# Integrated Soil Fertility Management in Africa: from Microbes to Markets (ISFM Africa 2012)

## Conference Information, Program and Abstracts

A short history of ISFM in Africa is captured in this series of quotes ...

*The soil nutrient losses in sub-Saharan Africa are an environmental, social, and political time bomb. Unless we wake up soon and reverse these disastrous trends, the future viability of African food systems will indeed be imperiled.* Norman Borlaug, 2003

*The African Union Member States resolve to increase the level of use of fertilizer from the current average of 8 kilograms per hectare to an average of at least 50 kilograms per hectare by 2015.* African Fertilizer Summit, 2006

*ISFM is the application of soil fertility management practices, and the knowledge to adapt these to local conditions, which maximize fertilizer and organic resource use efficiency and crop productivity.* Bernard Vanlauwe, 2009

*An overall nutrient supply strategy "N from the air and others from the bag" offers flexible adjustment to local conditions and opportunity for optimizing the use of available agro-minerals. ... ISFM empowers farming households to wiser decisions concerning crop enterprise and resource management on a daily basis.* Nteranya Sanginga and Paul L. Woomer, 2009

*But how far have we really come to assure that small-scale farmers have the knowledge, technologies and products to engage with ISFM and what must we do to move forward more effectively in the future?* ISFM Africa 2012 Organizers

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Cover design by Paul L. Woomer. Line drawings by Nicholas Mwema.

1520 - 1540 Health break and poster viewing. Poster presentations C33 to C51

1540 - 1600 Multi-functionality of agroforestry systems; Can integration of trees and crops contribute to enhance agricultural productivity, resource utilization and livelihoods for smallholder farmers? A quantitative approach. *Ingrid Öborn*
1600 - 1620 Drivers of rhizobial diversity in soils of smallholder farms in Malawi. *Anne Turner*
1620 - 1640 Agroforestry: An alternative soil fertility paradigm. A case of soil fertility management in Western Kenya. *Nelson Mango*
1640 - 1700 Discussion on BNF by tree legumes and fallow systems

***Afternoon Concurrent Session B2: BNF by grain legumes***
Chairperson: *Dr. Paul Mapfumo*

1400 - 1420 Effect of planting time on soybean yield and biological nitrogen fixation in Southern Rwanda. *Ruganzu Vicky*
1420 - 1440 Effect of N, P and inoculation on growth, nodulation, $N_2$ fixation and yield of promiscuous and non-promiscuous soybean. *Carlos Muananamuale*
1440 - 1500 Legume response to inoculation with rhizobium in Kivu, DR Congo. *Masamba Walangululu*
1500 - 1520 Effect of planting density on yield of a soybean-maize intercrop in Western Kenya. *Margarida Simbine*

1520 - 1540 Health break and poster viewing. Poster presentations C33 to C51

1540 - 1600 Strategies for enhancing common bean productivity in Kenya. *Catherine Kibunja*
1600 - 1620 Organic production of cowpea in mixed culture with sorghum. *Tenebe Ado*
1620 - 1640 Plant density and mineral fertilizer affect groundnut yield in Northern Mozambique. *Henriques Colial*
1640 - 1700 Discussion on BNF by grain legumes

***Afternoon Concurrent Session C: Theme 3: Exploring options for sustainable intensification and diversification of farming systems (continued)***
Chairperson: *Dr. Daniel Mugendi*

1400 - 1420 Effects of soil and water conservation techniques on run-off, sediment yield and maize productivity. *Felix Ngetich*
1420 - 1440 The potential application of ISFM principles in improving rice production in lowland rainfed and irrigated ecologies of East Africa. *Nhamo Nhamo*
1440 - 1500 Labour burden, not crop productivity, increased under no-till planting basins on smallholder farms in Murehwa district, Zimbabwe. *Leonard Rusinamhodzi*
1500 - 1520 Building fertilizer recommendations to support ISFM. *Adrian Johnston*

1520 - 1540 Health break and poster viewing. Poster presentations C33 to C51

1540 - 1600 Effect of long term fertilizer application on striga density. *Sibusisiwe Kamanga*
1600 - 1620 Response of teff (*Eragrostis teff*) to Zn fertilization on vertisols in Etiopia. *Bereket Haileselassie*
1620 - 1640 Towards implementation of fertilizer recommendations: assessment of crop limiting nutrients and appropriate nutrient rates. *Generose Nziguheba*
1640 - 1700 Beyond ISFM: A market driven approach to profitable, sustainable farming. *John Wendt*
1700 – 1720 Discussion on exploring options for ISFM

1700 - 1900 Launch of *"Africa Soil Health Consortium: Handbook for Integrated Soil Fertility Management"* in exhibition area (find additional details on page 16).

species. Crops planted early or during the normal planting window gave comparable yields that were significantly greater than yields of late planted crops. Marginal rates of return for maize production was >100% under high nutrient application rate and less than <30% for the low rate in the 2009/10 season in Makoni. For finger millet, the financial returns were vice-visa with >100% for the low nutrient application rate, against <30% for the high rate. On poor soils in Hwedza, the financial returns were <50% for all the three crop species regardless of nutrient application rate. Substantial delay in planting gave very poor yields and negative financial returns mostly for maize. Calculation of provision of energy indicated that maize production gave the highest energy while finger millet provided the highest content of calcium. Use of high nutrient application rates on more fertile soils is an important strategy for achieving maximum economic yield as well as increasing nutrient use efficiency in maize production. While use of low amount of nutrients was financially most attractive for the production of small grains particularly finger millet. This suggests that production of small grains can be a potential adaptation option for resource-constrained farmers. Resource endowed farmers can maximize maize production by use of high amount of nutrients. Soil nutrient management increased crop production of all crop species between early and normal planting windows. Thus, soil fertility management can be an entry point for restoring farmers confidence to revive production of small grains to sustain household food and improve on nutrition in a changing climate.

