

CONSERVATION AGRICULTURE NEWSLETTER



SEPTEMBER 2023 • VOLUME 9 • ISSUE 3

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Farmers in northern Tanzania intercrop pigeon pea with maize in February-March. The pigeon pea remains long after maize harvest, protecting soils throughout the long dry season while providing a cash crop and animal fodder.

Green Manure Cover Crops for Regions with Bimodal Rainfall

By Jean Twilingiyumukiza and Neil Rowe Miller, Agriculture and Livelihoods Technical Advisors

Rainfall patterns vary widely across sub-Saharan Africa, but are driven largely by movement of the [intertropical convergence zone \(ITCZ\)](#), a belt of converging trade winds and rising air that encircles the Earth near the Equator with high cloudiness, frequent thunderstorms, and heavy rainfall. The ITCZ shifts north and south seasonally, bringing rain to the northern half of the continent around March-June and the southern half of the continent around November-February. The ITCZ passes twice per year over the equatorial portions of Africa, resulting in two rainy seasons which are further impacted by factors like altitude, proximity to and [temperatures of the Atlantic and Indian Oceans, and global phenomena like La Niña and El Niño](#), resulting in a wide variety of bimodal rainfall amounts and patterns from Cameroon across the Congo basin to the great lakes region and East African highlands. An excellent source for information and weather predictions in eastern half of this region is [ICPAC](#).



Farmers in eastern Uganda report significant increases in cassava yield when they intercrop with jackbean.

While receiving two rainy seasons presents an opportunity for farmers to harvest crops twice per year, it also presents some unique challenges for incorporating green manure cover crops (GMCCs) into local cropping systems. GMCCs are crops which are grown to improve soil quality by providing soil cover, nutrients, and biomass. In a bi-modal environment, farmers need to select a GMCC which fits not only the current main crop, but also the crop they will plant in the following season. The following lessons have been gleaned from our Partners and programming in central and eastern Africa.

LATE-MATURING COVER CROPS, LIKE PIGEON PEA (CAJANUS CAJAN) AND LABLAB (LABLAB PURPUREUS), ARE EASIEST TO MANAGE WHEN INTERCROPPED WITH A MAIN CROP IN THE MARCH RAINS (SEASON B IN RWANDA).

By planting in this season, these crops will keep soils covered through the longer (3-5 month) dry season and can be harvested before planting the next crop in September-November (season A in Rwanda). In contrast, if these crops are planted in the October-November rains, they often will not have time to mature before the March crop needs to be planted. Pigeon pea *can* be planted in the October-November rains if it is spaced widely (e.g. 1 m between plants) or in alleys (e.g. rows 2-4 m apart as described in the Tharaka Nithi side bar). In this manner, they will grow through the following season, but shade-tolerant crops can be planted under their canopy.

COWPEA (VIGNA UNGUICULATA) AND VELVETBEAN (MUCUNA PRURIENS) CAN BE INTERCROPPED WITH MAIZE IN EITHER RAINY SEASON.

Most cowpea varieties mature early enough to harvest, even during the shorter dry season. If velvetbean doesn't mature in time for the next crop, it can simply be killed by slashing, leaving a mulch which will suppress weed growth (see side bar on AICT).

AN EFFECTIVE GMCC STRATEGY FOR CASSAVA AND OTHER LATE MATURING CROPS SHOULD CONSIDER BOTH RAINY SEASONS.

Since cassava grows slowly, and at a wide spacing, the open ground between newly-planted cassava should be seeded to a fast-growing legume like cowpea, mung bean (green gram), common bean or ground nut (peanut). Toward the end of this first rainy season, or early in the 2nd rainy season, jackbean (*Canavalia ensiformis*) can be planted between the developing cassava plants. This GMCC will provide ground cover and nitrogen through the second rainy season and can be kept alive, or slashed as mulch as the main crop continues to grow during the 2nd dry season.

