

# Water-Smart Agriculture through Adoption of Drought-tolerant Crops



**T**he primary goal of promoting water-smart agriculture (WaSA) is to support water management efforts in agriculture and increase crop productivity for every drop of water used. Similarly, there is a strong element of ensuring food security in promoting WaSA through drought-tolerant crops in Nakapiripirit, Karamoja Subregion by the Ecological Christian Organisation (ECO), a non-governmental organization with support from Cordaid. The practice also tries to build resilient communities in fragile ecosystems such as those Karamoja in to enhance sustainable management of resources, understanding the possible scenarios of climate change and disaster risk reduction measures with respect to livelihood.

The promotion of drought-tolerant crops started in 2012, targeting local agro-pastoral farmers in Lolachat and Nabilutuk subcounties as primary beneficiaries. ECO did a survey in October 2014 among the direct project beneficiaries to assess the effectiveness of growing drought-tolerant crops among other adaptation measures. In that survey, 78% of respondents strongly agreed that using drought-tolerant crops is a contextually effective and affordable measure. Other measures include weather information, early warning centers, drip irrigation, apiary, development of bye-laws and use of energy-saving stoves.

# Nakapiripirit District

Nakapiripirit is one of the districts of Karamoja, a semiarid area located in northeastern Uganda that comprises six other districts: Kaabong, Kotido, Abim, Napak, Moroto, and Amudat. The district is home to about 26,870 people and economically, about 85.6% of the rural population live below the poverty line—less than 1 dollar/day (UBOS, 2012). The area is characterized by low and unreliable rainfall, a unimodal rainfall pattern with one planting season, vulnerability to frequent droughts and persisting food shortage. Mean annual rainfall ranges between 600 and 1,000 mm. The area is characterized by low groundwater recharge, high potential evaporation, and growing water demand (MWE, 2013).

There is a water challenge cycle in Karamoja as demonstrated by low inputs into the system and high output rates. Being an agro-pastoral setting, water is needed for crops, animals, domestic use, and environmental needs. This puts pressure on the limited water resources and thus requires smart practices that ensure sustainable use and effective mitigation of disasters. Drought is the major hydro-meteorological challenge in Nakapiripirit, which leads to crop failure and food shortage (UNDP, 2013).

## Why drought-tolerant crops?

Drought-tolerant crops are being promoted as they are able to adapt to water-stressed situations. They also have low feeding habits and low nutrient needs, among other physiological advantages that drive the necessary management practices. Studies have shown that many areas with low and erratic rainfall, where crop water stress is common, are also deficient in nutrients. This deficiency is frequently the second most limiting soil factor. An interaction often occurs between soil water and nutrients, which means that soil water can influence the availability of nutrients, which availability can, in turn, affect the uptake of soil water and crop resistance to drought. Thus, reciprocally, both factors can influence each other. As a result, water deficiencies become more quickly apparent and damaging than nutrient shortages. This suggests that conserving water may often have priority and quicker benefit over attempting to conserve soil particles per se (FAO, 2014).

FAO Uganda in 2010 commissioned a study in the Karamoja subregion to ensure three adaptation strategies, namely: continuous agricultural production and development, water management, and ecosystem environmental protection. It identified drought-tolerant and early-maturing crops available for community uptake. Both traditional and improved varieties were identified and recommended. Crops recommended include sorghum varieties (indigenous) such as Tinyitinyi, Akirikir, Naterekune, Tinyang, Ekabir, and Loyokou, and improved ones like Sekedo. Other crops include green gram, cowpea (*Vigna unguiculata*), K131 beans, Tepari beans, pigeon pea, cassava Katumani, pearl millet, and bulrush millet.

## Growing drought-tolerant crops

Communities have long been cultivating some drought-tolerant crops such as sorghum, and millet. However, studies on the above crops have been carried out by various research institutions like the National Agricultural Research Organisation-Nakapiripirit ZARDI, and the National Agricultural Crop Research Institute Namulonge (NaCRRI). Local communities, through practical observation of varieties and practices in their fields, also contribute to experiential knowledge, thus making the practice adoptable.

Promotion is done through advocacy, sensitization, and direct support to agro-pastoralists by giving inputs such as seeds and gardening tools, teaching good agronomic practices, and providing training.

