AGROECOLOGY CASE STUDY

From Slash and Burn to 'Slash and Mulch'

In the semi-arid cropping regions of West Africa, fallow periods are getting shorter. As land becomes more scarce, farmers are not able to give their soils enough time to rest. This has led to the depletion of soil organic matter, severely threatening soil fertility and damaging soil structure. In the worst cases, crops hardly yield anything anymore. But this is not an option for family farmers. In Burkina Faso, some have found ways to restore their soils by reviving a traditional system dubbed 'slash and mulch'. The improvement and spread of 'slash and mulch' techniques through farmer-agronomist collaboration underscores the importance of partnerships between farmers and researchers in developing locally suited practices.

The Story of Idrissa

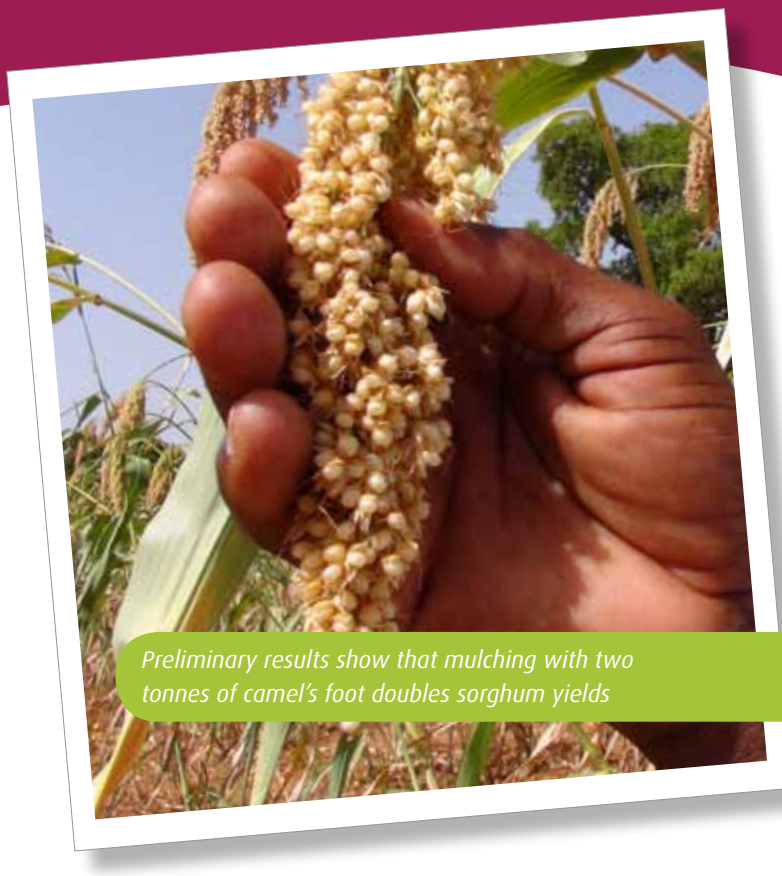
Idrissa Ouédraogo lives in Yilou, a village in the Central Plateau of Burkina Faso, with his wife Fatimata Sawadogo, and their children, Nafisatou and Felicité. They grow mainly sorghum and cowpea, and also raise chickens, sheep and goats on a plot Idrissa had been given some years ago from an elder as a gift. The soil had a hard surface crust and was completely degraded (such soil is known locally as zippélé).
Nothing would grow on it, not even grass. But Idrissa had a vision. He knew he had to bring back native vegetation if he wanted to grow food. And he knew which shrub he needed, baagandé, or camel's foot (*Piliostigmareticulatum*).

Camel's foot is one of the most abundant shrubs in the landscape. Local farming communities are well aware of its multi-purpose properties. Its bark is used to make ropes, its leaves are used to wrap food, its pods are a rich fodder for animals, and its branches serve as fuel for cooking. However, Idrissa went further and used it to restore his soil.

Idrissa first built stone bunds along the contours of his plot to decrease rainwater runoff. This was supported by PATECORE, a development project that financed the installation of soil conservation measures by farmers throughout the region. Then, branches of camel's foot, including leaves and pods, were cut from the surrounding scrubs and added as mulch to the zippélé areas.

After a few weeks, Idrissa noticed that some of the pods sprouted and camel's foot was growing in the field. Months later, Idrissa allowed cattle to feed on the plot during the dry season. The animals would consume the fruits of the camel's foot shrubs while leaving precious manure on the field. When the rains started, the seeds, partly digested by the animals, sprouted from the manure on the field, beginning a process of re-greening the degraded land. Idrissa's job during the first years of this experiment was to observe what would happen and how the land would react.

Idrissa's success in his creative use of camel's foot to restore his degraded land have encouraged other farming families to do the same and plant more native shrubs on and around their fields.



Preliminary results show that mulching with two tonnes of camel's foot doubles sorghum yields

Farming in Yilou

Food production in Yilou, semi-arid Burkina Faso, and in much of dryland Africa, is supported by only three to four months of rainfall each year. The main crops grown in Yilou are sorghum, cowpea, sesame, okra and other vegetables, hibiscus, and maize around the homesteads. Producing enough food to sustain family nutrition year round is an enormous challenge for farmers. Typically, farmers quickly prepare their land at the start of the rains in early June, plant by mid-June, and hope that the rains are abundant and evenly spread throughout the season.