GMCC SPECIES SELECTION MUST ALSO TAKE INTO ACCOUNT THE ALTITUDE AT WHICH THEY WILL BE GROWN.

Velvetbean, lablab, and jackbean generally need lower altitudes (below 1600 masl) to grow with the vigor needed for effective soil cover and nitrogen fixation. Pigeon pea and cowpea also prefer warmer temperatures, but some varieties do well at altitudes up to 2000 m.

GMCCS' ABILITY TO PRODUCE HUMAN AND ANIMAL FEED MUST ALSO BE TAKEN INTO CONSIDERATION.

Cowpea, pigeon pea and lablab all can produce high protein grain for human consumption and high quality forage for livestock. Thus farmers often prefer them over other species. In a survey of farmers we work with in Rwanda, they overwhelmingly identified velvetbean as the most effective GMCC for covering soils, but preferred pigeon pea and cowpea overall due to their ability to produce food. In contrast, farmers in the Lake Victoria area of Tanzania (see side bar), prefer to grow velvetbean or jackbean as intercrops or sole crops due to their ability to thrive in and improve their acid, sandy, lake-bed soils. And farmers in areas with high-livestock populations and free grazing practices, prefer jackbean since roaming livestock won't destroy it through the dry season.

Growing GMCCs in bimodal areas presents unique challenges of fitting the right species into the right season, micro-climate and cropping/livestock system. Nonetheless, the potential benefit to the farming system is also very high due to the GMCCs' ability to boost production and protect soils through ground cover, nitrogen and other nutrient provision, reduction of nutrient leaching, and provision of organic matter for soil health.

PIGEON PEA ALLEY CROPPING TRANSFORMS THARAKA NITHI, KENYA

The community of Tharaka Nithi, in central-eastern Kenya, has transformed this semi-arid community from a basket case to a breadbasket in just two generations, in part due to adoption of green manure cover crops. The area typically receives their heaviest rain beginning in October-November at which time farmers plant their main grain crop (principally sorghum and pearl millet). Interspersed among the rows grain are single or double rows of late-maturity pigeon peas spaced 2-5 m between rows and 20-25 cm between plants. The grain crops mature in January-February, at which point the pigeon peas are still growing vegetatively. In March-April other legumes (cowpea, green gram, beans, ground nut or lablab) are planted between the pigeon pea alleys. These crops are harvested in July-August and the pigeon peas are harvested in September, in time to prepare for the next season.



Pigeon pea alleys between sorghum rows



Cowpeas grow between pigeon pea alleys in the second season

This excellent combination of intercropping and rotation of multi-purpose, leguminous GMCCs and grain crops is well suited to the dry environment of Tharaka Nithi. In recent years, the National Council of Churches in Kenya (Partners of United Church of Canada and CFGB), have further enhanced their cropping system by helping farmers shift to conservation agriculture. Farmers who used to struggle to produce maize and beans, now market legumes as cash crops and sorghum to Kenya Breweries, generating enough income to buy maize for to supplement the food they produce themselves.

Their diverse cropping system reduces the risk of crop failure, and keeps soils covered with living plants through most of the year, a key strategy for protecting

soils and enhancing soil health. From Tharaka Nithi County, where several hundred thousand farmers have adopted pigeon pea alley cropping, the practice is spreading into the dry counties of southeastern Kenya. A community which was once stigmatized as beggars and day laborers, is now leading a movement toward sustainable production and soil health through adoption of conservation agriculture with GMCCs.

IMPROVED FALLOW AND INTERCROPPING WITH VELVETBEAN AND JACKBEAN IN THE LAKE VICTORIA ZONE OF TANZANIA

Farmers in the Lake Victoria zone of Tanzania receive two relatively reliable rainy seasons beginning in July and March. However, they struggle to produce their staple maize and cassava crops due to their infertile, lake-bed soils.