## Awareness and advocacy as prerequisites

Essential is the community awareness of both indigenous and improved varieties, their sources and markets, handling and propagation procedures, importance of the practice and their overall contribution to soil health, agro-pastoralism, water resources and human well-being. The effectiveness of the practice to produce high-yielding and drought-tolerant crops largely depends on variety, environmental conditions, and management.

The sensitization helped build consensus, achieve

**Table 1.** Comparison of water uptake of various crops (FAO, 1996)

Food	Crop coefficient	Growth period (days)	Daily crop water requirement (mm/day)	Seasonal crop water requirement (mm/day)
Sim sim ground	0.8	120	3.3	396
Nuts	0.8	130	3.3	429
Sorghum	0.8	125	3.3	412.5
Green gram	0.875	90	3.6	324
Cowpea	0.875	100	3.6	360
Millet	0.6	105	2.5	262.5
Maize	0.825	120	3.4	408
Banana	0.75	365	3.1	1131.5
Beans	0.75	90	3.1	279
Sugar cane	0.95	365	3.9	1423.5

greater understanding of the practice, manage expectations, and facilitate wider adoption.

## Drought-tolerant crop selection and cultivation

The community was given a number of alternatives to choose from and practice. ECO has directly supported 2,000 households by supplying seed of their chosen crops—these included green gram, simsim, groundnut, sorghum, and cowpea. Very few people were interested in millet. The beneficiaries have organized themselves into 78 groups since 2012, composed of women, men, the youth, and the elderly. ECO has reached other stakeholders through awareness campaigns and advocacy meetings at the local, district, and national levels. Households participated in both group gardens and private (own) gardens and the model was hailed for being able to spread risks, enable collective action, learning and sharing, and strengthen community cohesion. Monitoring

of progress was easy because each group has a leadership structure. The leaders ensure communication, keep records, address conflicts, convene meetings, and facilitate management.

Most of the crops planted have been doing well though yield varies across communities due to a number of factors. Farmers are encouraged to plant various crops and varieties so that they can complement each other, and spread the risk. Drought-tolerant cropping in Nakapiripirit and areas with related environmental conditions is unique given the various benefits that accrue. For instance, they require attention to site-specific attributes, harmonization of efforts, and ability to strengthen linkages between research and policy to inform practice and vice versa, which are vital to WaSA. It promotes comparative advantages in agricultural production, supports food security, and mitigates overconsumption of resources like water, and enables producing within resource capacity means, among others. Beneficiaries have greatly endorsed the practice as effective for their local setting.



## Key results

- ◆ Promotion of drought-tolerant crops has resulted in commendable acceptance of agriculture in a predominantly pastoral community, evidenced by the wide adoption of drought-tolerant crops.
- ◆ Local communities are more aware of and concerned about issues of climate change and how to adapt to climate and become water-smart. This has been achieved through



accompanying the provision of drought-tolerant crops by awareness and weather information dissemination.

- ◆ In a region characterized by one growing season, members are able to produce good and increasing crop yields out of their gardens through agricultural intensification. The recent survey by ECO established a qualitative increase in crop yields among agro-pastoralists and an increase in agro-land acreage since 2012. Evident in the survey, crop yields have risen from 43% to 48% among most beneficiaries who cultivated within acreage range of 1.5–2.5 ha compared with the time before the interventions. The increase varies according to group, community, individual, year, season, and agronomic practices used. For instance, people/groups and individuals who planted early at the onset of the rainy season usually reported better yields than those who planted late.
- ◆ Through proper agronomic training accompanying the practice, communities have learned new agricultural techniques and/ or reinforced the traditional agro-pastoral knowledge. Currently, the communities are ably intercropping, planting in rows, planting early following the onset of rains, seeking out guidance on crop varieties to plant, and deploying other soil and water conservation techniques that they had never used before such as mulching.
- ◆ Growing drought-tolerant crops has benefited the various households, development partners, government, private sector businesses dealing with agro-inputs, research institutions in the region, and ECO through the ability to realize their missions and objectives of sustainably improving the food situation.
- ◆ There is noticeable behavioral and attitude change, improved decisionmaking, reduced need for humanitarian intervention, informed agro-decision making by the implementing partners, and better research use/application for the related institutions in the project area compared with the past.
- ◆ Lastly, optimizing soil moisture is one other key result through the adoption of drought-tolerant crop. Most crops such as banana and sugarcane use large quantities of water, which under rainfed conditions come entirely from water in the soil. Thus, crops that are light feeders like sorghum tend not to overdrain the

soils, making them fit for an already soil water-stressed area.