Cattle feeding on crop residues and camel's foot during the dry season

Next to the treasured rainfall, soil organic matter is the next most critical ingredient for productive rainfed farming. Basically, rainfall must be able to penetrate the soil and be held there for the crops to use in the weeks after. Soil that is rich in organic matter is better able to perform these two functions.

As rainfall is short and intense, with only an average of 500-600 mm each year, minimising runoff and increasing infiltration are crucial. Also, the more the soil is covered, the more will the rain infiltrate and the less will it evaporate. Reducing runoff with physical barriers such as stone bunds and mulch has the added benefit of reducing soil erosion and sediment loss, an important measure in rehabilitating degraded lands.

> "Farmers and agronomists conducting experiments to find a balance between crop yields, feeding their cattle and improving the soil."

Farmers' Innovation

Minimum tillage and crop diversification are two common agronomic techniques, besides stone bunds and mulches, long known and used by West African farmers. NGOs in the region have also promoted Conservation Agriculture, which encourages a third principle: permanent soil cover. Agronomists recommend using crop residues as mulch to cover the soil. However, farmers prefer to use crop residues as animal feed. This limits the quantity of residues available for mulch. So farming families have to choose between feeding their soils and feeding their cows. This is where the ingenuity of the farmers' comes in, such as in Idrissa's case.

Farmers in Yilou are well aware that they need crop residues for the soil and their livestock, too. They have found a way to get around this tradeoff. Instead of using only crop residues for mulch (in this case, sorghum stalks), farmers like Idrissa also cut and add branches of native shrubs such as camel's foot that grow in the surrounding area. This has proven to be a successful strategy that allows for sufficient soil cover. The patches of soil that are covered with mulch attract termites. Just a few weeks before the sowing season, the termites consume the straw, leaves and branches; burrow the debris into the soil; and open up underground tunnels. These tunnels channel the rainfall, helping water to infiltrate into the soil rather than running off. The result: crusted soils become useable again with enough organic matter and water-storage capacity to grow crops. Farmers in Yilou have observed that crops on such newly restored patches outperform the rest of the field. This 'slash and mulch' approach, using only local resources, is kick-starting a community process of rebuilding soil organic matter.

This process is enhanced by farmers' careful observations. Their soil quality varies, with patches of very good soil intertwined with patches of compacted and crusted soil. So, farmers are precise in their practices and mulch the patches that they see need restoration. They have developed precision agriculture in this semi-arid context. Instead of using global positioning systems, local in-depth knowledge of the soil and the environment is guiding the farmers' ecological intensification of agriculture.

Farmers observe how different amounts of mulch impact sorghum yields

Farmer-Agronomist Partnership

The 'slash and mulch' system was actually originally developed by elders in Yilou and has been in the region for more than 50 years. To better understand how the system works, participatory action research on it began in 2013, involving local farmers and agronomists. Experiments on farmers' fields and research stations were initiated to evaluate how different amounts of mulch impacted crop yields. Farmer field schools and learning sessions where farmers get to 'play' with different management scenarios called 'companion modelling platforms' were also set in place.

Preliminary results on pilot tests in Yilou have shown that mulching with two tonnes of camel's foot per hectare can double sorghum yields. But even the highest crop yields of around one tonne per hectare are still relatively poor in comparison with other regions, and farmers are busy discussing not just the successes, but also the limitations of their innovations. Some of them acknowledge that there used to be much more vegetation in the landscape before and are considering if having more trees and shrubs is what they need to better restore their soil.

Farmers in Yilou know well that crop production is only possible with careful management of soil organic matter, especially where rainfall is limited and becoming increasingly unreliable. Mulching soils with branches from native shrubs and regenerating native vegetation are two practical ways to rebuild lost soil organic matter so as to be able to continue farming.

Of course, camel's foot has a number of benefits in the field but it cannot occupy the largest share of cropping land and its presence should not compete with crops nor interfere with tillage operations. However, the doubling of sorghum yields easily compensates for growing camel's foot on part of the cropping land. The challenge now is to find out what the most suitable density of camel's foot shrubs to produce the most food with the least work is.

Collaboration between farmers and agronomists can lead to practical, innovative and technically sound solutions. Putting into practice the conservation agriculture principle of maintaining permanent soil cover and overcoming the trade-off between feeding animals or mulching the soil is only possible when farmers and researchers share their knowledge and start experimenting together. There are farmer innovators like Idrissa throughout the whole of semi-arid West Africa. Their innovations need to be understood, explored, and extended to ensure that life is brought back to their degraded lands and they can produce sufficient food to feed their families and communities sustainably.

> "Farming families have come up with their own innovations"

Spreading the Secret

A youth came one day to Idrissa's farm from another village, Tem Gorki, 35 km south of Yilou, to harvest camel's foot bark. He wanted to make rope out of it as in his own village, there was virtually no camel's foot left because the farmers there had consistently slashed and burned the shrubs. Idrissa shared his wisdom with the youth: "Instead of harvesting the bark, take some seeds and plant them. If you don't have shrubs on your field, just pick some mature fruits and leave the seeds in water for one night. Then make a little planting hole in your field and place the seeds in it with a bit of soil; after three weeks you will see them grow." The young boy followed the advice and came back a year later with a chicken to thank Idrissa.

> "Idrissa knew he had to bring the native vegetation back if he wanted to grow food."

Farmers visiting a research station where agronomists are evaluating how different amounts of mulch impact crop yields

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