsewhere. The purposes of Cultivating the Past are to document in detail the agro-archaeological remains, to understand the functions of the agrosystem, to initiate a test-cultivation program, and to disseminate research results at a local field museum organized by the project.

Today, the agro-archaeological remains are threatened by destruction. Contemporary smallholders of the Yungas practice extensive, swidden cultivation that promotes soil erosion, deforestation, and a loss of biodiversity. In particular, large inputs of pesticide chemicals in
current farming regimes damage local fauna and transform local ecosystems. Profuse inputs of chemicals may also have wider effects as local agro-chemical discharge leaks into the lowland hydrological system. The ultimate scope of *Cultivating the Past* is to provide a case study of the application of agro-archaeological data on past resource-use in the design of future sustainable agricultural production systems. We are not working under the naïve assumption that prehispanic agro-technologies offer complete alternative solutions to contemporary issues in rural development. But we do think that we in cooperation with local stakeholders can generate important insights of slope, cropping, soil, and water management strategies that will contribute towards more resilient and sustainable cultivation strategies in these landscapes. We are also confident that local cooperation in research and public outreach is important to capacitate local rural populations and will strengthen local awareness of history, identity, and self-appreciation. Indeed, to be successful, field projects in applied archaeology—perhaps more than in any other subfield of archaeology—must be firmly anchored locally, and to a significant extent builds on the exchange of knowledge between the specialist competences of the archaeologist and knowledge systems based in the life-long engagement with a local agrarian landscape. Applied archaeology for rural development can bridge the potential discrepancies between antiquarian concerns for the protection of the cultural heritage, conservationist agendas to promote biodiversity, and local economic development, linking these in a common goal of locally managed sustainable agrosystems with low external inputs.

Reference


*Keywords: Applied archaeology, agro-archaeology, rural development, Bolivia.*

**Measuring the contribution of diversification to rural income growth in sub-Saharan Africa**

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Global poverty has declined during the past 30 years mainly due to rapid economic growth in several Asian countries. Still, though, almost a fifth of the world’s population lives in extreme poverty. Of those, a majority lives in the rural areas and relies, directly or indirectly, on the agricultural sector for both food and their livelihood. To increase rural incomes is therefore a crucial element in order to reach the UN Millennium Development Goals to halve the proportion of people whose income is less than $1 a day between 1990 and 2015. An important strategy for increasing the incomes of small-scale farmers in developing countries is to help them diversify from low-value commodities into higher-value commodities, such as livestock, dairy products, fish, fruits, vegetables and spices. The demand for these products in both developed and developing countries is rising as increased globalisation expands markets for non-traditional agricultural exports and urban growth in poor countries creates new sources of demand from the affluent parts of the urban populations. The purpose of this study is to investigate to which degree rural poverty can be reduced by income diversification in agriculture. More precisely, the project analyzes how much diversification is occurring, which households are participating and what kind of income diversification strategies proves to be most successful. The results have implications for agricultural policy and the design of extension programs.

The project is undertaken in cooperation with the *International Food Policy Research Institute* (IFPRI) in Washington D.C. who has undertaken a series of studies in Asia to investigate whether the rural poor can benefit from changing food consumption patterns in the region and growing global demand. This project extends the analysis made by IFPRI regarding income diversification into high-value agricultural commodities to sub-Saharan Africa, in particular to Uganda, and incorporates the specific problems faced by countries in this region into the analytical framework. Conclusions are drawn regarding policy changes needed to support poverty alleviation by accelerating growth in the production of high-value agricultural commodities in the region.
Mechanisms for cytosolic Na\(^+\) homeostasis in rice under salt stress

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A high concentration of Na\(^+\) in the plant cytosol interferes with many K\(^+\)-binding enzymes and, thus, hinders the metabolic activities in cells and is termed as Na\(^+\) (ionic) toxicity. We described two important aspects of Na\(^+\) toxicity in rice (Oryza sativa L. cvs. Pokkali and BRRI Dhan29) cells: i) how Na\(^+\) is transported into and out of cells, and ii) how cells react by changing cytosolic Ca\(^{2+}\) and pH for activation of the adaptive responses. Experiments with single rice protoplasts, fluorescence microscopy and specific ion-selective dyes suggest that Na\(^+\) must be sensed inside the cytosol, before any prolonged changes in [Ca\(^{2+}\)]\(_{cyt}\) and [pH]\(_{cyt}\) occur. Inhibitor analyses show that Na\(^+\)-induced increase in [pH]\(_{cyt}\) in the tolerant cv. Pokkali, and a decrease in [pH]\(_{cyt}\) in the sensitive cv. BRRI DHan29, likely are coupled to different H\(^+\)-ATPases. Under salt stress the ability to reduce Na\(^+\)-influx into the cytosol, and subsequently increase the compartmentalization of cytosolic Na\(^+\) into the vacuole, appear to be the significant salt-tolerance determinant in the salt-tolerant rice cv. Pokkali. These mechanisms were either absent, or less efficient, in the salt-sensitive rice cv. BRRI Dhan29. Expression analysis of OsHKT2;1 (previous name OsHKT1), OsHKT2;2 (previous name OsHKT2) and OsVHA transcripts in rice, using RT-PCR and fluorescence in situ-PCR, shows a variable and cell-specific induction/down-regulation in the two rice cultivars under salt stress condition. The low [Na\(^+\)]\(_{cyt}\) in cv. Pokkali might depend on the fast down-regulation of OsHKT2;1, causing less uptake of Na\(^+\), and the fast up-regulation of the OsVHA transcript, and subsequent activation of the Na\(^+\)/H\(^+\)-antiporter in the tonoplast. To decrease the cytosolic Na\(^+\)/K\(^+\) ratio under Na\(^+\) toxicity, cv. Pokkali may also induce increased uptake of K\(^+\) through induction of OsHKT2;2, and other specific K\(^+\)-transporter genes.