## Key challenges

- ◆ High rural poverty levels are a key challenge in promoting related interventions and their sustainable uptake. Most community members cannot afford seeds, improved varieties, and on-site field studies of their soils.
- ◆ High levels of illiteracy where 86% of project beneficiaries could not write and read (ECO survey, 2014) constitute a barrier. This hinders farmer record keeping, reading, and research on interventions individually.
- ◆ While promotion of indigenous drought-tolerant crops is appreciated by many farmers, these farmers sometimes exhibit bias in the promotion of trial varieties. They are interested in new varieties that raise their expectations, and when their expectations are not quickly and easily met, they get demoralized.

## Limitations

- ◆ Use of drought-tolerant crops alone is 'no silver bullet' to increase crop yield, and confront soil and water challenges in the area. They require packaging well with other supportive interventions, and understanding the technicalities involved, which are normally hard to comprehend locally.
- ◆ Climate change effects amidst other naturally existing challenges of aridity and low soil fertility also hinder the performance of these crops.
- ◆ Projects are unable to quantitatively establish the water smartness of crops in various fields.

## Key lessons

- ◆ Beneficiaries mostly focus on output and impact rather than on practice/mode. ECO directly links the practice to the community needs and visions they developed, demonstrating how drought-tolerant crops contribute to the attainment of the Vision 2020 maps of the various communities developed and adapting technical terminologies to local understandable concepts.

- ◆ Drought-tolerant crops are water-smart, given their physiological makeup. Therefore, promoting them in drought-prone areas results in higher adoption.
- ◆ Also learned, the communities have long developed confidence and attachment to their indigenous varieties. If found worthy, they should be promoted more by re-cultivating confidence in the use of these varieties.
- ◆ Usefulness of rainwater and organic matter should be promoted. By recycling through different biotic processes as many times as possible, adoption of multiple soil and water conservation techniques will support the natural elements of drought-tolerant crops.
- ◆ Focus should be on socio-environmental acceptability rather than on textbook philosophy. Research should bear a clear understanding of the people and their social-cultural perspectives, build consensus, and mobilize local support.

## Conclusion

Substantive studies have been done on existing and new varieties of potential drought-tolerant crops that can be planted in semi-arid areas like Karamoja and other relatively dry environments. These crops are found to have mechanisms that are adaptable to water stress conditions and thus use available water effectively and efficiently. These studies inform our decision to promote drought-tolerant crops with the end in mind. The crops are worthwhile ventures to enable food security and are greatly endorsed by the local communities. However, drought-tolerant crops also require additional support of good agronomic practices, continuous monitoring of enabling factors, and also alternative exploration of livelihood options. Depending on available resources, ECO plans to scale up to other parts of Karamoja with related messages, continued evidence-based advocacy, and direct support. They intend to continue building linkages with research institutes and work with other players who support livelihood improvement in Karamoja as well.

## Key recommendations

- ◆ WaSA should be promoted through comprehensive and informed communication about the available options fit for setting drought-tolerant crops in water-stressed areas.
- ◆ Continuous support to livelihood improvement interventions through use of drought-tolerant crops and other livelihood options is necessary to reduce overdependence on fields in the Karamoja subregion.
- ◆ Recognize soil and water as key and living components of the environment. To date, it has received far less attention in comparison with the aboveground components, which are more readily perceived, and should therefore be promoted.

- ◆ There is a need for more research on indigenous varieties that can easily be adopted, are affordable, and can be replicated. Research finding must be disseminated to the people who need them in easy-to-comprehend terms.
- ◆ Continuous linking with research institutions to keep abreast of local and other site-specific agricultural requirements and knowledge should be encouraged and promoted to ease adoption of WaSA practices and technologies for development.

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