ASARECA
Transforming Agriculture for Improved Livelihoods

1st ASARECA GENERAL ASSEMBLY

Theme: "FEEDING OUR REGION IN THE 21ST CENTURY"

Paper Abstracts and Executive Summaries

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Sub-theme I: Agricultural development challenges and opportunities

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Agricultural science, technology, and innovation: Feeding Eastern and Central Africa in the 21st Century

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This paper was prepared to assist the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) advance its mission to promote the role of science and technology and innovation in feeding the region in the 21st century. ASARECA was established in 1994 and its member countries include Burundi, Democratic Republic of Congo, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Sudan, Tanzania, and Uganda.

The paper argues that feeding the region will require fundamental reforms in the structure of agricultural research to bring innovation to bear on raising agricultural productivity. This can be achieved through systemic links between research, training, commercialization, and extension.

The region is dominated by fragmented approaches where these functions are carried out in separate institutions often under different ministries with weak linkages between the functions and among the institutions. The bulk of new agricultural knowledge is generated in national research institutes that have no teaching mandate except through sporadic partnerships with universities. Higher technical training, on the other hand, is carried out by universities that have limited research budgets and weak connections with farmers and the business community. Extension services that used to exist in government departments have virtually collapsed in most Eastern and Central African (ECA) countries. Commercialization of agricultural research results in limited products and is often hampered by the lack of supportive policies, institutions, and financing. Emphasis by donor agencies on the role of nongovernmental organizations (NGOs) has not served as a viable alternative to robust linkages between research and farming communities.

ECA countries have tried to address some of these challenges by promoting collaboration between universities and research institutes. A common approach involves university students spending part of their time in research institutes. Other approaches include strengthening agricultural research in universities, with a focus on post-graduate training as well on the creation of new agriculture departments and faculties. Although such incremental efforts are important and should be encouraged, the magnitude of the challenge facing the region requires new and bold efforts to improve the agricultural innovation system as part of the larger agenda of enhancing the application of science, technology, and innovation to overall economic transformation.

There is an urgent need to create a new generation of innovation-oriented agricultural institutions that bring together in an efficient way agricultural research, training, commercialization, and extension. There are at least three complementary options for achieving this. The first is to add research and extension components to existing agricultural universities. Some of this is already being done, but the scope is too limited and universities continue to focus more on degree training and less on research. These educational functions are needed and their quality should be improved.

The second option is to create a new generation of agricultural universities with the four functions as their core mission. This option could be pursued in countries that are in the process of expanding their higher education systems and creating new universities. This is not an option for many countries given the high costs involved. Private enterprises, especially large farms, could be encouraged to pursue this

approach as part of their efforts to improve farm productivity and competitiveness. In addition, most ECA countries would find it politically difficult to justify such new investments given the low level of funding to regular universities and national research institutes.

The third option is to significantly upgrade the training, extension, and commercialization functions of existing national agricultural research institutes (NARIs). This appears to be a more viable option because it would build on a strong research tradition, ongoing training efforts, connections with the private sector and farmers, and extensive international partnerships. Strengthening NARIs in this manner would also lay the foundation for the emergence of ECA's first generation of research universities with an initial focus on agricultural innovation.

Achieving this goal will require considerable political commitment at the highest level of government. The efforts would need to be championed primarily by ministers responsible for agricultural research but will inevitably involve input from other ministers whose functions touch on education, finance, commerce, science and technology, and infrastructure. More fundamentally, the new agricultural institutes will serve as the loci for coordinating interactions between government, industry, academia, and relevant civil society in fostering innovation.

These institutions would need to function under incentive structures that would differentiate them from existing universities that focus on teaching. Their primary mission would be to foster agricultural innovation through research, training, commercialization, and extension. The reforms needed to enable them to emerge as a new species of research and technical training institutes may involve the adoption of new legislation.

Little innovation occurs without committed champions. Promoting the creation of the ECA's first generation of research universities will require dedicated advocates. Ministers responsible for agricultural research will need to plan a leading role in the effort to upgrade NARIs so that they can serve as new centres for agricultural innovation. This advocacy will involve seeking political support, promoting policy and legislative reform, launching national pilot initiatives, rallying additional financial support, strengthening regional and international partnerships, and recognizing and rewarding agricultural innovation.

The proposal laid out here is not aimed at advancing agricultural research at the expense of other sections of the economy. To the contrary, it seeks to kick-start a process by which ECA can achieve the larger goal of bringing science, technology, and innovation to bear on long-term economic transformation. Ideally, the legislative framework created for upgrading national agricultural institutes should set out incentives that could also benefit other research-oriented agricultural universities.

Furthermore, the framework would also be used to promote similar efforts in fields such as industry and services. In this regard, the creation of agricultural innovation universities would serve as a starting point into the broader efforts by ECA countries to strengthen the role of science, technology, and innovation in economic transformation. This initiative is not a trigger for institutional rivalry; it is paving a new path for the future of ECA.

Managing current and future climate induced risk in Eastern and Central African Agriculture

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Agriculture, the mainstay of economies of all countries in Eastern and Central Africa, continue to remain underdeveloped with inadequate adoption of yield-enhancing technologies, inefficient with low levels of

productivity and uncompetitive in a rapidly globalizing world. Farmers continue to prefer use of conventional techniques involving low level of investments over improved technologies that led to green revolution in other regions of the world. One of the main reasons for the low levels of adoption of improved technologies is that agriculture in the region is predominantly rain fed and hence highly vulnerable to uncertain and erratic distribution of rainfall. Rainfall during the crop season, especially in the semi-arid areas, varies from about one third to two and half times the normal amounts creating vastly different seasons with different possibilities. Analysis of long-term historical climatic data indicates that the region experiences cycles of wet and dry periods that are closely linked to cycles in ENSO phenomenon. The entire region, with the exception of Sudan, records above normal rainfall during El Nino years. An increasing trend in temperature is noticed in all the months and in the annual mean minimum and maximum temperatures. The observed rate of increase in temperature compares well with those reported by IPCC in its fourth assessment report. According to IPCC the region will be warmer by about 3.20C and will receive 11% more rainfall by end of the century. Though there are problems in predicting accurately where, when and by how much climate changes, there is general consensus that the rainfall will be more variable with increased frequency of occurrence of extreme vents. The current variability and projected changes will have significant negative impacts on agriculture through changes in the growing environment and in other parameters such as nutrient and water availability on which crop production depends. Several available soil, water and crop management technologies have the potential to mitigate the negative impacts of climate variability and change but their adoption by smallholder farmers is very low, mainly due climate induced risk and uncertainty over returns on investment. The paper presents some of the available options that help in preparing for and managing climate risks. It highlights the potential benefits from use of seasonal climate forecast information in planning farm operations and suggests some simple, inexpensive and efficient technologies that involve very low levels of investment and risk. In general, research community from the region paid very little attention to climate induced risk in agriculture which needs to be corrected to address the threats from climate change effectively.

The emerging impact of CAADP as a planning and partnership platform to accelerate growth and poverty reduction in Africa

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In 2002, the African Union Commission (AUC) adopted the Comprehensive Africa Agriculture Development Programme (CAADP) as one of the main components of the New Partnership for Africa's Development (NEPAD). CAADP serves as a continent-wide framework to guide efforts by African governments to accelerate growth and progress toward poverty reduction and food and nutrition security by revitalizing agriculture and rural development.

More specifically, the CAADP agenda asks African governments to adopt policies and programs and raise investments to achieve a growth rate of 6 % and a budget share of 10 % for the agricultural sector. For most African countries, achieving the above objectives will require significant increases in agricultural expenditures and a much greater efficiency in planning and executing investments in the agricultural sector. In addition, CAADP promotes a set of core principles such as inclusive dialogue, peer review, benchmarking, and mutual learning in order to improve the quality of governance as well as policy and program design and implementation in the sector, which will thereby raise the chances of success. Ensuring that the principles listed above are followed and the growth and budget targets are met

requires that policies and programs are well planned, growth and poverty reduction outcomes better evaluated and tracked, lessons drawn, and best practices documented and disseminated.
The objective of this paper is to review progress on the CAADP implementation process and, in particular, its agricultural policy and investment planning, review, dialogue, and partnership modalities and evaluate their likely and emerging impact on future growth and poverty-reduction outcomes.

- *Leadership and ownership* at all levels by African government and local stakeholders;
- *Inclusiveness* of all major stakeholder groups in all planning and implementation processes; partnerships and mutual accountability among African governments and their constituencies and development partners;
- *Evidence and outcome based planning and implementation* to improve growth and poverty reduction outcomes in the agriculture sector;
- *Constituency building* to encourage civil society's participation in setting agriculture sector objectives and prioritizing programs as well as encourage public- private partnerships;
- *Open consultations* to guide every level of the implementation process, including consultation with the AUC, regional economic communities (RECs), governments, and stakeholders;-Investment priority setting to create an analytical base for informed choices on agriculture program design; and
- *Resource mobilization*—to build sufficient capacity within the NEPAD Planning and Coordination Agency (NPCA), regional economic communities (RECs), member countries, and CAADP affiliated technical institutions to roll out and scale up CAADP effectively.

To guide CAADP investment planning, framework documents have been prepared by designated Africa-based institutions to help guide RECs and member countries with the design and implementation of agricultural policies and investment programs. In particular the frameworks identify critical success factors in meeting key challenges under each pillar and compile best practices to inform course of action at the country level. Section 2 also elucidates on the i) various CAADP implementation processes of stocktaking and analysis of agricultural growth and poverty reduction options, CAADP Compact signing, developing and implementing an agricultural investment plan; ii) various CAADP actors and stakeholders; and iii) dialogue and mutual review mechanisms that been set up to support CAADP implementation.
Section 3 delves into one of the many innovations of the CAADP process which is its broad use of high-quality, locally based analysis to guide and inform decisionmaking processes—not just planning and implementation, but also review and dialogue by stakeholders around program priorities and outcomes. This innovation is comprised of reviewing past, current, and emerging country agricultural and rural development efforts against CAADP objectives, including:

i. Examining recent growth performance of the agricultural sector, as well as future growth and poverty outcomes based on observed trends;
ii. Determining how outcomes compare to the targets established for the sector under the CAADP agenda and how they compare to the first millennium development (MDG1) target to halve the proportion of people living on less than US$ 1 a day by 2015;
iii. Measuring the prospects of meeting CAADP and MDG targets and analyzing the implications for future sector growth and poverty-reduction strategies; and
iv. Estimating the long term funding needs to accelerate agricultural growth and achieve the poverty MDG target.