Keywords: Rice; salinity stress; Na\(^+\)-toxicity; vacuolar compartmentalization.

Potato moth challenges potato growing in Latin America. 2. Designing efficient and environmentally safe control methods.

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The Guatemalan potato moth Tecia solanivora is the most devastating pest of potato in Central America and adjacent South American countries. It has only recently emerged as a pest of potato, and the growers are not prepared to control this insect. Females enter soil crevices to oviposit close to potato tubers, and the larvae feeding inside the tubers are protected from insecticide sprays. Harvest losses frequently exceed 50\%, despite multiple insecticide treatments. Important losses occur even in storage facilities, where fresh potatoes must be protected with further sprays.

We aim to design a dual control strategy, using synthetic pheromones in the field for disruption of mating flights, and plant volatiles for mass-trapping of egg-laying females in storage.

Tecia solanivora moths hide in the soil during most of the day and are on their wings only prior to mating and oviposition. Pheromones have an advantage over insecticides for control of this insect, since they enable behavioural manipulation of moths aboveground, during their activity period. In 2007, a field trial on ca. 10 ha has been completed, for comparison of pheromone application techniques and two different pheromone blends. These tests confirm earlier studies that mating disruption can become an efficient control strategy (1) and lead to refined tests in 2008.

Both flowering potato plants and tubers attract gravid T. solanivora females for egg-laying. Chemical identification of these volatiles may lead towards efficient and inexpensive mass-trapping technique, especially for use in rural household storage.

Volatile were collected from potato foliage at different phenological stages, sprouting, tuberization and flowering, as well as from potato tubers. The collections where analysed by gas chromatography and mass-spectrometry (GC-MS) and screened with the moth antenna (GC-EAD)
for bioactive compounds. A number of esters, alcohols and terpenoids released from young leaves, flowers and tubers elicited a strong antennal response. Interestingly, some of these compounds co-occur in flowering foliage and in tuber headspace. Behavioural assays of the female attraction and oviposition response towards the identified compounds are the next step.

Our first results confirm the potential of pheromones and plant volatiles for development of sustainable control techniques against Guatemalan potato moth.

(1) Bosa CF, Cotes AM, Osorio P, Fukumoto T, Bengtsson M, Witzgall P. 2006. Disruption of pheromone communication in *Tecia solani* *vora* (Lepidoptera: Gelechiidae): flight tunnel and field studies. *J econ Entomol* 99:1245-1250

Key words: Guatemalan potato moth, semiochemicals, pheromone, plant volatiles, insect control

Assessing soil fertility change from farmers’ perspective and using bioassay test in Beseku, Ethiopia

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Most soil conservation efforts in Ethiopia have failed due to top-down, interventionist approaches where farmers themselves have been excluded from any influence over the design and resource allocation in the soil conservation projects (Yeraswork, 1998). In participatory approaches one attempts to work together to reach a common understanding between farmers and researchers concerning problem definition and design of abatement strategies. In earlier studies we have followed the decline in soil fertility of Humic Haplustands with time after deforestation and conversion to agriculture in the Ethiopian highlands (Lemenih et al. 2005a; Lemenih et al. 2005b). In an ongoing project we are trying to find measures to make the soil quality last. One key element in participatory approaches is to reach a common understanding of key concepts in the problem at hand, in this case soil fertility. In interviews we have asked farmers how they judge soil fertility. In an attempt to test these indicators we let 27 male and female farmers rank seven different soils collected from different fields in the Beseku village according to their perception of soil fertility. We compared the ranking with measurements of loss on ignition (LOI, 550°C). Farmers ranking closely followed the LOI measurements. Twenty-two (22) of the 27 farmers ranked the soil sample having the highest LOI as the most fertile soil. Ten (10) farmers ranked the soil with the lowest LOI as the poorest soil despite a very small difference in LOI (<1%) compared to some of the other soils.

