RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security

CGIAR CCAFS

Info Note

Climate-smart villages and the hope of food secure households

Preliminary results from climate change adaptation and mitigation initiatives in the Nyando climate-smart villages

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Key messages

- Shift in farming techniques reduces number of households eating one or no meals each day
- Households adopt three to five crop innovations and above, greatly expanding on-farm choices for resilient varieties
- Resilient crossbreeds of small livestock better adapted to changing feed and water conditions in Nyando provide additional income

The Nyando basin in western Kenya is a rich agricultural flood plain around the large Lake Victoria water mass. The population density exceeds 400 persons per square kilometer making it one of the highest populated rural localities in east Africa. In the villages of Nyando, 81% of the families experience 1-2 hunger months in a year, while 17% of the families experience 3-4 hunger months; a period when they are unable to produce from their own farm source. Agriculture remains their main source of livelihood, including growing staple cereal maize and sorghum in mixtures with legumes such as beans and cow peas. Local zebu cattle are also kept alongside local poultry and small ruminants of sheep and goats.

Climate risk and lost opportunities

There is greater variability in the expected onset of seasonal rainfall in Nyando with long dry spell days observed at early onset and extreme flooding during late onset events. From long-term 50-year historical data, the onset appears to have drifted from what farmers perceive is a start, on or about 15 February to a true onset on or about 15 March. From the scientific analysis, the probability of encountering a dry spell of 10 days in the subsequent 30-day planting window dramatically declines 6 fold from 0.6 in mid-February to 0.1 in mid-March. These dry spell periods reduce the length of the main growing season which is 90 to 110 days. Because of the lack of timely seasonal forecasts, smallholder farmers manage the risk of increased drying by sowing traditional long season sorghum and maize varieties.

Local livestock are fed crop residues from the harvested fields but since the yields are low and herbage of poor quality, farmers are unable to bridge dry season feeding resulting in a loss of condition for the local livestock. This stalls their growth rate, reduces market value during drought and increases the risk of death when disease affects livestock on a low plane of nutrition. Given poorly adapted crops and livestock, farming households have few choices but to adapt to the impacts of climate variability. In addition, poverty, lost labor, less diversified livelihoods and land degradation increase the vulnerability of farming households in Nyando to climate risks, directly reducing household food supply and impacting their nutritional status.

With access to multiple stress tolerant (drought, disease, pests) seed varieties, farmers vulnerability to climate change is greatly minimized. Photo: S. Kilungu (CCAFS)

New partnerships for science-based solutions

Since 2011, the Consultative Group on International Agricultural Research (CGIAR) Research Program on Climate Change, Agriculture and Food Security (CCAFS) facilitates a partnership in seven villages around collective action that integrates a science approach to deliver development outcomes in Nyando. This approach is based on a climate- smart village (CSV) model.

The CSV model focuses on improving local knowledge of climate risks and variability in seasonal rainfall, dry spells, and disease and pest conditions to inform farming decisions. The goal is to respond to climate variability, reduce periodic hunger, ensure food security and enhance household incomes. This is achieved through the participatory application of resilient technologies, training to build the knowledge and capacity to change local practices and improve planning for adaptation to changing farming conditions. To help tackle this problem, the partnership through action research approaches is facilitating the testing of a portfolio of climate-smart agriculture (CSA) interventions, allowing farming households to make progressive changes to crops and cropping patterns as well as introducing new resilient livestock breeds.

New livestock are able to withstand heat stress, better utilize low quality herbage, cope with the disease burden, recover from drought with faster compensatory growth, therefore maturing to market weight in shorter rearing periods compared to the local breeds. Being climate-smart therefore means farming households are able to combine these scientific tools and products with changes from adaptive management to address climate related risks and build resilience at local scales.

Collective action for adaptive management

Community innovation funds ensure farmer groups can access money to invest in new crops and improved varieties. Photo: V. Atakos (CCAFS)

Over a period of three years, three strong community based organizations (CBO) are operating in the initial seven villages and expanding collective action for agricultural innovations in investments from rural savings, table banking schemes and loaning from revolving funds. The community based organizations are umbrella to more than 50 mixed farmer and youth groups serving members in 106 villages in Nyando. More than 60% of these are women or youth below the age of 25. This is a remarkable turn from 2011 when only 20% reported to belong to a group. When the program started, 17 groups with membership from 306 households were operational and their income base from savings was nearly USD 14,850. Under this initiative, the number of groups has more than doubled to 50 with membership from 1,675 households, mobilizing USD 69,500 in a community innovation fund. Borrowing from the facility has reached 90% and the leading uses for the loans include purchase of food, procurement of farm inputs, payment of school fees and start up for small trade.

In the beginning, one of the reasons cited for low uptake of fertilizer and certified seed was that the nearest agricultural input stores were at least 17 kilometers away for farmers in lower Nyando and up to 44 kilometers away for those in upper Nyando. At that time, most of the CBO members procured seed within the group networks and other on-farm sources. By setting up an input supply store in the community, the number of farmers using local seed has reduced by half. From 2013 to 2014, the annual average quantity of inputs procured is now 16 tons of fertilizer, 1.2 tons of maize, 0.9 tons sorghum, 0.8 tons of beans, 0.6 tons of green gram and 0.3 tons of cow pea seed. In addition, since most farmers will often have prior knowledge of the seasonal outlook, they can now purchase the appropriate seed and fertilizer for the season.