The Section presents a sample of the results from analyses that have been used as input to guide planning and dialogue processes associated with the CAADP Compact and detailed national agriculture investment plans (NAIPs) in 7 countries in East and Southern Africa, namely, Rwanda, Kenya, Uganda; Malawi, Mozambique, Democratic Republic of Congo (DRC), and Zambia; and 14 in West Africa, namely,

Benin, Burkina Faso, Cape Verde, Gambia, Ghana, Guinea, Cote d'Ivoire, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. Key findings are summarized below:

Are countries on track to meeting the CAADP 6 % growth and MDG1 poverty reduction targets by 2015?

Under current trends (business as usual-BAU) of maintaining current agricultural yields and production levels, no country in East and Southern Africa will be able to meet the CAADP 6% annual growth target by 2015. However, Uganda would be the only country that can meet the MDG1 target of halving poverty by 2015 under current trends. Under an alternative scenario which assumes the attainment of the CAADP 6% target, all countries with the exception of Uganda and Mozambique would be unable to meet MDG 1 poverty target by 2015. Since Uganda is projected to meet the poverty target under its current trends, a 6% agricultural growth rate will allow it exceed the goal; reducing poverty by 68 % by 2015.

Similar to East and Southern Africa countries, no country in West Africa would be able to meet the CAADP 6% target by 2015 under current trends. However, Mali and Nigeria would come close with growth rates of 5.5 and 5.7% annually between base year and 2015. Only two countries, Ghana and Cape Verde would meet the MDG1 poverty target by 2015 under current trends. However, under current trends, by 2015 poverty would actually increase in Benin, Cote d'Ivoire, and Liberia, i.e. poverty rates would be higher in 2015 than in 1990. For West Africa countries a scenario that looks at the potential impact of pre-CAADP strategies was also considered. Under the pre-existing strategies, agricultural growth was projected to increase to more than 6% in about 5 countries while Benin would join Ghana and Cape Verde in meeting MDG1 poverty target by 2015. However, halving its poverty would require Benin to triple its agricultural growth which might be a tall order given its current growth trend. Poverty rates for Cote d'Ivoire and Liberia would still be higher in 2015 than in 1990 under pre-existing strategies. Under an alternative scenario assuming the CAADP 6 % growth in all West Africa countries, Burkina Faso would join Ghana and Cape Verde in meeting MDG1 by 2015. Under this scenario Senegal comes very close to halving its poverty while poverty rates would still increase in Cote d'Ivoire and Liberia. Cote d'Ivoire and Liberia would experience poverty increases likely due to poverty having increased in the two countries since 1990 particularly in the face of severe economic contraction following years of protracted civil unrest.

How fast should countries grow to achieve the poverty MDG?

As many countries would be unable to meet the MDG1 poverty target by 2015 under current trends or a CAADP 6% growth target, a scenario to project required annual growth rates in both agricultural GDP and government spending was therefore considered. For East and Southern Africa countries, Rwanda, DRC, and Zambia were estimated to require agricultural GDP growth rates of close to or greater than 9% to halve their poverty rates by 2015. In Kenya and Malawi growth rates of greater than 6.3 and 7%, respectively, balanced with growth rates of at least 8% in the non-agriculture sector would be required to meet the MDG1 target by 2015. The growth in government agricultural spending required to meet the MDG 1 was also projected to 2015 and revealed substantial increases in many countries. For example, between the base year and 2015, in Kenya it would need to grow at an annual rate of about 21% and by close to or greater than 40% in Rwanda, Malawi, and Zambia for the MDG1 target to be realized by 2015. Meeting the CAADP 6% target would also entail higher costs in government agricultural spending. High spending growth rates ranging from 21 % in Kenya to 34% in Malawi were estimated.

Many West Africa countries would require double digit agricultural GDP growth rates per year to achieve the MDG1 poverty target by 2015; between 12 and 15% for Benin, Mali, the Gambia, Niger, and Cote d'Ivoire and as much as 26% in Liberia. By historical standards these are prohibitively high rates which means achieving the MDG1 is out of reach for these countries and may take until 2020 or beyond for some for these countries to halve their poverty rates. Also, model simulations show the required rise in government agricultural spending to meet the poverty MDG and CAADP 6% targets by 2015 or 2020 to be prohibitively high. For example, 8 countries would require annual growth in spending to rise

by more than 20 % to meet the poverty MDG by 2015 while another 6 countries would require spending to grow by close to or more than 20% to meet the CAADP 6 % target by 2015.

As many of the countries in the sample have an elasticity of agricultural growth with respect to spending that is very small, below the SSA average of 0.3, achieving the MDG1 and CAADP 6% targets will require not only increasing the level of agriculture spending but also efficiency of spending by, for example, reducing leakages and improving financial controls, auditing, and accountability measures. Adopting the CAADP evidence and outcome based approach to agricultural policy planning and implementation improves targeting of resources and thus contributes to better efficiency.

The mobilization of external funding will be a critical component of CAADP implementation particularly for countries that already allocate a significant share of overall funding to agriculture but rely on external sources for 80% or more of the funding for agriculture. In addition, efforts to increase agricultural funding under CAADP will have to address the constraints to effective budget execution, as in many African countries the average rate of disbursement of agricultural budgets has been distinctly lower than the rate of overall budget execution. All in all while many countries might not achieve the MDG1 under the CAADP 6 growth scenario, implementing CAADP will make substantial contributions to reducing poverty and improving overall economic growth.

How consistent are agricultural investment priorities and related growth and poverty outcomes among the first group of implementing countries?

After NAIPs have been completed they are assessed to determine the extent to which they are consistent with alternative long term growth, poverty reduction, and funding requirement scenarios, usually estimated before the CAADP Compact signing.

For West African countries, the comparisons between investment plans and pre-compact long term growth and poverty reduction outcomes revealed significant discrepancies in some countries between proposed investment plan costs and simulated long term funding requirements for similar rates of growth. For example, NAIPs for the Gambia, Mali, Nigeria, and Benin appear to be significantly underfunded in order to deliver the expected growth outcome while NAIP funding levels appeared considerably higher than required to meet growth targets in the case of Sierra Leone, Liberia, and Guinea, and to a lesser extent for Cape Verde, Ghana, and Senegal. Only Togo and Niger have suggested funding levels that are consistent with projected long term growth outcomes.

The consistency analysis also assesses the degree of realism of pursed poverty reduction outcomes by comparing targeted poverty reduction levels under the investment plans with projected outcomes under continuation of pre-CAADP trends. Results showed Benin, Nigeria, Guinea, and Senegal to experience the largest poverty declines by 2015 under NAIPs than under pre-compact long term scenarios. However, because Benin and Nigeria appear to have underfunded their investment plans they are thus less likely to achieve the expected poverty reduction outcome. Sierra Leone, Guinea, Ghana, and Senegal would also experience greater poverty declines under NAIPs than pre-compact projections and because they have seemingly overfunded NAIPs should be in a position to realize the expected declines in poverty levels at a lower cost than budgeted under the current investment plans.

Section 4 examines emerging trends in agricultural investments and growth across countries. While it is too early to say anything definitive about the impact of CAADP on the agricultural sector in Africa, there is no doubt that CAADP implementation is happening at a time when performance in the agricultural sector has been strengthening. The Section notes Africa's recent economic and agricultural growth recovery during the last 10–15 years; characterized by average growth rates of 6% before the onslaught of the food price crisis in 2008. Both economic growth and agricultural gross domestic product (GDP) growth rates are already showing signs of a rebound following the crisis and grew at 5.2% in 2010 and 4.6% in 2009, respectively. The recent growth is reflective of improved growth in total factor productivity (TFP) for SSA which accelerated from 1.65% during 1984–93 to 1.83 % during 1994–2003, a rate comparable to Latin America and above that of India. In terms of emerging trends toward the

CAADP 10 % target, more still needs to be done as fewer than 10 countries have reached the 10 % target while another 10 have budget shares exceeding 5%. It appears that many of the reporting countries have not yet responded to the call to increase agricultural funding, despite the fact that many are making steady progress toward that goal.

Section 5 highlights the increased support for agriculture-led development as reflected in not only statements by major donors but also tangible increases in agricultural official development assistance (ODA) to Africa as a whole. All major international development agencies have now broadly embraced CAADP. The Global Donor Platform for Rural Development has established a CAADP Development Partner Task Force to facilitate alignment and action on the ground by country-based agencies. A Multi-Donor Trust Fund has been established at the World Bank to support the implementation of CAADP activities by RECs, countries, and Lead Pillar Institutions. At the global level, the adoption of the L'Aquila Food Security Initiative and the Global Agriculture and Food Security Program (GAFSP) are a further testament to the efforts by the development community to support the CAADP agenda. For example, the GAFSP has thus far allocated US$270 million to support CAADP investment plans of Ethiopia, Niger, Rwanda, Sierra Leone, Liberia, and Togo.

Finally Section 6 provides recommendations for the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA). As the lead research organization for the region, ASARECA should come up with a consolidated research agenda to target main priority science and technology areas emerging from national implementation plans. ASARECA should also lead the long term efforts for the region to master future technologies, such as biotechnologies, and ensure that national agricultural sectors are competitive in future global markets. The cost of developing the required infrastructure and expertise and the scope of scale economies and spillovers in this area suggest that a regional approach is the most reasonable course of action.