Soils from the seven different fields were also used in a green-house experiment. There was a close correlation between total maize biomass production and farmers’ ranking of soil fertility. We will continue to collaborate with the farmers and test different measures to enhance soil fertility in on-farm trials.


Keywords: Ethiopia, soil fertility, participatory soil fertility management
Improvement of milk production in smallholder dairy farms in Vietnam

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The overall aim of this research project is to improve milk quality and milk quantity in Vietnam by identifying problems and possibilities in the milking and management routines. Dairy production was introduced to the south of Vietnam in 1989 when the demand of the domestic market dramatically increased. Although a few large-scale (i.e. more than 100 cows per farm), modern dairy farms have been established in the peri-urban areas small dairy farms are still, system contributing 90% of the total milk volume produced. However, the dairy farmers still have little practical experience and the smallholder dairy sector requires improvement for further development of the milk production.

The first part of the project was a survey study, carried out in the peri-urban areas of Ho Chi Minh City, located in the South of Vietnam. The objective was to obtain information and increase the knowledge about smallholder dairy farms in order to identify some factors of importance for dairy production in Vietnam, which could be improved by management at farm level. Data on milk production and management routines were obtained using a 56-point questionnaire and field observations at 120 smallholder dairy farms in the two districts, Cu Chi and District Number 12. Feed samples were collected from all farms and milk samples from 360 cows. Results of the survey show that the average herd size was 12 animals (ranging from 2 to 17) and lactating cows were the major proportion in the herd structure (6 cows per household). The main breeds of dairy cattle were crossbreeds with a high proportion of Holstein Friesian at F2, F3 and F4 (95.8%), and 4.2% F1 crossbred Sindhi. The total diet (DM intake) on average consisted of 34% concentrates, 47% roughage and 19% by-products. Hand milking was practiced in 91.4% of the farms, and 9.6% of farmers had purchased a milking machine. Further, almost none of the farmers used any solutions for cleaning the teats at the start of milking. Daily milk yield was 16 kg/cow and there was a large variation in the milk composition between the farms. The milk somatic cell count (SCC) was high in all of the surveyed farms, with an average of 1300 x10³ cells/ml milk. It was concluded that milking management is one of the most important factors to improve, due to the high level of milk SCC in the studied farms.

Further work in this project will include a) Effect of hand milking, machine milking and teat cleaning routines on milk quality and udder health, b) High somatic cell counts (subclinical mastitis) in relation to herd size, management and milking routines.

This project is a part of the MEKARN-project financed by Sida SAREC.

Key Words: milk quality, questionnaire, smallholder dairy farms, milk SCC

MEKARN (Mekong Basin Animal Research Network); an example of a successful regional network for education, research and information exchange in sustainable livestock production

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The Department of Animal Nutrition and Management at SLU has since 1989 co-operated with several universities and institutes in Vietnam in a bi-lateral program financed by Sarec. MEKARN includes co-operation with 14 universities and research institutes in Vietnam, Laos, Cambodia and Thailand and SLU and the program is headed by a Steering Committee with a representative from each country. The administration of the program is headed by a Vietnamese co-ordinator based at the University of Agriculture and Forestry (Nong Lam), Ho Chi Minh City, Vietnam.
Research and training in the program are focused on the role of livestock in integrated smallholder systems in SE Asia - especially nutrition and feeding - in order to improve the productivity and sustainability of these systems.

MEKARN includes principally four different activities: MSc program, PhD program, Research fund and Networking.

The MSc program starts every second year with 16 to 18 students from the four Asian countries. The program has been 60 credits: 21 months, 6 months courses and 15 months research and writing of the thesis. The courses are given in all 4 SE Asian countries, the research work is done at the home institution and the writing and presentation of the thesis at Nong Lam University with a board of international examiners. Teachers and supervisors come from all the collaborating countries, and program leaders and diploma from SLU. The education will be adapted to the Bologna model for the coming course.

The PhD training is 4 years and based on the sandwich model with all the research work done in the home country and course work and writing of the thesis in Sweden. In general around 18 months in total are spent in Sweden and the PhD diploma is awarded by SLU. There has been financing for around 10 students per year in the program and most of the students are able to finish within 4 years.

The research fund will distribute 200,000 USD per year in the coming project period. Any researcher connected to the participating universities and research institutes are encouraged to apply for funds. The applications are evaluated and decisions about the grants taken by a research committee consisting of representatives from the steering committee and international researchers. Last year the fund received 73 applications and the grants varied from 4000 to 6000 USD.

The networking consists of continuous education for researchers, PhD courses for students, workshops and seminars in specific subjects. The MSc theses, workshop proceedings etc can be found on the MEKARN homepage [http://www.mekarn.org](http://www.mekarn.org).

During the first two project periods from 2001-2007, 51 MSc and 11 PhD theses were presented and about 60 papers published in international journals.

Key words: MSc/PhD training, livestock systems, smallholders, sustainable

Pigs in Urban farming – an economical opportunity but a public health hazard?