Over the past eight years, the Africa Inland Church of Tanzania dioceses of Geita and Mara-Ukerewe (Partners of World Renew and CFGB) have been promoting use of velvetbean and jackbean as intercrops and improved fallow in their conservation agriculture projects. Area farmers are somewhat unusual in that they are willing to take fields out of food crop production for a season in order to grow a non-edible cover crop. When asked why this is, they reply that the increase in production is enough that their production over two seasons is as high or higher than continuous production of food crops. Furthermore, the GMCCs have eliminated the need to import mulch for their CA fields, and suppress weed growth, thus significantly reducing labor for the following food crop.

Farmers are also beginning to intercrop jackbean in their cassava crops. Jackbean is either planted at the same time as the cassava, or relay-cropped after intercropped cowpea or green gram (see above article). Jackbean thrives in the low-fertility, sandy lakebed soils, and can continue growing throughout the life of the cassava crop.

Since farmers in these communities use oxen to prepare their farms, one challenge with cover crop adoption is that the vigorous, vining GMCCs make it difficult to use CA rippers and direct seeders. The ALTA team is working with AICT to develop attachments which cut and/or push aside the GMCC residue and facilitate the use of ox-drawn mechanical planting equipment.



Rusia Petero, of Bunda, Tanzania, planted maize in this field of velvetbean residue with virtually no weeds and no need for further mulching.

Scaling Conservation Agriculture-based Sustainable Intensification in Ethiopia (SCASI)

Neil Rowe Miller, Agriculture and Livelihoods Technical Advisor for Eastern Africa



Integrating CA with soil and water conservation in Benishangul Gumuz.

A new approach used for scaling up conservation agriculture-based sustainable intensification (CASI) in

Ethiopia began in late 2021 through a unique partnership between CFGB, three Partner NGOs, CIMMYT, and the Ministry of Agriculture (MoA). The project, which is being implemented in three regions, promotes the classic CA practices of minimum soil disturbance, soil cover with dry mulch and cover crops, and crop diversification through intercropping and crop rotation. It also promotes 12 complementary good agronomic practices including:

- organic fertilizers (compost, vermicompost etc)
- inorganic fertilizers
- agroforestry
- locally-adapted varieties
- forage production
- CASI mechanization
- crop protection (IPM, weeding, etc)
- natural resource conservation
- post-harvest management
- seed multiplication and security
- controlled grazing and
- liming

This combination of CA principles plus good agronomic practices closely resembles the CA-Plus approach championed by many CFGB Partners.

CIMMYT helped design the CASI implementation approach, and organizes action research. The MoA and its line offices play a key role in extension through local Development Agents in 40 Farmer Training Centres (FTCs). CFGB staff provide overall coordination of the project, while the local Partners train and follow up with farmers.

The project's research approach involves "mother trials" with multiple treatments at the FTCs and "baby trials" with fewer treatments managed by farmers on their own fields. One major research question being addressed with this approach is how to best combine natural and synthetic fertility sources. With rising fertilizer prices and diminishing foreign exchange resources, the results of this research will be useful well beyond the three regions where the project is being implemented.

Project staff have also championed CA mechanization, including development, fabrication and testing of the *maresha* direct seeder to plant crops with minimal soil disturbance. Finally, data is collected at the end of every season to understand the opportunities and challenges of CASI implementation to help planning for the next season.

As a result of the project, in 2022, 2951 farmers (32% female) are using at least three CASI practices on 382 hectares of crop land. CASI farmers' yields increased 15-40% compared to conventional farming practices. 100 CASI farmer field schools provide a forum for farmers to discuss and solve common problems together. CASI farmer groups also engage in savings, credit and other activities. Community bylaws have been developed/strengthened to control free grazing, and FFS groups have been empowered to enforce implementation of these bylaws.

The SCASI project illustrates the remarkable effectiveness of combining NGO efforts with a research institution and government extension.



Asnakech Zema

CA Farmer Profile: Asnakech Zema

Asnakech Zema lives in Shoma village in southern Ethiopia with her husband and 8 Children. For years they struggled to feed themselves and pay for other needs. Despite plowing the soil repeatedly, yields declined and soil quality deteriorated.