High and volatile food prices: drivers and impacts on food security in Eastern and Central Africa

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Global food prices increased substantially between 2007 and 2008 but declined in the last half of 2008 and stabilized in 2009 only to begin surging again in 2010 to reach unprecedented peaks in February 2011. Indeed the recent price levels are the highest since the inception of the United Nation's Food and Agriculture Organization (FAO) food price index (FPI) in 1990 suggesting a renewed food price crisis. On the other hand, domestic food prices within the ECA region defied international trends to remain

persistently high throughout the period under review. As global food prices rose sharply and peaked in the first half of 2008, food prices within the ECA region increased too, but at lower rates. Furthermore, even though global commodity prices slumped in the second half of 2008 and stabilized throughout 2009, food prices within the ECA region remained high. In 2010 and 2011, food prices within the ECA region have continued to rise in tandem with world food price trends. This paper draws from several reports and briefs that have been prepared by the Regional Strategic Analysis and Knowledge Support System for Eastern and Central Africa (ReSAKSS-ECA) in collaboration with the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) in the last three years. It presents the results, major conclusions and recommendations from the analysis to provide information on the nature, content, causes, effects and implications of what has been called the global food price crisis in the context of the ECA region. Such information is useful for governments, donor agencies and other stakeholders concerned with addressing the food price crises, both in the short and long term.

A key result is that while the price rise involved most of the staple commodities including maize, rice, wheat, and meat, different countries in the ECA region exhibited different patterns and were affected differently. Among the countries considered in the analysis, the Food Price Index (FPI) rose fastest in Ethiopia and Kenya in that order. Uganda started experiencing a surge in the FPI in early 2010. Results also show that domestic prices are more volatile than global prices. The differing pattern between global and domestic prices is largely explained by the low transmission of global price changes to domestic markets, an indication of poor integration of ECA markets to international markets.

The factors behind the dramatic surge in global prices are varied and to a large extent remain contested. Many authors have argued that the overarching cause for the spike in global food prices was that demand had outstripped supply. However, recent evidence on the causes of the global food price crisis points to a combination of economic factors both on the supply and demand side. On the demand side, the combination of rising incomes in developing countries, increasing world population, rapid urbanization, changing diets and an ever increasing demand for biofuel products to cater for energy needs have been the driving forces behind the food price crisis. On the supply side, the combination of high agricultural input prices (especially fertilizers and fuel), climatic shocks, reduced world food stocks, reduced exports, underinvestment in agriculture and declining agricultural resources such as land and water have been associated with low supply of food commodities.

In the context of the ECA region, the food price crisis has been attributed to a combination of the global causes and other region specific factors. One of the dominant causes of the high food prices in the ECA region is a rapidly expanding population that has created a huge demand for food. Unfortunately, the region is characterized by low agricultural productivity that is partly attributed to underinvestment in the sector, high input prices and recurrent droughts. As a result food supply has not expanded adequately to match the increased in food demand fueling an increase in prices. The ECA region specific causes of the food price crisis include unstable macroeconomic conditions, inappropriate trade policies, poor transmission of international prices to domestic markets, recurrent droughts, natural disasters and conflicts.

The high and volatile food prices have different effects on different countries and members of the community. It can deliver tremendous benefits to the farming communities and countries whose economies are dominated by agriculture. However such benefits accrue mainly to net-producing households or net-exporting countries. Commercial farmers, who can respond to the increase in prices by increasing production, can potentially benefit from the price boom provided that changes in the prices are transmitted to them through the value chain. Net exporting countries benefit by experiencing increased revenues from sales, and hence improved terms of trade. Despite these potential benefits of the surge in commodity prices, the high food prices have impoverished many small farmers in ECA countries and lead to household food insecurity as most farming households are net buyers of food. The surge in food prices has also adversely affected ECA economies, especially those of net food importing

countries. Such countries face the threat of food price-induced inflation, large food import bills and deteriorating terms of trade that add to the problem of food insecurity at both the national and household levels. The food price situation has posed significant challenge to the achievement of the Millennium Development Goals within the ECA region, and in particular to the reduction of poverty and hunger.

The responses to the food price crisis reflect a diversity of sorts across countries in the ECA region. Overall, two interrelated categories of responses have been noted. First, international actions and policies that were advocated for by donors, and secondly country specific responses that were initiated by individual governments. Within the ECA region, the policy responses adopted are greatly varied but can be broadly classified into demand side and supply side policies. The most common responses broadly aim to ensure that there is an adequate and affordable food supply for the majority of consumers and that safety nets are provided for the most food insecure and vulnerable. They also aim at fostering a positive agricultural supply response.

The conventional consumption policies adopted to cushion consumers against the adverse effects of rising food prices in the ECA region included interventions such as food subsidies, food stamps, food for work projects, safety nets and tax reductions. On the other hand, the supply side policies implemented to increases food production revolved around release of food reserves, input subsidies and producer price support measures. In addition to the demand and supply side policies, several ECA countries adopted trade policies to cushion their producers and consumers. The most popular trade policy measures adopted to manage food price increases included import tariff reductions and the imposition of export taxes and export bans.

Given the many social problems that the food price crisis has created within the ECA region, this report recommends the adoption of both short-term and long-term policy measures. In the short-term, governments and donors within the ECA region can meet the food needs of the most vulnerable by the provision of emergency food aid, zero rating of duties on food imports, abolishing of price controls and export restrictions coupled with the adoption of food safety nets. In the long term, investing in smallholder agriculture is undoubtedly the most sustainable safety net for the ECA region. The priority areas of agricultural investment should focus on increasing productivity and access to inputs and markets so that farmers are less vulnerable and more capable of responding to production incentives.

In the short-term, governments and donors within the ECA region can meet the food needs of the most vulnerable by pursuing the following demand and supply side policy measures;

- Provision of emergency food assistance – This can be achieved through the distribution of relief food by both donors and governments and the release of public (reserve?) stocks of food staples by governments
- Adoption of food safety nets to cushion the vulnerable against the adverse effects of the food price crisis (e.g. cash transfers, food stamps)
- The provision of agricultural inputs and services
- Abolishing price controls and export restrictions
- Adjustments in trade and tax policy measures
- Macro-economic policy management such as maintaining low inflation rates and reduction of domestic borrowing
- Investing in and strengthening the early warning and disaster management systems

In the long term, investing in smallholder agriculture is undoubtedly the most sustainable safety net for societies. The priority areas of investment that should be considered include:

- Investment in agricultural research to create a green revolution in Africa
- Investment in key agricultural services such as extension services, to ensure that the latest technologies are disseminated to farmers

- Investment in local infrastructure – irrigation, communications, power and transport. In particular there is a need to invest in the "last mile" rural roads – to ensure that what is produced by poor rural people can actually reach the markets and fetch a good price
- Investment in rural financial services, markets and linkages so that smallholder farmers can buy fertilizer and better seeds, gain more control over when and where to sell their produce, and insure themselves against risks such as drought
- Investment in agro-processing to add value to primary products and to reduce post-harvest losses and improve quality
- Enhance the ability of farmers to cope with effects of changing climate through research and supportive climate adaptation policies

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Harnessing Livestock Resources for Food Security in the Pastoral Areas of Eastern and Central Africa

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Pastoral areas constitute the major land use in the drylands of Eastern and Central Africa (ECA), and in countries such as Kenya and Ethiopia the drylands account for a considerable land area and are home to millions of people. Pastoral livestock productions systems are the most suitable and adapted land use in the ECA drylands, and currently the meat and milk produced by those systems contribute significantly to local, national and regional food security as well as GDP. However, this livestock production and productivity face a number of challenges. First, the drylands are characterized by very high precipitation variability and droughts occur regularly, most recently every 3 to 4 years. Second, the mobility that pastoralists have traditionally relied upon to manage in the face of such high climate variability is increasingly constrained by various forms of land expropriation and fragmentation, which exacerbates degradation in the accessible grazing areas. Third, poverty and food insecurity are prevalent among ECA pastoral communities and are becoming chronic for some groups, especially those who have very low herd sizes or have "dropped out" of livestock production all together. Fourth, although pastoralists have always participated in markets, this participation could be higher, more equitable and contribute more income to pastoral producers. Additionally, milk markets, the domain of women, are not well supported. Fifth, little research has been done on improving pastoral livestock breeds or supporting species diversification. Sixth, rangeland management studies and interventions are also lagging and could contribute greatly to enhancing livestock productivity. This paper therefore outlines a strategy for "harnessing" the livestock resources of pastoral production systems as they have great potential to contribute to food security in ECA. This strategy relies on the combined efforts of research and development to ensure a long term and sustainable future for pastoralism.

The role of mainstreaming gender in agricultural research and development and its contribution to feeding our region in the twenty first century

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This paper seeks to highlight one of the major contradictions bedeviling efforts to feed the ECA region in the present times; whereas the gendered management system of food production in particular and agricultural production in general has not changed much over the last century, the bio-physical production system has undergone tremendous change. As a result, there has been increasing demand for food without commensurate increases in food production. Unfortunately, while the deteriorating bio-physical production system that has depressed food production has evidently received research and policy attention, the static gendered management system has received scanty attention. This is because the gendered management system is part of the broader structure of gender relations that are so entrenched in the formal and informal institutions in society that they are treated as givens or "natural". Hence, agricultural and social scientists and policy makers rarely recognize the challenges posed by the gendered management system to food production.

Yet, evidence abounds that the gendered management system entitles males with ownership and control of resources and decision making powers in the production, exchange and consumption of food more than it does the females. Paradoxically, the responsibility for food provisioning within smallholder farming systems in the ECA region lies predominantly with females. In here lies the challenge for feeding the ECA region from a gender perspective. For those onto whom custom bestows the responsibility for food production are less entitled by the same custom. Asymmetries in males' and females' entitlements are the foundations for gender inequalities not only in the agricultural sector but in the wider sectors of society. Therefore, if feeding the ECA region is to be realized, we cannot continue with "business as usual" without addressing the constraints and challenges embedded within the static gendered management system of food production.