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By 2030, it is estimated that more than 60% of the global population will live in large cities. This rapid increase of urban dwellers is increasing the demand on farming in and around urban areas. Already, this urban and peri-urban agriculture (UPA) supply food to about 700 million people in the cities worldwide. Food security may be improved by UPA and there is an opportunity for economical growth for small-holders through local markets. Typical challenges for UPA are restrictions in access to land and water, and sanitary aspects. The latter is very much related to UPA with livestock farming and its handling of dung and manure. Unfortunately livestock may also serve as reservoirs for pathogens dangerous to humans, i.e. for zoonotic pathogens.

As a well known example, the current transmission of highly pathogenic avian influenza to humans is an effect of humans living in close proximity with poultry. Hence, the close contact between livestock and man in UPA is a public health concern, both regarding general sanitary aspects and the transmission of specific zoonotic infectious diseases. Obviously, this concern is a constraint and challenge for the development of livestock farming in UPA. In this project we will focus on one mosquito-borne zoonotic infectious disease that spreads from pigs to humans, the Japanese encephalitis (JE). This infection is numerically the most important cause of epidemic encephalitis in humans and is geographically expanding despite the availability of vaccines.

In the current project, we will survey the pig production in and around two cities in the Mekong Delta in southern Vietnam, compare the density of vector-mosquitos close to pigs and far away in the cities, analyse the proportion of virus-carrying vectors by PCR and the numbers and proportions of infected pigs by Elisa-serology.
The data generated in these studies will give novel information on the presence and importance of JE-virus in UPA as well as provide generic and unique knowledge about vector born zoonotic diseases in UPA. The results will be presented and discussed at workshop with relevant stakeholders in Southern Vietnam. The aim of that workshop is to identify recommendations for UPA with pig farming in the region.

Key words: Urban farming, Pigs, Japanese Encephalitis Virus, zoonosis

Development of a new variety of rice (Oryza sativa) for effective prevention of people and their environment from arsenic contamination

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Rapid sequencing of human and plant genome has created a large potential for modern biotechnology. Using bioinformatic and biotech tools we can now identify specific genes of our interest and predict their function much faster than by using conventional methods. This project is a part of our scientific collaboration between University of Skövde in Sweden and University of Rajshahi in Bangladesh. We have initiated this project in October 2007 and it is financed by a grant from FORMAS-SIDA/SAREC.

The fundamental goal of our research is to eliminate/reduce arsenic contamination of the staple food rice in Bangladesh. This would protect more than 30 millions people in this country from rice-derived arsenic contamination resulting severe damage of kidney, liver, lungs, bladder etc and many other neurological and vascular disorders. To achieve this goal we will generate a genetically modified variety (or varieties) of rice either by inhibiting/activating native gene(s) responsible for arsenic uptake or by insertion of foreign genes responsible for arsenic metabolism “in planta”. We will also attempt to improve the molecular mechanisms involved in localization of arsenic to vacuoles of the root cells.

For identification and characterization of these genes, gene products or other “second messengers” we will initially employ data mining, an in silico analysis based on searching of the existing genomic databases. As an alternative to in silico analysis we will also screen available T-DNA insertion mutants for identification of target genes. Results obtained in both in silico analyses and screening of T-DNA insertion mutants will be then utilized for designing gene cloning experiments e. g., cloning of target genes by PCR, inverse PCR, RT-PCR or plasmid rescue. The cloned target genes will be studied in heterologous systems such as the yeast or E. coli. Vectors containing the target genes will be constructed for transformation of rice. For validation of the transgenic results we will also include Arabidopsis thaliana as a model plant in our experiments. Both transgenic rice and Arabidopsis will be then exposed to arsenic contaminated soil and the results will be studied.

Data mining experiments performed at the University of Skövde resulted in identification of four candidate genes that are involved either in uptake, transport or cellular localization of arsenic in plants. However, there is only one candidate gene that might be involved in arsenic metabolism in rice. We are now studying the 3-D structures of these genes for further understanding of their function. At the University of Rajshahi, we already have elaborated an efficient protocol for transformation and regeneration of transgenic rice cultivated locally in the arsenic contaminated region of Bangladesh.

Keywords: Arsenic contamination, Bangladesh, Bioinformatics, Genetic modification, Rice
Modelling metal binding and accumulation in Vietnamese soils treated with biosolids and wastewater

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In northern Vietnam, biosolids and wastewater are used as fertilizers in agriculture. However, these materials may contain elevated concentrations of trace metals because of, e.g., insufficient pollution control in local industries. As a result, trace metals accumulate in the soil, which can lead to increased plant uptake and leaching to water bodies, and associated human health and ecotoxicological risks. The long-term risk caused by metals is dependent on soil chemical reactions such as adsorption to organic matter, (hydr)oxides and clay. Thus to predict the risk for serious soil pollution arising from biosolids and wastewater, geochemical models may be developed that take these reactions into account.