### Combination of lime, organic matter and fertilisers foster productivity of the acidic soils in Southern Rwanda

Pascal Rushemuka, Vicky Ruganzu, Athanase Nduwumuremyi, Gilbert Ndizeye, Antoine Nyirigira and Jama Bashir. Rwanda Agriculture Board, Butare, Rwanda. Email: *rushem2005@yahoo.fr*

Southern Rwanda is dominated by extremely acidic (pH ≤ 4.7, Al= 4 meq/100g of soil) and washed soils (base saturation = 20%) under *Eragrostis vidaceaa* K Schumach. A series of field experiments were undertaken in farmers' fields for crop production. The study aimed at (1) identifying the best Integrated Soil Fertility Management technology to address low productivity of these soils and (2) demonstrating the benefit of lime. The treatments were Irish Potato, wheat, climbing beans and soybeans during 4 consecutive cropping seasons. The experiment layout consisted of a set of four treatments (control, lime + farmyard manure, lime + fertilisers and lime + farmyard manure + fertilisers), the mother experiment, and farmers were requested to choose one or more treatments to try on their own fields: baby trials. Findings show that with the binary combination, there were yields but still very low. With the ternary combination, yields were spectacular: 30-40 t/ha of Irish potato, 3-5 t/ha of wheat, 3-4 t/ha of beans and 2-3 t/ha of soybean. Lime is expected to raise pH, to supply $Ca^2$+ and $Mg^{2+}$, to avail P and to neutralise Al. Organic matter is expected to increase the CEC and the fertilisers to supply nutrients (NPK). It is concluded that to expect any food production in those soils, the combination of lime+organic matter+fertilisers is absolutely required. Furthermore, the mother and baby demonstration trials approach is efficient to create awareness and to speed up technology adoption.

### Labour burden not crop productivity increased under no-till planting basins on smallholder farms in Murehwa, Zimbabwe

Leonard Rusinamhodzi, Marc Corbeels, Justice Nyamangara and Ken Giller
Wageningen University, Netherlands. Email: *l.rusinamhodzi@cgiar.org*

No-till planting basins are promoted using seed and fertiliser inputs as incentives for their widespread uptake in Zimbabwe. No-till planting basins are planting holes measuring 15 cm width x 15 cm length x 18-20 depth, spaced 60 cm within the row and 75-90 cm between rows leaving up to 90% of the soil surface undisturbed. They are intended to conserve moisture and improve the targeting of nutrient application. We evaluated the effect of planting basins on crop yield and labour requirement in an on-farm experiment over two seasons in Murehwa district, Zimbabwe. The experiment was established in clay and sandy soils, in two fields types; degraded and better managed fields in 2009/2010 and 2010/2011 seasons. Two tillage treatments i.e mouldboard ploughing and no-till planting basins were tested. Tillage plots measured 1080 $m^2$ (18 m x 60 m) and labour hours were derived by direct measurement in these plots. Due to grazing in the dry season, soil surface cover by crop residues in the experimental fields was less than 10% in both seasons. Previous field management, nutrient management in the experiment and season had a significant effect on crop yields ($p < 0.001$); there was no significant effect of tillage. The largest maize grain yield of 5.6 t $ha^{-1}$ was obtained with a combination of 3 t of manure and 60 kg N $ha^{-1}$ under conventional tillage the equivalent treatment under planting basins yielded 4.6 t $ha^{-1}$ in the 2009-2010 season. Rainfall was poorly distributed in 2010-2011 season and the same treatment gave the largest grain yield of 1.6 t $ha^{-1}$ under conventional tillage and 1.2 t $ha^{-1}$ under no-till planting basins. Land preparation under conventional tillage required 6 man days $ha^{-1}$ while making planting basins required 27 man days' $ha^{-1}$ for the clay soils and 15 man days $ha^{-1}$ for the sand soils. Weeding in planting basins required 40% more labour compared with conventional tillage (12 man days $ha^{-1}$) due to greater weed densities associated with no-tillage. Planting basins did not enhance moisture conservation in a the 2010-2011 season when rainfall was poorly distributed. The increased labour requirement suggests it is unlikely that farmers will abandon the plough in favour of the hand hoe especially if they own cattle. Planting basins are easier to make in sandy soils and require less labour than in clay soils. Conversely, they are easier to maintain in clay soils than in sandy soils. Although planting basins were practiced by about 98% of farmers, the maximum land size allocated to planting basins was only 0.2 ha per farm, 10% of the landholding at most. Given that planting basins increase the labour burden but not crop yield, widespread adoption by smallholder farmers seems unlikely.