New crops address food and nutrition challenges

Given that Nyando has a likelihood of one in 10 failed seasons and the amount of rainfall available in the minor season is insufficient to grow cereals, it is common for farm households to experience more than six hunger months in a year. To deal with this risk, households diversify crop choices and select those whose multiple uses serve both their food and livestock feed requirements. In 2011, 64% of farm households in the seven villages were already introducing at least one new crop variety of maize or sorghum, and sometimes with beans. Currently, the proportion of farm households growing maize and sorghum crops for subsistence remains high and nearly all households are incorporating drought tolerant varieties of both crops. In any given year, at least one half of all households monitored in Nyando will plant legumes. Overall, less than six percent of households will sell crop produce therefore most of what

is produced in consumed on-farm. The CGIAR and CCAFS partners continue to work with farmers to test a portfolio of crops that include pigeon pea that withstands drought and water logging. Moreover, pigeon pea leaves can be harvested as nutritious fodder for small ruminants. Others are cassava that resists the deadly mosaic virus, sweet potatoes that are better adapted to low moisture in the minor season, tissue culture bananas that resist the bacterial wilt disease and mangoes as well as pawpaw trees whose fruits are harvested for food and also sold for income. Early results show a shift to high diversification and households are now adopting more than three to five crop innovations, greatly expanding on-farm choices for resilient varieties.

Nyando's climate-smart village scientist
William Sang is not your usual farmer, always keen on new innovations; he now has all his energy focused on **climate-smart agriculture** techniques. With just three acres of land, Sang's rocky farm already functions like a self-sustaining machine. To reduce the effects of surface run off and soil erosion on his hilly piece of land, stone terraces and stone bunds have been skillfully constructed to reduce risk of loss of fertile soil.

We find a **sorghum demonstration plot** on one corner where members of his farmer group in Tabet village are testing the adaptability, vigor and productivity of several sorghum lines that include *Serena* and *Seredo* varieties. The trial is done in collaboration with the Kenya Agricultural and Livestock Research Organization. In an adjacent plot, he grows an improved finger millet variety - a small grain cereal crop - developed by the International Crops Research Institute for the Semi-Arid Tropics.

"When compared to maize, finger millet utilizes less water. It also better resists attacks from pests and diseases" said Sang. He is also trialing tissue culture bananas; another innovation from the International Institute of Tropical Agriculture. Farmer Sang is also working with **climate scientists** from the University of Reading, Maseno University and the Kenya Meteorological Services to improve access to seasonal weather forecasts that will enable him make farm decisions. Sang has been trained to measure the amount of rainfall received and sends the data via mobile messaging system to a central server. This data is used to produce two to three day forecasts which help farmers in this village plan their farm activities Read more about Sang here: **http://ow.ly/KSjgo**

Ruminant stock; small is better than big?

The Galla goat is adapted to drylands, has good growth rate as well as milking ability. Photo: V. Atakos (CCAFS)

Following participatory assessment in 2011, the International Livestock Research Institute (ILRI) partnered with the local CBOs to introduce resilient breeds of Galla goats and Red Maasai sheep in 2012 to mid-2013. At that time, nearly all households owned local chicken, 59% kept zebu cattle and small sheep and about half (48%) owned and reared east African goats. Because their productivity was low and they often showed poor recovery from drought and disease, farmers proposed changes to the breeds and rearing practice that would help transform the local livestock. The aim was to cross selected Galla goat and Red Maasai sheep with the small local East African breeds for resilience. The Galla goat is docile and easy to handle. It is adapted to drylands, has good growth rate, matures earlier by up to six months compared to the local breeds and shows good milking ability.

Female Galla goats have a long productive life and continue to breed and rear kids for up to 10 years. They are rarely culled due to loss of teeth and have a very strong compensatory growth after long dry seasons. The Red Maasai sheep is a breed reared for meat and is renowned for its faster growth, resistance against internal parasites, and good tolerance to trypanosomes, drought and heat stress. The cross breeds of Red Maasai sheep and Gala goats also mature earlier compared to the local breeds. In the local markets, they may attract up to three times the price of the local breeds. It also takes less time and labor to raise small ruminants compared to large cattle, and the meat and milk gains of small ruminants far exceed cattle because they have shorter reproductive cycles and maximize grass and fodder use from grazing sheep and browsing goats.

In Nyando, small stock is sold to supplement household income. Households, each own four to five sheep and between five and six local goats. In 2011, nearly 64% of the 467 households in the seven test villages had not introduced new livestock breeds. This changed in 2012

when 70 breeding units of Galla goats were acquired, and also in mid-2013 when 30 breeding units of Red Maasai sheep were installed. During the main growing season, when crops are in the field, additional household income from sheep, goats and chicken ranges between USD 266 and 300. From the 100 breeding units of Galla goats and Red Maasai sheep, a total of 1,506 crosses were registered in 2014. This represents about one third of the total 4,336 sheep and goats in the seven villages. At this rate, it is anticipated that the current total population of 38,725 sheep and goats (on average 57% of households keep sheep and goats) in the 106 villages could be replaced by new Galla and red Maasai crosses in five years, bringing the benefit of resilient genetics of crossbreeds for adaptation to changing feed and water conditions in Nyando.

Further Reading

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This Note presents preliminary results from participatory action research activities conducted by CCAFS and partners in the Nyando climate-smart villages in Western Kenya.

The titles of the INFO NOTE series seek to disseminate research findings on climate change, agriculture and food security, as well as stimulate feedback from the science community.

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