We used state-of-the-art geochemical models to investigate whether they could describe the binding of cadmium (Cd), chromium(III) (Cr), copper (Cu), lead (Pb), manganese (Mn) and zinc (Zn) to eight Vietnamese agricultural soils. Two multisurface models, taking into account the binding of metals to organic matter, (hydr)oxides and clay, were tested. Both models used the Diffuse Layer Model for metal sorption to (hydr)oxides, and the Gaines-Thomas equation for metal binding to clays, but they used different submodels for organic complexation (the Stockholm Humic Model and NICA-Donnan model, respectively).

There was no systematic difference between the models regarding their general performance. The results showed that both models could predict the dissolution of Cd, Cu and Zn from the soils reasonably well, usually within a factor of 2-5 from the observed values. However, both models performed rather poorly for Cr(III), Mn and Pb. In addition, the models predicted the soil pH and the content of organic matter to be the single most important factors that govern the fate of the trace metals (e.g., Khai et al., 2008). In a follow-up study we used a calibrated geochemical model to predict the maximum allowable soil concentrations of Cd, Cu and Zn that do not cause excessive leaching of metals to groundwater. Again, the model simulations show that the final result is heavily dependent on assumptions regarding soil pH and organic matter content. In the more weathered Acrisol soils (in particular Cd) accumulation up to the present maximum allowable concentrations (MAC) would lead to excessive metal leaching. Thus to prevent environmental pollution risks, it is essential to keep the soil pH and organic matter content at sufficiently high levels; however, the best way to reduce the long-term risks would of course be to reduce the metal concentrations of these fertilizer materials. The results also indicate that the present Vietnamese MAC for Cd in soils (2 mg kg⁻¹) can be too high in certain soil types.

Keywords: trace metals, geochemical models, organic matter, pH

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Constraints and possibilities for milk production in Burkina Faso

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The aim of this on-going research project is to identify constraints and possibilities for milk production in Burkina Faso. Milk consumption in Burkina Faso is as low as 10.2 litre per person and year in urban areas and it is believed to be even lower in rural areas. The most common dairy cattle in Burkina Faso, like in most West African countries, is the Bos indicus, also known as Zebu. The Zebu is well adapted to the environment but their low milk production is a problem, both for farmers and consumers. Very little data is available on Zebu milk production and about
dairy cows and dairy farms in Burkina Faso. This makes it difficult to help farmers to increase and improve dairy production.

The first part of the project was a survey study, which was carried out around two large cities in Burkina Faso, aiming to contribute to the understanding of the situation of local milk production and milk processing in peri-urban areas where the demand for dairy products is increasing rapidly. Twenty-two dairy farms associated with nine dairy processing units were selected for the study. Two separate questionnaires were used to investigate the prerequisites for milk production and milk processing and the interviews were carried out from August to October 2006. In addition to the interviews 110 milk samples from individual cows, 22 farm tank milk samples and nine dairy tank milk samples were analyzed.

Results of the survey showed that daily milk yield was 1-2 litres per cow in sedentary traditional farms and 2-4 litres per cow in semi-intensive farms. Milk temperature at dairy farm level (32.5 ± 4.6 °C) was an important factor reducing milk quality before reaching the collection centre. Milking was done by hand on all farms. According to the survey, the use of cottonseed cake in the diet resulted in higher milk yield per cow, both during the rainy and dry season (Chi-square = 9.32; P = 0.01). The use of crossbred cows was also related to higher daily milk yield per cow (Chi-square = 31.80; P = 0.001). It was concluded that more extensive supplementation of diets and cross-breeding would improve milk production in Burkina Faso. Furthermore, milk cooling systems at farm and at dairy processing level are needed.

Further work in this project will include 1 monthly milk recording from individual cows at farm level in order to generate data on variation between cows and farms in milk yield and length of lactation, 2 day-to-day variation in milk production in individual cows, 3 the effect of different hand milking techniques on teat health and milk quality and 4 hygiene of raw milk at dairy farms, local markets and milk processing units in the rainy and in the dry season.

This project is part of a research cooperation programme between Swedish universities and universities in Burkina Faso and SIDA is greatly acknowledged for funding the work.

Key words: dairy farm, dairy processing unit, milk composition, milk quality, zebu

Title of work: Livelihood strategies in a changing environment: Umutara case study in Eastern part of Rwanda

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The majority of Rwandan population lives in rural areas and depends primarily on farming activities for their livelihoods. The rural population density remains among the highest in Africa and has been a source of pressure on land available. Contrary to other regions that present very high population densities confined to a very limited land base, Umutara area located in the Eastern Province presents a particularity of having been, in its big part, humanized in the aftermath of 1994 genocide. Hence, it presents relatively lower population densities. However, from the last decades, the area has been characterized by unprecedented land use dynamism that needs to be investigated. In fact, land distribution, massive population settlement and subsequent rapid land exploitation have triggered off land use activities leading to visible environmental changes. In parallel, the population strives to cope with new challenges in adapting their livelihood strategies to land resource changes and land scarcity resulting from excessive exploitation.