These constraints and challenges can best be addressed through mainstreaming gender in agricultural research and development. Gender mainstreaming is a globally accepted strategy for promoting gender equality. Mainstreaming is not an end in itself but a strategy, an approach and a means to achieve the goal of gender equality. Mainstreaming involves ensuring that gender perspectives and attention to the goal of gender equality are central to all activities in policy development, research, advocacy/dialogue, legislation, resource allocation, and planning, implementation and monitoring of policies, programmes and projects. It is in this context that we examine the role of mainstreaming gender in agricultural research and development and its contribution to feeding our region in the twenty first century.

Sub-theme II: National and regional institutions perspectives

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Role of farmers, the regional FO and their strategic partners in feeding our region in the 21st century

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Small scale agriculture contributes >80% of food in urban centres, this contribution is however threatened by regular famine cycles abetted by climate change (among others) and poor policy responses to this overall challenge thus rendering our countries as perpetual net food import countries. The result of this is food prices spiralling out of control and this phenomenon has pushed over 70 million people to poverty and hunger. History thus suggests the necessity of productivity increases in smallholder agriculture. Except for a handful of city-states, there are virtually no examples of mass poverty reduction since 1700 that did not start with sharp rises in employment and self-employment income due to higher productivity in small family farms (Lipton 2005).

Making markets work for smallholder farmers will require actions from many different actors, both private and public, as well as from international financial and donor organizations. Our premise, however, is that the public sector role is decisive. If public sector policy choices do not reduce the currently high levels of risk and uncertainty in African agricultural markets, and if governments use their scarce resources in ways that do not provide greater investment incentives for the private sector, then there will be limited scope for private investment to provide smallholder farmers with the access to markets that they need. Financial markets will also stay away from African agriculture if the risks of investment remain very high relative to the returns. On the other hand, if African governments define their roles clearly, implement these roles transparently and consistently, and invest their scarce resources in ways that make the greatest contribution to agricultural growth and poverty reduction, then this approach is likely to leverage even greater private investment in support of smallholder agriculture. When the conditions are created for profitable and stable private investment, the private sector has in other parts of the world grown and responded as seen in much of Asia, and there is little reason to believe Africa is different. Hence, private sector investment patterns and the supply of bank financing for private investment, are largely outcomes of public sector behavior – its policy choices, integrity of its institutions, and the ways it spends its funds through that matters.

For these reasons, there is no single or deterministic “future” of the small farmer in Africa. The decisions made by governments (regionally and nationally) primarily and international organizations (to provide support in research, advocacy, information etc) secondarily will largely determine the future of smallholder agriculture in the region. Without renewed attention to sustained agricultural productivity growth, most small farms in Africa will become increasingly unviable economic and social units. Sustained agricultural productivity growth and poverty reduction will require progress on a number of fronts, most importantly increased public goods investments to agriculture, a policy environment that supports private investment in input, output and financial markets and provision of key support services, a more level global trade policy environment, supportive donor programs, and improved governance. Subsidies, if they are focused, well conceived and implemented, and temporary, can play a complementary role but should not be seen as the primary engine. Most of these challenges can be met. Meaningful progress will start when the political will is mobilized to adopt the policies and public

investments which substantial evidence shows have the greatest chances of driving sustainable pro-poor agricultural growth.

The role of universities and their strategic partners in attaining food security in the eastern and central Africa [ECA] region in the twenty first century

Prof. Geoffrey C. Mrema

Consultant

The objective of this paper is to review the current status, key challenges and opportunities in the context of the role of universities in feeding the Eastern and Central Africa [ECA] region in the 21st century. The review aims at initiating and inspiring discussions to facilitate a constructive debate on the subject during the meeting of the ASARECA General Assembly scheduled for December 2011. The paper focuses on the role of **Faculties of Agricultural and Allied Sciences** hereafter referred to as **FAS** and includes agriculture, forestry, veterinary medicine and those parts of faculties of science and social sciences which are active in agricultural research and development. The role of the FAS is covered focusing on two aspects – (i) Higher education and training (ii) Research & development[R & D]. The two sets of activities are estimated to take respectively and on the average about 50 and 25 % of the working time of the scientific human resources of the FAS. Estimates are that in 2008 about 4476 scientists were employed in teaching and R & D functions of the FAS in 9 countries of the region [cf. 3748 employed by NAROs mostly for research] [ASTI(2011); Flaherty (2011)].

The milestones in the evolution of the FAS in the ECA region are presented – starting from the two pioneering FAS which were established in 1950s at Makerere and Gordon Colleges in Uganda and Sudan respectively to the over 100 FAS established during the period 1960 to 2010. The foci of the FAS in the early years and up to almost the end of the 20th Century was on producing human resources for the public sector –either working directly in government departments and agencies and/or in NGOs. However during the 1980s/90s all countries in the region implemented economic Structural Adjustment Programs [SAPs] with the objective of reducing the role of the public sector and increasing the role of the private sector. This reduced employment opportunities for the graduates of the FAS and forced them to orient their programs towards the needs of the private sector – a task for which they are still doing but are not adequately prepared for.

The capacity of the FAS in R & D efforts of the region is quite significant. This is largely because of the higher qualifications of their staff [e.g. 45% of the FAS academic staff in 9 ECA countries have PhD qualifications cf. 22% in the NARIs/NAROs] and the fact that organizationally staff of different disciplines are stationed in one station. In addition because of their teaching functions the FAS normally have more specialized and sophisticated equipment. However, in most countries, the R & D effort of the FAS is not that well coordinated both internally [within the FAS itself] and externally [with the efforts of the NARIs/NAROs]. It is apparent that the effectiveness and efficiency of the national agricultural research systems could be greatly increased if there is better coordination and enhanced synergies in planning and implementation of the R & D thrusts of the NAROs and the FAS. This will require changes in the current institutional framework which coordinates and implements the national R & D work.

A brief overview of the institutional frameworks for managing the higher education and research thrusts of the FAS as well as of NAROs established in other parts of the world especially where they have had significant impact in the positive transformation of the agricultural sector is presented. This includes, among others, the land-grant colleges in the USA where the teaching, research and extension functions

at the state level administratively fall under one organization - the College of Agriculture – a system which is quite effective and efficient. Also reviewed are the State Agricultural Universities [SAUs] of India which were established in the 1950s and 60s and modelled on the USA land-grant colleges and have been quite successful - they were instrumental to the success of the green revolution which transformed agriculture in that part of the world.

An overview of the issues which need to be factored in when considering the development of the agricultural sector in the 21st century is presented. These include the need to look at the entire agri-food chain from on farm production, to harvesting, processing, transportation and marketing given the demographic trends in the region with the projections that over 50% of the population of all countries will be living in urban areas by the mid-century. These demographic trends also may require a review of current sectoral policies from almost entire focus on small scale peasant farmers to the more commercial farmers – especially the small and medium scale ones who are the ones who are likely to produce significant surpluses for the market. Other issues discussed include rural infrastructure and environmental issues.

Challenges and opportunities which the FAS have to grapple with in relation to human resources development include: Declining employment opportunities for their graduates in the public sector and hence need to revise programs to focus on the needs of the private sector; declining university budgets and government scholarships; inadequate practical and entrepreneurial skills in the training programmes as well as the need to design program specifically geared towards training commercial farmers including strengthening the capacity of teaching staff in this area. The R & D issues include need to intensify efforts to establish true national agricultural research systems to better coordinate and manage the planning and implementation of the national and regional research efforts. There is need to improve planning within the FAS and strengthen linkages with departments in the universities which are undertaking strategic policy research.

The institutional and organizational mechanisms necessary to enhance the role of the FAS in the human resources development as well as in R & D efforts to feed the region in the 21st century are discussed. Two programmatic issues as related to ASARECAS' involvement with the FAS are presented:

(i).***Institutional Framework for a NARS***: There is need to increase efforts towards the formation of true NARS and it is recommended that ASARECA should, as a matter of priority, initiate a program for designing and recommending to its members options of national institutional frameworks. This should lead to well coordinated national systems which plan and coordinate the consolidated national agricultural research programs starting with the work of the NARIs and FAS. In this regard, ASARECA could partner with other institutions with experience in institutional building in developing the conceptual framework for such a program as well as other details. This is one of the core functions of ASARECA as stated in its strategic plan for 2007/16 – however none of its current programs is dealing with this function.

ii)***Involvement of ASARECA in Education Matters:*** While ASARECA states in its Mission statement that its mission includes agricultural education and training, it is not apparent from its strategic plan that it intends to get involved directly in what the FAS are doing in this area. The broad area of development of human resources is critical to the whole agenda of feeding the region in the 21st century and ASARECA has to decide on the level and extent of its involvement in this area first. This may require further consultations and studies given the fact that the FAS have not been that active in ASARECA matters especially in the area of HR development through formal under and post graduate programs.

Three organizational options for enhanced linkages between ASARECA and the FAS are proposed:

- ASARECA could link up with already established regional organizations such as RUFORUM and/or IUCEA and sign MoUs with them on working together to enhance the role of the FAS in HR development as well as in R & D efforts. This will however depend on being able to resolve the issues related to the congruency of mandates as well as geographical coverage

- ASARECA could consider establishing a Committee of Deans as was done in Southern Africa in the 1980s/90s to serve as a Sub Committee of its Board for handling all matters related to HR development as well as collaboration and coordination of the R & D work undertaken by the FAS. This is subject to this option being possible under current governance instruments.
- ASARECA could start a program/project to coordinate all its work-plans and activities with the FAS on the understanding that the FAS will contribute to the program/project and that the program will evolve within a specified time frame into an *Association of Faculties of Agriculture in Central and Eastern Africa [AFACEA].* The Association would then take over the coordination of all the HR development activities as well as those of R&D handled by the FAS in the region. They may also be able to elicit the support of ministries of education in addition to the agriculture ones as well as from other agencies like FAO, UNESCO, UNIDO, etc.