“Except for God’s blessing, life was very stressful for me,” explains Asnakech. “The costs of sending my children to school, the famine, taxes, the holiday season, all of this worried me a lot.”

“Due to the problem of climate change, we were not able to feed ourselves.”

Asnakech enrolled in a conservation agriculture training project implemented by Terepeza Development Association (TDA), in partnership with Tearfund Canada and Canadian Foodgrains Bank. She began mulching her soils, rotating crops, and growing a greater diversity including soil-enhancing pigeon peas, and drought-tolerant cassava. Soon, she began seeing results. “With conservation agriculture techniques, we are able to cope with climate change and protect our soils.”

Her husband, Memhru Simon, was skeptical at first. “My wife is the one who studied CA. When she came from learning, I was angry and rebuked her. Then I saw the results and I started supporting her. Due to her training, we are able to get good education and feed ourselves year after year.”

Asnakech also joined a self-help group organized by TDA. The group has 22 members who save money together. Instead of paying high interest rates to money lenders, they are able to borrow money from the group at reasonable rates. Asnakech has used her savings to buy 15 goats which she fattens and resells at a profit.

“Now my husband never denies my rights. He usually asks me what I want to cultivate on my land. He also asks me how I want to spend the money I earn from selling my product. We do everything from mutual discussion.”

Although life has truly changed for this rural Ethiopian family, farming is still challenging. In recent years, the community struggled with drought. The maize crop failed, and they lost some livestock. In response, she worked very hard to grow peppers as a cash crop. She sold them for 30,000 birr, more than 600 USD. With those funds, she ensured her family had enough food.

“This is hope,” she says, sweeping her arms around her field. “My children’s children will continue this work!”

Visit [this link](#) to learn more about their transformation through adoption of CA, and to watch a video of Asnakech and her family.



Asnakech in her CA maize field.

ALTA TRAVEL SCHEDULES

Lilian Zheke:

8-15 October, 2023
Monkey Bay, Malawi
TSA Training & Support Visit

23-27 October, 2023
Gutu & Zvishavane, Zimbabwe
ZCC Training and Exchange Visit

5-10 November, 2023
Karonga, Malawi
Country-level Workshop

11-13 November, 2023
Malawi
CFGB Learning Visit

15-18 November, 2023
Tete, Mozambique
CCM-Tete-Partner Support Visit

27-30 November, 2023
Masvingo, Zimbabwe
CA Master Training- Refresher Training

5-8 December, 2023
Chimanamani, Zimbabwe
CA Mechanization Workshop

Jean Twilingiyumukiza:

9-13 October, 2023
Gitega, Burundi
CA Master Training-Session Three

23-27 October, 2023
Burera and Gicumbi, Rwanda
Follow up visits to CA Master Trainers

13-17 November, 2023
Cankuzo, Rutana, Makamba and Kirundo, Burundi
Mentoring visits to CA Master Trainers

20-24 November, 2023
Bujumbura, Burundi
CA Master Training (Session Four) and Graduation

4-8 December, 2023
Eastern Rwanda
Help Channel-Burundi Exchange visit

John Kimathi Mbae:

9-13 October 2023
Lodwar, Kenya
ADRA Kenya Training

16-20 October, 2023
Makueni, Kenya
Nature+ Support

23-27 October, 2023
Machakos, Kenya
Nature+ Training (Baseline)

13-17 November, 2023
Soroti, Uganda
Training and Support to PAG & COU Teddo

20-24 November, 2023
Soroti, Uganda
Country-Wide Networking Workshop

Neil Rowe Miller:

1-9 October, 2023
Assosa, Ethiopia
Country-Wide Networking Workshop

7-15 November, 2023
Southern, Tanzania
National GMCC Summit
EKHC, Zala project visit

20-24 November, 2023
Soroti, Uganda
Country-Wide Networking Workshop

5-8 December, 2023
Chimanamani, Zimbabwe
CA Mechanization Works