The paper presents an ongoing study of different processes revolving around population-environment relationship with special regards upon land uses and their impacts. The overall aim of the study is to understand how local farmers change their physical environment through crops growing and livestock rearing and how they, in turn adapt to the effect thereof by developing various adaptive strategies. A theoretical framework is discussed drawing upon the “political ecology” theory, “livelihood framework”, the “frontier”, and “intensification” concepts. In the methods, both quantitative and qualitative approaches are used with focus on structure and actor orientation.
Some results have already been obtained and the material processed pertains to the population dynamics in the study area as well as the household characteristics. It appears that the areas under study have been occupied mainly by immigrants at different time periods. Whereas the number of persons per households remains high in various areas, the education level is still low with very high rate of illiterates among advanced aged groups. On the other hand, the active population is very reduced and the main activities are either cropping, livestock rearing or the association of both.

**Keys words:** population growth, land use dynamics, environmental changes, adaptive strategies

**References:**


**Food security and Climatic Change Effect on Pakistan Agriculture.**

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Agriculture in Pakistan is affected due to climatic change and environment pollution, due to these condition the agriculture food supply become shortage in the country and not able to full fill the growing demand of the country. The main reason is the illiteracy in the country which is 58% in the urban areas , while the Pakistan economy is based on agriculture and more than 70% population is living in the rural areas where the illiteracy is more than 75% .Due to illiteracy the farmers are not able to cope up with the changing situation and new methods of agriculture. They may be able to save about 40% loss of fresh produce , which resulted due to pre and post harvest technology lacking in this country. But due to lack of advance technology and knowledge and use of biotechnology and genetic engineering is absent and climatic conditions the soil erosion, water logging, salinity, deforestation, and carbon di-oxide emission have pushed the Pakistan agriculture into to the position that now the country depends upon the import of fresh produce to meet the country ‘s demands, which put lot of Burdon on Pakistan economy and its progress towards the prosperity and sustainability.

On the one hand, the nation needs more food to fulfill the demands of its increasing population while on the other hand, each year the cultivable commanded area is decreasing due the water logging, salinity and erosion and deforestation. The climatic change and high temperature results into shortage of irrigation water supply, due to high evaporation rate and as a result of climatic change the season of cropping pattern have shifted toward north pole, This bring shortage of food supply to feed supply to feed the nation, under such circumstance the only solution for survival is to take the help of genetic engineering and biotechnology to develop and evolve species of crops that can survive under harsh condition, resist to drought and have short life span, with better nutrition and shelf life.

Key words. Climate, food security, biotechnology, Sindh.Pakistan.
Demographic, socio-economic and environmental impact of AIDS in rural Tanzania
Franz-Michael Rundquist, Mikael Hammarskjöld, Petter Pilesjö and Ulrik Mårtensson

Although adult HIV prevalence rates in Tanzania never reached the very high levels of its southern neighbours, it is one of the countries in the world worst affected by the AIDS epidemic. In December 2006 an estimated 1.4 million adults and children in the country were living with HIV. The first AIDS case in Tanzania was identified in Bukoba district, Kagera Region, in 1983, and by the end of the 1980s the epidemic had spread all over the country. In the region, in 1987, prevalence rates were ranging from between 0.4 and 10 percent in rural Kagera, to as high as 24.2 percent in the Bukoba urban area. The worst-affected regions of the country in 2004 were Mbeya and Iringa with HIV prevalence of more than 15 percent in some urban areas.

The paper is the first part of the reports from an ongoing research project on the consequences of AIDS in SSA, particularly Tanzania. The underlying premises for this paper are that the drastic increase in adult mortality due to AIDS has caused changes in population and household structures, which in turn have impacted on rural production patterns, labour use and thus also on the environment. The purpose of the paper is threefold:

- To discuss and present possible AIDS-related demographic changes that can be identified in Tanzania at national and regional levels using national census data;
- To present possible AIDS-related changes that can be identified in land-use/land cover patterns over time in the Kagera and Iringa Regions by using remote sensing and Geographical Information Systems (GIS);
- Against this background discuss the impact of these demographic and resulting environmental changes on rural production and livelihoods using a wide range of published case studies and other secondary sources;

Keywords: AIDS, GIS, Demography, Land-use

Application of charcoal to soils in Western and Central Kenya – initial analysis of effect on maize yields and soil properties
K. Roing, O. Andrén, L. Chibole, L. Nyambega

Land degradation is a major cause of food insecurity and environmental degradation that affects most people in Sub-Saharan Africa. TSBF-CIAT has been addressing these constraints by using the Integrated Soil Fertility Management approach that increases land productivity and alleviates poverty by providing technology options that increase farmers income. Understanding how different soil fertility amendments influence soil nutrients can improve our knowledge of agricultural practice that enhance C sequestration and provide sustainable management options.