What is the Role of NGOs and the Regional Forum and their Strategic Partners in feeding the Eastern and Central Africa in the 21st century?

Pascal Baridomo

The development of an agricultural system capable of feeding the people of Eastern and Central Africa is a major issue of concern for ASARECA and other stakeholders, NGOs in particular. The theme suggested by ASARECA for its General Assembly aims to strengthen the role of NGOs in the sub-region in order to meet the following challenge: access to food for everyone in the 21st century especially in the area covered by ASARECA.

Compared to the context of NGOs' intervention and given their experience and their distribution in the field, NGOs are indispensable for successful goals set by ASARECA. NGOs and civil society in general, are part of the three main groups of actors namely: NGOs / CBOs, traders, governments. No matter how opinions may be divergent, these actors must co-exist and complement each other. It is also essential to enhance the adaptive capacities of NGOs in relation to the existing socio-economic and political settings, humanitarian assistance where needed and support for development in some other cases.

NGOs are active on issues of major concern for farmers. This is especially the concern on sustainable agricultural development policies taking into account the trend of continuous increase in population and population pressure on agricultural land, and adaptation to climate change. NGOs are involved in advocacy for productive, modern and sustainable family farming. In advocacy, their concerns focus on the type of agriculture to promote highlighting the debate on : sovereignty over the seeds compared to Genetically Modified Organisms (GMOs); the governance of agricultural land as related to the phenomenon of land grabbing; policies favorable to agricultural development for the benefit of farmers as related to the problem of financing the sector. In short, NGOs' expertise can be summarized in three categories of activities which are: the management of humanitarian activities, advocacy, research and training activities with farmers.

On a technical level, NGOs work on issues of alternatives to climate change, integrated techniques to improve agricultural production, forestry and animal husbandry, promotion of savings and credit systems among the farmers' communities; distribution of documents for information and training and so on. NGOs are entitled to some facilities provided by the Governments. They have opportunities to develop technical and financial partnerships at different levels: services delivery, cooperation between NGOs in the north-south context, responses to call for tender, selling products such as booklets or other documents.

The promotion and visibility of NGOs activities in the cooperative program with ASARECA, would address the following challenges:

- dialogue and common understanding of the stakeholders on the agriculture model to promote at the time when most NGOs and civil societies are struggling for agriculture and family-friendly policies;
- developing a communication strategy, a strategy for exchange of experiences and sharing of knowledge on agricultural research in the sub region to avoid repetition of what others have done and contradictions in the field or errors related to lack of reliable information;
- mobilizing financial and human resources and material to meet the needs on the ground so that interventions are to match the needs of people;
- endogenous and external financing of small farmers activities to modernize these activities and make them profitable;
- concerted strategies to support increased productivity without destroying the environment from the risks of divergent views : exchange of techniques and approaches that have been successful;

In terms of opportunities available, we can mention the involvement of NGOs and their forum can grow through:

- the possibility of capital appreciation of trust towards NGOs vis-à-vis peasant farmers and long experience in the field for the application of research skills;
- The representativeness of the various stakeholders in agricultural development in the ASARECA general assembly, particularly the country's NGOs and the Board of Directors for a better contact with the grassroots;
- The possibility of capitalization of accumulated knowledge and expertise of farmers in sustainable agriculture so that the approaches that reflect and enjoy the achievements of different NGO's;
- The possibility of sharing experiences on approaches and tools for education and training for rural adaptation of more effective and efficient methods;
- The ability to access information on the needs of field research and early warning in case of findings of particular problems on crops or livestock, to allow a timely discussions with ASARECA;
- The existence of networks of some NGOs and farmers' organizations at national and sub-regional levels as a channel for innovation or information;
- The NGO forums can help diversify funding sources and ways to achieve the set target.

For a greater involvement of NGOs, we suggest that the following actions be undertaken:

1. The establishment of a strategy of interactive communication and sharing information on current research, the achievements in the field and the practices by stakeholders (newsletters, radio programs, technical meetings, emails) so that ASARECA communicates its innovations but also that ASARECA gets feedback from the grassroots ;
2. Organize platforms on issues of research, early warning on problems in the field, and agricultural development strategies by countries.
3. Accountability of the NGOs' representatives on the ASARECA Board of Directors and the definition of its terms of reference to facilitate the involvement of NGOs from different countries;
4. Installation and management of joint programs on selected topics and the implementation of prior research (seed, production technology, conservation, processing and marketing of surplus, information through newsletters, fact sheets and books, radio programs, etc.). Each stakeholder involves himself in collecting funds and in the implementation of its own action plan;

5. Periodic training of stakeholders to introduce innovations and collective appropriation of the tools used to avoid contradictions in the field;
6. Strengthening the structure and the professionalism among the farmers organizations and hold them accountable for the monitoring of field experiments;
7. implementation of an advocacy strategy so that a sustainable agriculture is included in the national budget and in international cooperation frameworks ;
8. development of a document or strategic direction for the medium and long term, specifying indicators of strategic and operational objectives, with the roles of different actors especially NGOs;
9. The establishment of a strategy for monitoring and evaluation indicators related to the overall objective on feeding the sub-region in the 21st century.
10. The promotion of research on the realities of the sub-region, which ensures food security, biodiversity and biosafety ;
11. Include ASARECA programs and projects in each NGOs'action plan as a result of a harmonized view of the model of agriculture to promote;

Role of Extension, the Regional Extension Association, and their strategic partners in feeding the region in the 21st Century

Silim M. Nahdy(1); Max Olupot(1); Kristin Davis (2); Eliot Zwane (3)

1: African Forum for Agricultural Advisory services

2: Global Forum for Rural Advisory services

3: Agricultural extension services, South Africa

Nearly one billion people globally suffer from chronic food insecurity. The growing world population and climate change have affected farming practices, and the global demand for food is expected to increase dramatically. Engaging the research, Extension and Advisory Services and scientific community is critical to developing the new and innovative agricultural approaches required to meet this demand.

Empowerment of famers and producer groups encompasses various key elements such as: access to productive assets, strengthening capacity in development, establishing effective and efficient institutional structures, genuine participation in development, and democratic decision making process. Empowerment has different aspects including political, economic and institutional dimensions which are important in food security and poverty campaigns.

The biggest challenge is the transformation of our agricultural extension services from the old stereotype of connecting researchers and farmers - to being innovative, discussing and working with farmers, researchers and the business community. As a policy maker, educating people and sensitising them to understand the farming sector is important to avoid inaccurate, inappropriate policies

The private sector is one of the key actors to the success in extension and advisory services delivery and achieving food security in ASARECA region. In many cases this implies delivery of Agricultural Advisory Services (AAS) through social enterprises funded through public-private partnerships. Such partnerships would lead sector-wide growth that has direct and indirect benefits for the poor. The service centred around pro-poor growth should therefore not exclude the commercial sector which benefits African agriculture through increased investment, through gaining access to international and local markets, and through increased competitiveness and an improved policy environment. On the other hand reduced poverty creates increased opportunities and markets for entrepreneurs, processors and producers.

The African Forum for Agricultural Advisory Services (AFAAS') objective is to create efficient, effective and synergistic linkages and partnerships between AAS of member countries to improve the delivery of these services to farmers. It operates within the framework of Pillar IV of the Comprehensive African Agriculture Development Programme (CAADP), which has the objective of enhancing the livelihoods of African farmers and pastoralists and is spearheaded by the Forum for Agricultural Research in Africa (FARA). Within this framework it is AFAAS´ role to ensure that, through effective AAS, CAADP Pillar IV directly addresses the needs of African farmers, contributing to sustained growth and transformation of African agriculture

Key reforms to date include: decentralising administration of field extension services; improving linkages among farmers, educators, researchers, extension agents and other stakeholders; and increasing the independence and flexibility of extension services by creating small and semi-autonomous units within government ministries. Though each country has approached its reform in a unique manner relevant to its own concerns, all have a common need and obligation to improving accountability to clients, to put in place a demand- and market-driven service provision system, to ensure decentralisation of service delivery and to promote increased participation of the private sector in the provision of agricultural extension services. Thus, a wealth of knowledge and innovations has arisen in different countries.

Agricultural extension and services are a vital element of the array of market and non-market entities and agents that provide critical information that can improve farmers' and other rural peoples' livelihoods. Apart from their conventional function of providing knowledge for improved agricultural productivity, extension and advisory services are expected to fulfill a variety of new functions, such as linking smallholder farmers to high-value and export markets, promoting environmentally sustainable production techniques, and coping with the effects of HIV/AIDS and other health challenges that affect agriculture.

Role of the Private Sector, the Regional Private Sector Association, and their Strategic Partners in feeding our region in the 21st Century

Mr. John Kashangaki

Strategic Business Advisors [Africa] Ltd

Agricultural production (crop, livestock, fisheries and forestry) accounts for an average of 34% of GDP across the countries of Eastern and Central Africa. The sector provides the main source of livelihood for an estimated 80% of the region's population and is dominated by smallholder mixed farming systems which include livestock rearing, food and cash crop production, fishing and aquaculture .

While agricultural production has been improving in the region, time and again the region has not been able to feed its population for a number of reasons which include: natural calamities such as drought and floods, civil strife and conflict, as well as the inability of food products to move from surplus to deficit areas due to logistical and other policy constraints.

Given this situation, there is significant scope for the private sector to play a major role in reducing the region's need for external support to feed its population. Constraints facing production include overreliance on weather patterns, low productivity, lack of access to finance, markets and limited value addition among other areas. Despite these constraints the sector is growing and has potential to grow even more if attention is paid to key drivers: commercializing smallholder production and reducing reliance on weather patterns. Facilitating more access to finance, investing more in water harnessing and supporting the development of value chain clusters can contribute greatly to these two drivers of change.