To determine the effect of charcoal, or inert “black carbon”, on soil properties and production potential, a field trial was initiated in November 2006 in four locations in Central and Western Kenya. Trial design consisted of three main treatments (black fallow, maize, maize + fertilizer) and two sub-treatments (application of 5 kg charcoal m⁻²). Soil properties and maize harvest were monitored on a seasonal basis. The trial is still on-going.

Initial results on effect of charcoal application on maize yield and some soil properties will be presented and discussed.
A graduate research school in “Global Natural Resource Management and Livelihoods” at SLU

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The need to manage the world’s natural resources responsibly for coming generations continues to pose a global challenge socially, economically, politically and academically1. Understanding these issues requires a combination of skills and disciplines that have as a pre-requisite interdisciplinary collaboration and research training. Traditionally, the Swedish University of Agricultural Sciences (SLU) has had a strong foundation in the natural sciences with doctoral students training strictly in a “narrowly” defined discipline. Enhanced understanding that one discipline alone cannot presumptuously solve a problem, a number of researchers as well as doctoral students at SLU have expressed the need for transdisciplinary training courses as well as interdisciplinary research programmes.

Partnerships built with SLU and partners internationally have led to long-lasting fruitful contacts of mutual interest. A large number of doctoral graduates, scientific publications and innovative ideas have culminated in new research fields and methods and continue to stimulate research and development. Some of the methods and results have originated out of experience while collaborating with low-income countries and have provided solutions to problems in middle and high income countries. The formation of a research school on “Global Natural Resource Management and Livelihoods” provides an opportunity for researchers and doctoral students within the faculty to engage in these issues within a particular academic environment. A graduate school with an understanding of the complexities involved in global natural resource management, with a flexible organization leading to possibilities of taking fast initiatives can be a powerful springboard to firmly establish SLU as an internationally renowned research and educational institute.

The main purpose of the graduate school is to provide a forum for both researchers and doctoral students to engage in wider debate beyond traditional disciplinary boundaries and to equip graduates with the tools and skills to work with and in the context of natural resources.

Specific aims and activities of the graduate research school will be presented and discussed.

Effect of season and feeding during late pregnancy and early lactation on the performance of Zebu cows and calves

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The effect of supplementation 8 weeks before and/or 5 weeks after calving in the wet and dry season on cow and calf performance was studied using 24 pregnant Zebu cows in each season. During pregnancy the cows were randomly allocated to two treatment groups of 12 cows and after calving six cows in each group were again allocated to two treatments. All cows grazed natural pastures 8 hours/d and the treatments both before and after calving were: grazing only, or grazing and supplementation with cottonseed cake and molasses. The cows were milked twice per day and the calves were allowed to suckle after each milking. The weight of the cows after parturition was similar among treatments but significantly higher in the wet season. All cows, except the unsupplemented cows during the wet season, gained weight during the first 5 weeks of lactation. Pre-partum supplementation of the cows significantly increased the birth weights of the calves during both dry and wet season. Calves from cows supplemented pre- and post-partum gained 380 and 307 g/d and calves from unsupplemented cows 271 and 185 g/d in the wet and dry season,

Ostrom E and Nagendra H (2006). Insights on linking forests, trees, and people from the air, on the ground, and in the laboratory. Proceedings of the National Academy of Sciences 103(51):19224-19231
respectively. The total milk yields for cows supplemented pre- and post-partum were 5.02 and 4.24 kg/d and for unsupplemented cows 2.65 and 2.18 kg/d in wet and dry season, respectively. There were no significant differences in milk composition due to treatment. The best performance of cows and calves was obtained with supplementation both before and after calving, but supplementing during lactation only may give a better return than supplementing during pregnancy.

Key words: Milked yields, suckled yields, milk composition, growth, weight changes

Do conservation and intensification have their limits? The challenges of food security and reduced vulnerability amongst the Konso People of Southern Ethiopia

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The Konso people of Southern Ethiopia have been known for their conservation practices and complex mixed farming systems where trees played a central role. Their well known terraces helped them conserve biodiversity, soil and moisture in areas where drought are common. Recently, the people have become dependent on food aid and studies show they are more vulnerable than before. The present study explores vulnerability over time, adaptation and coping strategies, local institutions, effectiveness of development interventions, and the evolving role of trees in the Konso’s livelihood system.

Five randomly selected Farmers Associations in Konso District, Southern Nations Regional State, Ethiopia were in the study. The livelihoods framework was used to guide the research with due recognition of its limitations when it comes to the study of natural resources management. The study employed key informant interviews, focus group discussions, and a formal survey to gather data. Findings were then presented to communities and experts through workshops. The study is on-going.