Integrated Bioeconomy system for food security and sustainable development in Africa

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Bio-economy Africa

The Problem: High pressure on cultivable lands, water miss management in Africa plus relatively low yields obtained from existing agricultural practices has resulted in a food crisis in Africa, only alleviated by external aid and debts. The frequency and extent of these interventions has increased over the last 40 years. Before any agriculture led industrialization has any hope of success in Africa, the nation must feed itself and become green trading continent.

The Solution: The Integrated Bioeconomy System (IBS) Consortium has, over the last twenty years, developed innovative Ecohydrology and Biointensive Resource Management practices that immediately increase yields and also lead to long-term improvement in soil fertility and waste management as well as to the introduction of carbon-neutral benefits such as bio-gas production (for cooking and lighting) at the individual household level. There are many spin-off benefits such as cash income generation and improved mother and child health (through a reduction in smoke pollution, by replacing kitchen fires with biogas cookers).

IBS are an important part of an integrated approach to rural development. Members of the Consortium discuss with local peoples their perceived problems that often hinge around human and animal health, and agricultural productivity. IBS is introduced through demonstration projects, now established in five different regions in Ethiopia, and offers different elements of improvement of existing practices that can be put together differently and according to local demand. Thus, for example, Biofarm in the humid South West will have different elements from a biofarm in the arid northern regions. IBS setup principles can be applied by the individual farmer, or by the community or disadvantaged sections of it (such as single mothers). In the latter case the benefits are generally shared as cash income derived from the sale of IBS products. Local generation of cash from the sale of surplus productivity is clearly a key to pump-priming regional development. IBS training also includes novel income-generating opportunities e.g. for honey and silk production.

IBS system and its partner Institutes are also investigating all aspects of IBS development in Ethiopia, Cote d'Ivoire, DRC and Mozambique including the application of integrated pest management techniques and the minimization of post-harvest crop losses.

Outputs: The minimum outputs are IBS practices applied by well-informed individuals locally (private benefits). When applied at the community level IBS is an engine of development in which cash flowing back into the community from the sale of agricultural products may be used to generate public goods, such as clinics, schools or access roads. The IBS is a facilitator in this process. The IBS address adaptive growth and building of social, economic and ecological capital

Outcomes: By changing the behavior both of individual farmers and of whole communities this initiative can change a farmer's perception of the environment (as something sustaining and sustainable) which is more likely to lead to sensible rather than exploitative environmental practices. This was best encapsulated in one (Ecohydrology and IBS trained) farmer's comment "Now, for the first time, I can imagine leaving something for my son to inherit."

Sub-theme III: Advances in Research for Development: ASARECA Success Stories

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Overcoming seed potato quality constraints to tackle food insecurity and poverty in eastern and central Africa in the 21st Century

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In order to improve the availability of healthy seed potato in Eastern and Central African (ECA) countries, where more than 95% of mostly poor quality seed potatoes are sourced from farmers' own previous harvests or markets or neighbours, two technologies, namely seed-plot technique (SPT) and positive seed selection (PSS) were considered for validated and promotion through farmer-learning fora in Kenya, Uganda and Burundi. Noticeable improvements in the quality and availability of seed potato to small-scale farmers were made. The SPT achieved 2.5 to 3 times higher land productivity for bacterial wilt-free seed potato and about 50% less land requirement to meet on-farm seed tuber needs than was achievable under conventional ware production systems. In addition to meeting their own on-farm requirements, some farmers started producing high quality seed potato in larger seed-plots for sale to others in their neighbourhood. Additionally, farmers' enthusiasm to utilize the SPT spilled over to the setting up seed-plots for multiplication of planting materials of other vegetatively propagated crops such sweet potato and arrow roots as was the case in Kenya. On-farm ware potato yields under the PSS practice were at least 30% higher than in fields where farmers obtained seed potato from ware plantings with no regard to the health status of the mother plants. Farmers who embraced and applied this technology effectively benefited themselves by making potato farming more commercial and also became sources of high quality seed potato for other farmers. The role that the two technologies played in improving the availability of high quality seed potato was further strengthened by linking farmers to sources of starter seed potato. In particular, more farmers were familiarized with the processes of generating certified/clean seed potato in research institutions and some private establishments, including those producing mini-tubers through aeroponics technology. Through the trainings provided, farmers gained knowledge and skills that continued to enable them to safeguard seed potato quality by protecting against disease-causing agents such as *Ralstonia solanacearum* and viruses through intensive care of their potato plots that are meant to be the sources of their seed for subsequent planting.

Key words: *seed potato nursery, getting the best, self-sustaining*

Crop-Livestock Integration for Sustainable Management of Natural Resources in the Eastern and Central Africa

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The sustainability of smallholder crop-livestock production in the Eastern and Central Africa region is threatened by adverse effects of climate change leading to inadequate livestock feeds and water. Studies were conducted in Uganda, Kenya, Tanzania and Burundi from 2010 to 2011 to a) describe existing dairy farming in mixed crop-livestock systems and identify constraints to its productivity; (b) scale-up technologies and innovations for improved resilience and sustainable crop-livestock systems; (c) assess socio-economic benefits of improved technologies and innovations; (d) promote policies to transform smallholder crop-livestock system into sustainable and resilient profitable enterprises (e) increase awareness and knowledge and information on crop-livestock value chain innovations and (f) document lessons learned from introducing improved technologies and innovations.

Survey results to describe existing dairy farming revealed that households in semi-arid Kenya had larger dairy herd size (1-10 animals) compared with households in Uganda, Burundi and Tanzania 1-3 animals). The semi-intensive was the preferred production system in Kenya (55%, n=116) while in other study areas stall-feeding was the most preferred system (60%, n=344) due to land shortage. Low rainfall, feed shortage, high cost of forage seed, inadequate feed and poor soils were the major constraints affecting dairy production and was reported by over 70% (n=460) of the respondents.. Feed availability and milk yield closely followed the rainy season with scarce feed and low milk yield (5-10 litres) being reported during the dry seasons compared to the rain seasons (8-25 litres/cow/day).

Results of on-farm trials showed that total fodder availability and number of feeding days increased by over 70% when 0.5 ha of a mixture of Brachiaria mulato and forage legume (14,119$\pm$195.8 DM/ha/year; 193.6$\pm$19.4 days) and 0.5 ha of Napier grass-forage legume mixture (17,790 $\pm$331.2 kg DM/ha/year; 284.2$\pm$26.9 days) with manure application were both established on a farm. An on-station study to investigate the effect of manure type (goat, cattle and poultry) on cabbage production showed average yield (6,233.4 kg) of cabbages from manured plots was 157% higher than the yield (2,422.2 kg) obtained from plots with no manure. The cabbage heads obtained from plots with chicken manure were 9, 49 and 95% heavier than the heads obtained from goat (416.7$^{g)}$, cattle (305.6g) and non-manured plots (233.3g). Water harvesting from roof catchment and surface run-off enabled farmers to store 30,000 litres of water sufficient to cater for 4 people keeping 2 dairy cows for a period of 3-4 months. Milk yield and household income increased by over 50%. Irrigation and manure application increased vegetable yields by up to 500% and ensured year-round vegetable supply.

Major constraints to implementation of policies were: poor quality feeds, limited veterinary services, poorly equipped and capitalized veterinary practitioners, high interest rates on loans, poor breeds and limited facilitation to policy implementing institutions.

Over 2,000 stakeholders were trained on aspects of crop and livestock production through workshops, field days, field visits and on-farm trials. Ten scientific papers were presented in scientific conferences and workshops.

Major lessons learnt were: dairy farming contributes to sustainable crop and livestock production in ECA region. It is therefore important to identify innovations and technologies that provide early benefits to stakeholders. The farmers will want to first test the technologies and innovations on a small scale as this minimises risk. In conclusion, integrated management of improved forages, soil fertility improvement, water harvesting and irrigation technologies with favourable policies provides for sustainable crop and livestock production and productivity.

Genetic engineering of maize for drought tolerance in Eastern and Central Africa

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Maize, the most important staple food crop in East and Central Africa (ECA), is affected by drought – the single most important abiotic factor responsible for up to 70% maize loss. In the year 2008, a project funded to a tune of USD350, 000 by USAID through ASARECA was initiated. The objective of the project was to develop and avail drought tolerant engineered maize genotypes adapted to ECA. This was done using genetic engineering approaches of gene up-regulation, under-regulation (silencing) and drought inducible expression of candidate genes. To date 15 tropical maize genotypes have successfully been transformed with drought conferring genes; Annexinp35, Annat1, NHX1, XvPrx2, XvSAP1, IPT, CBF 1, amiRNA1 and amiRNA3 . The maize genotypes developed using these genetic engineering technologies are being advanced and evaluated in the glass house at Kenyatta University in preparation for drought stress experiments and field trials. The genetically engineered maize lines are: one Ethiopian open pollinated variety (OPV), one temperate line, eight Sudanese genotypes , one Tanzanian OPV and five CIMMYT inbred lines. The research products ready for uptake and utilization are the base sequence of a drought tolerance gene that has been isolated and cloned and optimized protocols for regeneration of maize germplasm adapted to ECA. Seventeen partners from around the globe have been identified and are playing different roles and responsibilities in the development of drought tolerant transgenic maize. Scientists from ECA region are being trained on genetic engineering at MSc. and PhD. Level. To avail drought tolerant engineered maize genotypes to farmers in ECA region more studies involving the generated maize lines are critical and this will be done by building synergies for up-scaling the utilization of findings of this research.