The major factors contributing to food insecurity are frequent drought, high population pressure leading to reduction in farm size, and declining soil fertility. This made most households food insecure even during normal years. Responses of households, the community and the government vary. Household strategies include reducing consumption, seeking food aid, using emergency foods, temporary out migration, selling firewood, borrowing money and eventually selling household assets. Community level responses are working together to renovate soil and water conservation structures, planting on community lands and sacred forest places, and supporting needy households with food grains and engaging in shared livestock rearing arrangements to help build assets. Government and NGOs provided food aid to the poor through food for work programs that also improved access to credit, health, education, and safe water and promoted soil and water conservation activities, and tree planting on private and communal lands.

Despite these, the number of food insecure households has increased over time. Major stakeholders believe that the interventions to address food insecurity in Konso have not been as successful as expected. Local officials see food aid as means to help people build asset and come out of poverty. Farmers, particularly non-beneficiary farmers, see it as a mechanism that promotes dependency and erodes the hard working culture of Konso people. Local institutions, indigenous methods of land management, socio-cultural support systems and networks that enabled Konso to cope with drought and food crisis in the past do not seem adequate today. This leads to a number of questions. Have the conservation efforts reached their limit given the population pressure and drought frequency? How can diversification to non-farm activities help reduce vulnerability and build assets? How can on-going support schemes be rethought to assist in this transformation and to help households build assets? What roles could local institutions and social net works play? What roles can trees play in this dynamics? What form of multi-sectoral approach would recognize the trade-offs between conservation and livelihood outcomes given that the increasing frequency of drought is limiting annual crop production and demand for fruits and construction wood in the nearby urban areas is growing?

Key words: Conservation, vulnerability, food insecurity, Konso, Ethiopia
Yields from Sida training programs on "Sustainable Agriculture in an Environmental Perspective"

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During the period 1998-2004 seven Sida programs on “Sustainable Agriculture in an Environmental Perspective” were arranged in Sweden with altogether 159 participants from 41 countries, each program lasting seven weeks. The topic is broad and teaching covered many aspects such as agro-ecology, crop production systems, biodiversity and plant breeding, environmental management systems, waste management, policy instruments and food safety issues. In 2006 two follow-ups were arranged, one in Kenya and another in Vietnam. Via these and E-mail networks we have been able to monitor the usefulness of the program. We will give examples of activities where the training program is believed to have had impact.

Towards the mitigation of environmental and public health risks due to heavy metal contamination in irrigated rice-based systems of Vietnam

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In many developing countries, there is a growing awareness of the potential for food production systems to become contaminated with heavy metals through rapid industrialization and urbanization. There is, however, very little evidence that heavy metal contamination, e.g. of soils, water and food crops, is a generic problem in SE Asia. Despite this, major concerns have been raised at local levels that include some serious implications for human health and the environment. The aim of this project was to assess the environmental and public health risks associated with heavy metal contamination in irrigated rice-based systems of Vietnam. Data on the concentrations of metals in paired soil and rice samples were combined with process oriented laboratory studies and soil chemical modelling. In order to estimate risks to specific population sub-groups, self-reported questionnaire data are being used to link measured concentrations of metals through to exposure via contact with soils, the environment, and through consumption of rice. The project will provide local communities and authorities with background data to support improvement and implementation of policies related to environmental and food safety.

The study sites were farm villages located adjacent to large industrial units (chemical fertilisers, batteries etc) or cities, and/or that had an economy reliant on household/farm-scale industry, e.g. metal recycling or brick production (both requiring significant coal burning). In half of the villages domestic/industrial wastewater was used for irrigation whereas river water was applied in the other villages (reference sites). Analyses of soil and rice were used to identify ‘hot spots’ where concentrations of heavy metals were elevated. The household survey identified potential pathways for metal exposure (e.g. food and drinking water supplies and intake, off- and on-farm occupational activities), and population sub-groups that may be more vulnerable or sensitive to the potential exposures. In the risk assessment we will explore associations between the biophysical data and the data from the household questionnaire (1). The environmental concerns, i.e. risk of soil accumulation and leaching losses to water, are being studied by applying soil chemical models (2). The results from the soil-rice survey, so far, indicate that some of these villages are heavily affected by metal emissions. However, in villages mainly using domestic wastewater for irrigation concentrations of metals were not significantly different to background levels. At some sites cadmium (Cd) concentrations in rice exceeded the maximum level set by FAO/WHO (0.4 mg kg⁻¹) (3), and 20% of the sites were above the EC limit (0.2 mg Cd kg⁻¹) (4). Also lead (Pb) sometimes exceeded the EC limit for rice (0.2 mg Pb kg⁻¹) (4). Results are still being evaluated and the risk assessment modelling for metal exposure is presently being undertaken. We can thus conclude that in certain ‘hot spot’ areas soil and crop quality may be compromised. In turn, this may lead to concerns and risks for food safety and human health.

Keywords: food safety, environmental contamination, health risk, metal exposure
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