Evolution of the seeds sector policy harmonization and rationalization in Eastern and Central Africa

Evans Sikinyi; Michael Waithaka; Miriam Kyotalimye

For a long time, sub-Saharan Africa commanded less than one % of global trade in seed with little if any intra regional trade between neighbours. Regulations and policies established when most plant breeding and formal seed production were dominated by the public sector constrained growth in the sector as variety release procedures were designed to meet the needs of public research institutes and seed certification was focused on public or parastatal seed enterprises. Each country developed its own seed certification regime. The lack of harmonised procedures and standards for key processes along the seed value chain posed a significant barrier to seed trade and inhibited the spread of new varieties beyond national boundaries. This led to delays in release and often rejection of useful varieties that did not meet the criteria and procedures. A public variety released in one country faced long battles to gain release in a second country. Phytosanitary regulations that were not based on scientific evidence further restricted possibilities for trade. Commercial seed trade was also hampered by lack of intellectual property protection for plant varieties and by different procedures for import and export of seed.

Starting in the late 90's an ASARECA initiative brought together key stakeholders in the seed industry to analyse the policy landscape, review and spearhead efforts to adopt options for policy reform. Options were clustered around five key areas – variety evaluation and release, seed certification, plant variety protection, phytosanitary issues and export and import documentation. A harmonisation agreement around these key areas was adopted by delegates from Kenya, Tanzania and Uganda in 2002 and later rolled out to all ASARECA countries. The operationalisation of this agreement was vested in a public–private entity launched as the Eastern Africa Seed Committee (EASCOM) in Kigali, Rwanda in 2004.

Reforms included a review of national seed industry laws and regulations to align to the regional position on seed; providing more autonomy to national seed agencies; creating more space for participation of the private sector; recognising the role of plant variety protection and streamlining export and import documentation procedures. As a result, seed production and trade has more than tripled, while prices for the key tradable—seed maize—have also stabilised. The total welfare gain for enhanced intra-regional trade in seed maize alone arising from harmonised seed policies has been estimated at US$ 727 million per year for the ASARECA region.

The pace of harmonisation has been slow with some countries adopting reforms faster than their counterparts. The agreed reforms must be communicated through a policy process that may not be sympathetic to the view that regulation's principal purpose is to encourage seed system development rather than to be a "police force". Amendments of laws and regulations takes time, but changes in attitude and interpretation are often as important and as difficult to achieve. In addition, many regulatory reforms imply changes in institutional responsibilities and the establishment of new protocols that require additional resources.

Promoting farmer-led seed enterprises of African indigenous vegetables to boost household incomes and nutrition in Kenya and Tanzania

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The problem of food security in sub-Saharan Africa is aggravated by micronutrient deficiencies, a major impediment to social and economic development. Malnutrition including lack of essential micro-nutrient deficiency can impair growth and/or cause high mortality, especially among vulnerable populations of

women and children. In Kenya and Tanzania, 40% to 45% of pregnant and nursing women suffer from anaemia while 25% to 30% of children under five are stunted and highly susceptible to infectious diseases. African indigenous vegetables (AIVs), including *Africa nightshade*, *Amaranths*, *Crotalaria*, *Spiderplant*, *Jute mallow* and *African eggplant* are rich in micronutrients such as iron, zinc, Vitamin A, and contain non-nutrient substances called phytochemicals, which help protect people against non-communicable diseases. Consumers in many parts of Eastern and Central Africa (ECA), especially in urban areas are becoming aware of the nutritive benefits of these vegetables. A growing number of smallholders in turn are striving to take advantage of this renewed interest in the AIVs by growing and supplying them to markets in both the rural areas and in urban centres. AIVs are becoming a common item in major supermarkets and green grocery stores in some countries notably, Kenya, Tanzania, and Uganda, to name a few. However, the potential to meet the growing demand for these vegetables in the region is limited by lack of good quality seeds. The majority of farmer use seeds obtained either saved from their own previous crop or from open air markets, which have problems of purity with mean germination rates rarely above 50%. Depending on seeds from such sources also means that farmers have limited access to seeds of improved varieties that meet consumer preferred attributes. Effective seed supply system and an assured market for seed is critical in unleashing the potential of AIVs to improve food security and livelihoods of target communities, and increase adaptation of vulnerable populations. This paper describes the process used and the success achieved in an ongoing pilot project aimed at validating and promoting farmer-led seed enterprise (FLSE) models for sustainable supply of quality seeds of AIVs. This is being implemented in Kenya and Tanzania, however, the lessons learned on these models will be shared for scaling up in other countries. Three FLSE models are being evaluated: private sector seed company-mediated model, research-mediated model and informal grade model. The success of the models is based on development of technical capacities of seed producers as well as building strategic and functional linkages through public private partnership with institutions/organisations in the value chain. Success parameters, such as volumes of quality seed (certified or quality declared depending on country seed regulations) of different AIVs produced and sold, number of smallholder seed growers trained and able to go through the quality assurance are among those used in the evaluation of enterprise models. More than 500 farmers (>40% women) have been trained on quality seed production and post harvest handling. Through the private sector mediated farmer-led seed enterprises model in Kenya, farmers are earning on average $4,500 per annum from indigenous vegetables seed production. One exceptional farmer earned up to US $ 17,000 in 2010. Similarly, from the training and inspection by the government seed certification agency farmers in Dodoma Tanzania are now producing and selling high quality declared seed of *African eggplant*, *amaranths* and *nightshade*. These are quality seeds, which have been shown to have a mean germination and purity standard above 90%, are in high demand both locally and in Dar es Salaam and fetching good prices of approximately US$ 3 per kilogram.

Keywords: African indigenous vegetables, technology, dissemination, farmer, seed enterprise, income, Kenya, Tanzania

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Improving capacity for Agricultural Research in Eastern and Central Africa: The SCARDA approach at ARC Sudan

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Strengthening Capacity for Agricultural Research and Development in Africa (SCARDA) was a continent wide capacity strengthening initiative funded by DFID and coordinated by FARA. In East and Central Africa, SCARDA was managed by ASARECA, and targeted three NARS represented by *Institut des Sciences Agronomiques du Burundi* (ISABU), *Institut des Sciences Agronomiques du Rwanda* (ISAR) and the Agricultural Research Corporation (ARC) in Sudan. The SCARDA programme goal was to strengthen the institutional and human capacity of African agricultural research and development systems to identify, generate and deliver research outputs that meet the needs of poor people. SCARDA had three components: (a) strengthening competencies and capacity in agricultural research management, (b) strengthening capacity for professional development in agricultural research and development, and (c) empowerment of tertiary agricultural educational institutions. Most of the focuss at ARC-Sudan was on components (a) and (b).

Under component (a), a series of learning workshops to strengthen the competencies and capacities of Agricultural research managers were delivered. The learning workshops, focused on five competence areas: (1) facilitation for change, (2) managing research for development and quality of science, (3) facilitating partnerships and innovation platforms for impact, (4) managing self development for leadership, and (5) Managing organizations, units or teams. In each of these areas, participants gained a level of proficiency enabled them to professionalize their engagement in change at ARC and to improve their overall performance as leaders and managers. Furthermore, during the workshops participants were able to identify key issues/challenges which were then assigned to peer learning groups (PLGs) to address, using principles acquired during the group learning sessions.

Under component (b), activities undertaken were MSc training for young ARC scientists in disciplines that had been found to be deficient. Short targeted re-fresher courses in selected agricultural research and development areas were also delivered, and a mentoring program for middle level and early career development staff undertaken. In the MSc training, a total of 15 young and mid-level scientists from the ARC and a few other satellite institutions in the Sudan were supported for training in various disciplines, including Plant Breeding, Horticulture, Natural Resources Management, Range Management, and Agricultural Information and Communication Management. Short training courses were provided in two areas: Integrated Pest Management (IPM) and Laboratory Management for research technicians. The IPM course benefited 30 staff of ARC and it's partner institutions and covered critical areas relating to the identification and management of insects, diseases and weeds. The Laboratory Management training benefited 16 technicians from ARC and covered topics such as best laboratory management practices, clean seed production, seed certification, seed legislation &marketing, principles of research ethics, plant disease diagnostics, and data management.

At the individual level the ARC staff gained new knowledge & skills in agricultural research management. The learning workshops reflective sessions touched some deep issues in ARC and brought them to surface, e.g. strategy development, regionalization of research and institutionalization of M&E systems. These issues are now on the ARC agenda and the trained managers are actively involved in the ongoing change process. Feedback culture is defusing gradually among ARC staff and is expected to be anchored in the ARC system. A mentoring & coaching culture has formally taken root at ARC and is expected to cover a wide range of areas, such as career guidance, technical and professional development, and leadership. ARC staff in some of the research stations have successfully applied knowledge and skills acquired during the training related to the facilitation of partnerships and innovation platforms for enhanced impact. The Master's training programme has enhanced professional skills of researchers in

areas such plant breeding & biotechnology and Agricultural Information Communication and management (AICM). The short term training for technicians has upgraded their skills for laboratory analyses and crop protection techniques and the trained staff have become part of a wider net work in the region.

Harnessing Agrobio-diversity for food security and sustainable development in eastern Africa: Plant genetic resources conservation and use in Sudan

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Sudan, being an eastern African country is one of the eight member countries of the Eastern Africa Plant Genetic Resources Network (EAPGREN/ASARECA), a projects operating under the umbrella of Agrobio Program of ASARECA. Sudan has been part of EAPGREN since its conception in 1997. The Plant Genetic Resources Program in Sudan is operating under the Agricultural Research Corporation (ARC) of Sudan. It is being run through a PGR Unit in the ARC, with a main objective of conserving and enhancing the use of the plant agro-biodiversity and PGRs in the country.

Sudan has benefited considerably from the implementation of activities related to EAPGREN since its operationalization in 2004. The activities were conducted using funds that were made available through the project on "Capacity Building and Networking for Conservation and Utilization of Plant Genetic Resources in Eastern Africa", with funding from the Swedish International Development Cooperation Agency (Sida). The capacities of the PGR program in Sudan to conserve and enhance the use of PGR have been improved significantly as the result of the project support from EAPGREN. This is reflected in the improvement of germplasm storage capacity by 65% and increase in the total PGR holdings by 80%, as well as increase in number of germplasm accessions that have been multiplied and characterized by more than 100%. Human capacity of the PGR programme in Sudan has also been upgraded through post-graduate trainings leading to master and PhD degrees, as well as through specialized and on-job short-term trainings. A PGR documentation system for facilitating data capturing, storage, access and retrieval has been adopted as part of a regional arrangement for PGR information management. Passport data of PGR collections in Sudan are made accessible through the internet using the EAPGREN Data portal. Activities to raise awareness and solicit public participation have also been undertaken resulting in wider level of sensitization and interaction in the PGR domain. Arrangements for back-up and safety duplication of PGR collections from Sudan have been undertaken in collaboration with sister institutions inside and outside the country.

The PGR activities undertaken during the project life are useful in addressing basic PGR activities, challenges and backlogs in Sudan. Although further studies are required, the germplasm characterization works have reveled useful agronomic traits that can be used in future crop improvement programs. All project outputs constitute the basis for PGR conservation and sustainable utilization in Sudan with significant implications to food security and sustainable development in eastern Africa and beyond.

Market-focused Approach to Natural Resource Management: Potential for bee keeping in rehabilitation of degraded water sources and riverbanks, and biodiversity conservation: A Case of Lushoto District, Tanzania.

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Beekeeping is a major activity for socio-economic and environmental conservation benefits, providing food (honey, pollen, brood), industrial raw material (beeswax candles, lubricants), medicine (honey, propolis, beeswax, bee venom) and income. Beekeeping in Tanzania is mostly carried out using traditional methods which account for 99% of total honey and beeswax production. About 95% of all hives are traditional, hanged on trees far away from household: a practice that is unfriendly to women. Although legislations recommend 60 to 200m buffer strip around a water body, land shortage makes enforcement difficult. Where buffers satisfy socio-economic and ecological demands, a win-win situation is attained. Modern beekeeping is a profitable enterprise for monetary and biodiversity conservation benefits.The overall objective of the research was to promote adoption of sustainable NRM technologies through development of farmer-market value chain for honey as a stimulant to NRM investment. Specifically, the objectives were: (i) To evaluate the effect of introducing improved beehives on honey production; (ii) To assess the effect on vegetation cover and biodiversity. Studies were initiated in Mwangoi and Migambo villages, Lushoto district, Tanzania, using modem beehives (SUA-ITATOBE). Honey production, marketing, market linkages, vegetation regeneration and ground cover were monitored between 2008 and 2010, and used to calculate density, species abundance, and dominance diversity indices, profit margin and discounted benefit-cost analysis. Beekeeping has become a commercial activity, carried out by both men and women, unlike what it traditionally was. With bees serving as 'police' to the would-be land degraders, improved bee keeping has resulted in vegetation recovery and species diversity in the once degraded water sources and river banks. During 2008, 2009 and 2010, average honey production in the project sites increased from 69, 142.5 and 203 kg, and mean ground cover from 2.5%, 22.5 and 62.5%. Though improved honey harvesting, handling and packaging, farmers accessed honey buyers in Lushoto town and Dar es Salaam city for better market access. Profit margin (farm gate) ranged from Tz Sh. 834 to 1,111 per litre of honey.

Key words: Restoration; Biodiversity; Financial analysis; Benefit-cost

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Productivity and profitability of groundnuts with phosphorus fertiliser in Mbale district, Uganda

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The productivity and profitability of groundnuts following phosphate use on four varieties (red beauty, serenut 2, serenut 3 and serenut 4) were assessed on farm in Bungokho sub county, Mbale district, Uganda between 2009 and 2010. Phosphorus was applied as single superphosphate at 0, 17.48, 34.96 and 52.44 kg Pha^{-1} in 2009 and at 0, 4.37, 8.73, 13.10 and 17.46 kg P ha^{-1} in 2010. During 2009, response was highest for red beauty followed by serenut 3 then serenut 4. Response was quadratic for serenut 3

and serenut 4, with a peak observed at 35 kg Pha^{-1}. For red beauty, the response was linear; no response was observed for serenut 2. Phosphorus application increased groundnut yield in 2010 with a quadratic and significant ($P<0.05$) response but varieties did not differ in their response to P. Agronomic response was observed up to 8.73 kg Pha^{-1}, beyond which no significant increment in yield was observed. Highest gross margin (US $ 47 ha^{-1}) was observed at 4.37 kg Pha^{-1}. Considering that fertiliser cost contributed between 18 and 40% of the production costs, phosphate use at rates higher than 8.73 kg P ha^{-1} although agronomically beneficial, was not profitable under the prevailing groundnut market price conditions. Breakeven prices, however, indicated for the four varieties with various P rates, how high groundnut price would have to be for additional output to become profitable. Profitability would be assured with red beauty and serenut 3 varieties if their prices rose by 10% for all rates of P. Profitability with serenut 2 and serenut 4 varieties could be assured if their prices rose by 20% for P rates between 4.37 and 13.1 P ha^{-1} only. The study recommends a need for governments and other value chain actors to put in place mechanisms for smallholder farmers to access and use fertiliser for enhanced productivity and profitability.

Key words: Groundnut varieties, phosphate use benefits, Commodity value chain, marginal analysis, sensitivity analysis

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Evaluating the Potential of Grain Amaranth as a Climate Change Adaptation Strategy for Rural Communities in East Africa: A Case Study of theWestern Highlands of Kenya

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The growing scientific evidence linking climate change to many socio-economic and biophysical challenges affecting the vast majority of communities especially among developing countries calls for urgent need to develop viable coping strategies. This study evaluated the potential for Grain Amaranth (GA) as a climate change adaptation strategy in Gem district, Western Kenya between 2009 and 2010. The objectives were: (i) To evaluate the potential of GA as an adaptation strategy to climate change for smallholder farmers; (ii) To develop soil fertility management guidelines for sustainable GA production; and (iii) To facilitate value chain development for GA. Farmyard Manure (FYM) at 0, 2.5, 5.0 and 7.5 t ha^{-1} and Diammonium phosphate (DAP) at 0, 25, 50 and 75 kg ha^{-1} were applied as factorial structure in a RCBD Design, replications three times. Maize hybrid 511 was planted in adjacent fields under the same fertiliser treatments. Financial analyses for both GA and maize were carried out using *partial financial* analysis. Highest average amaranth grain yield was obtained from a combination of 75 $kgha^{-1}$ DAP and 7.5 t FYMha^{-1}. However, best Marginal Returns for GA was obtained by at 75 kg DAPha^{-1}. Marginal Returns for GA was about 5 times higher than that of maize receiving the same FYM and DAP treatments. Moreover with a shorter growth period and less moisture requirement GA presents a possible alternative for rural poor communities to adapt to the impacts of climate change. The project introduced and tested on-farm, prototypes of equipment for planting, harvesting and threshing GA to ease field operations and reduce post harvest losses. Farmers were also trained in GA value addition including milling, packaging and processing into different products, and linked to local and regional markets.

Key words: Financial analysis; food security; nutrition; coping strategy

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Up-scaling of soil water management technologies and drought tolerant varieties for increased maize productivity in East and Central Africa countries

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East and Central Africa region has an average production of 9 million tons of maize on 5 million ha of land and an average yield of 1.8 t/ha. These yields are relatively low compared to the potential yield of 4.5-7.0t/ha. Among major constraints facing maize productivity include drought and low soil fertility. The current changes in climate from global warming will further exacerbate the problem of drought that already exists in the region. However, research has developed technologies and innovations that could alleviate the problems and hence boost maize productivity in the region. The challenge is that the technologies are not yet adequately used by the small scale farmers in target areas and hence no wide scale impact. A review was conducted in Ethiopia, Tanzania and Kenya to document proven soil/water management technologies (SWM) and drought tolerant (DT) varieties for improved maize productivity and to identify constraints to adoption. SWMT were documented using literature review, participatory approach during workshops and focused group meetings with farmers and other stakeholders. Use of priority SWM practices with appropriate drought tolerant varieties optimized productivity of maize, more than doubled yield, created demand for capacity building in the technologies and contributed to household food security. However majority of smallholder farmers have limited access to technological knowledge, researchers lack adequate resources for adaptation trials to enhance technology dissemination, there is poor linkages and institutional frameworks. Increased stakeholder participation and empowerment at all levels including primary to tertiary is required to increase research building upon generated knowledge to meet created demand; hence increase up-scaling initiative to achieve a wider scale impact needed to meet food security for the region in 21st century.

Key words: Soil water management technologies, drought tolerant maize varieties

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UTILIZATION OF COMMON BEAN FOR IMPROVED HEALTH AND NUTRITION IN EASTERN AND CENTRAL AFRICA

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Common beans have the potential to alleviate micronutrient malnutrition and hunger as they are rich in quality protein, fiber, micronutrients such as iron, zinc and vitamin A. Although several interventions have been implemented to alleviate micronutrient malnutrition including supplementation, fortification of foods and use of diverse micronutrient rich diets, micronutrient malnutrition has remained rampant in developing countries. This has been due to limited reach and unaffordability of the interventions by the rural and urban poor. Utilization of biofortified nutrient dense beans which is popular in the diets of many vulnerable groups offer potential and sustainable solution to malnutrition and hunger related deficiencies. The national bean research programs across ECA region developed nutrient dense bean varieties with iron and zinc contents above 70ppm and 30ppm, respectively for farmer use in the region. Twenty one micronutrient dense bean varieties have been released across the region while twenty varieties are at pre-release stage in eight countries. The national bean research programs have also developed bean based food baskets and recipes (twenty six recipes) for utilization of bean for improved health and nutrition in the region. The developed varieties and bean based food baskets are being intensively promoted through awareness creations (demonstrations, publications, trainings) for use among the vulnerable groups in EAC region for improved health and nutrition. Preliminary results from Rwanda and Uganda showed improved health and nutritional status of HIV affected communities with regular consumption of micronutrient rich beans. Therefore, improved access to micronutrient rich beans and bean-based products is likely to improve health and nutritional status of the vulnerable groups in the communities across EAC.


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