

**F**armers, researchers and extension agents in northern Ghana regard low soil fertility as a major constraint to crop production. Increasing human population has led to the shortening of bush fallowing, a traditional method to replenish soil nutrients. Application of inorganic fertiliser to restore fertility has become non-

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profitable, as prices are beyond the reach of smallholders. They are therefore being encouraged to intensify their farming through intercropping, crop rotation, agroforestry, soil and water conservation, and organic manuring. Traditionally, widespread dry-season burning of vegetation was practised. Burning as a labour-saving tool to clear land and prevent weed infestation is now being brought into question, because more organic matter is needed in the soil. Many development agencies now advocate non-burning.

**Assessment methods**

Case studies of non-burning at Goziire (Upper West Region) and of non-burning and organic manuring at Zagsilaari (Northern Region) had suggested that these practices support sustainable



Photo: Bert Lot

# Assessment of non-burning and organic-manuring practices

agriculture by improving soil fertility and conserving soil and water (Kombiok, et al 1997). Existing experiences in sustainable agriculture can serve as examples for other communities in the same agro-ecological zone. However, other farmers are more likely to be convinced and to try these practices if they had more information on inputs and yields. A follow-up study was therefore designed to quantify the inputs and outputs of non-burning and organic-manuring

practices, and to assess the benefits of these practices from the farmers' point of view.

The follow-up study was conducted in the 1998 cropping season (June-November) at the case-study sites chosen with extension agents from MOFA and some NGOs. At each site, four farmers - two who practise non-burning and/or organic manuring, and two who do not but were interested in the study - were selected.

In each farm, four 10x10m plots of various crops were demarcated randomly.

Data were collected on labour inputs, plant height and population, and crop yields. During farmers' fora at the end of the cropping season, the communities assessed the advantages, disadvantages and problems associated with the practices. Participatory Rural Appraisal techniques were used to encourage them to discuss the issues and socioeconomic implications freely and to give their opinions.

**Increased grain yields**

At Goziire, sorghum was taller after three-year fallow than in the non-burnt plots. Millet in the non-burnt plots with farmyard manure was twice as tall as in the burnt plots with manure or without. Sorghum yields ranged from 1.1 to 1.4 t/ha and were higher after non-burnt fallow than after non-burnt continuous cropping, even with FYM. Yields of millet were lower (1.1-1.2 t/ha) than those of sorghum with the same treatment, and were as low as 0.48 t/ha even with FYM in the regularly burnt area.

At Zagsilaari, maize yields in the non-burnt plots were more than double those in the burnt plots. Sorghum

**Table 1: Grain yields (kg) from 10x10m areas on burnt and non-burnt plots at Zagsilaari**

Farmer	Practice	Crop	Plot 1	Plot 2	Plot 3	Plot 4	Mean
David Agongo	Non-burning	Maize	27.0	23.0	26.0	24.0	25.0
Iddi Dorkurugu	Non-burning	Maize	11.0	10.0	8.0	11.0	10.0
Yakubu Mbangba	Burning	Maize	10.0	9.0	6.0	7.0	8.0
Alitu Dorkurugu	Burning	Maize	8.0	8.0	9.0	9.0	8.5
David Agongo	Non-burning	Sorghum	3.0	3.0	2.5	3.0	2.9
Yakubu Mbangba	Burning	Sorghum	2.0	1.0	1.5	1.5	1.5

yields in non-burnt plots were double those in the burnt plots (Table 1) and the sorghum heads were longer (45 vs. 34cm) and heavier (1650 vs. 1500 g).

The number of years an area is not burnt also affects crop yields. At Zagsilaari, plots not burnt for six years had higher yields than those not burnt for three years. This may be due to the longer accumulation of organic matter and the greater amount of soil nutrients for crop uptake.

### More labour for weeding

Data on labour for land preparation, planting, weeding and applying manure/fertiliser were collected at Zagsilaari. All the farmers used bullock ploughs to prepare their land, but only David Agongo owns a pair of bullocks and a plough. The others hired bullock services, paying twenty thousand cedis per acre. Labour inputs for land preparation did not differ between practices, but more labour was needed to weed the non-burnt plots than those that had been burnt regularly (Table 2).

### Farmers' fora

The farmers' fora were open to both men and women, but only about 20% of the participants were women. At both sites, the farmers agreed that non-burning and organic manuring bring tremendous benefits.

### Communities develop strategic burning

In recent years, the awareness-raising campaigns about non-burning have led to heated discussions in communities in northern Ghana. Burning of grass on fallow and bushland has several advantages: it removes heavy vegetation and reduces labour inputs to bring fallowed land back into cultivation, it reduces the incidence of weeds and pests in cropland, it prevents bush encroachment on grazing areas, it gets rid of low-quality over-mature grass and makes way for fresh regrowth of grass nutritious for livestock, it stimulates the germination of certain tree species, and it reduces the risk of devastating uncontrolled flash fires that can destroy crops and homes. On the other hand, farmers are aware that burning also destroys vegetative biomass that could be used to improve soil quality.

Through their observations and discussions, some communities are now developing a more differentiated view of fire: it is a question not of burning or non-burning but rather of when, where and how burning is practised. Burning at the right time of year, under strict control, can achieve the positive effects and reduce the negative impact of this practice. These communities have drawn up by-laws that stipulate when and where burning is allowed, and have strict social controls to ensure that burning outside these limits is punished. There is still room for action research by communities to determine the best ways to employ burning as a valuable tool when used strategically and with caution.

Source: Discussion during ILEIA research workshop, March 1999.

**Table 2: Estimated labour inputs (person-days) in burnt and non-burnt plots cultivated to maize and sorghum in Zagsilaari**

Farmer	Crop	Practice	Ploughing	Planting	Weeding	Applying manure/fertiliser
David Agongo	Maize	Non-burning	2	4	13	-
Dorkurugu	Maize	Non-burning	2.5	11	21	6
Yakubu Mbangba	Maize	Burning	3	6	11	-
Alitu Dorkurugu	Maize	Burning	2	3	8	8
David Agongo	Sorghum	Non-burning	2	3	14	-
Yakubu Mbangba	Sorghum	Burning	4	6.5	11	-

### Advantages of non-burning at Goziire mentioned by the farmers were:

- regrowth of natural vegetation, especially grasses and trees for grazing and construction
- better establishment of wood lot plantations and improved yields of shea and *dawadawa* (*Parkia biglobosa*) trees
- good conservation of soil and water, thus reducing erosion, improving crop germination and increasing crop yields
- retention of livestock in village because forage is available during the dry season.

### Benefits of non-burning and organic manuring mentioned by Zagsilaari farmers were:

- improvement of soil fertility
- reduction in soil erosion
- increased crop yields and self-sufficiency in food for families
- use of less land, allowing sedentary agriculture.

### Disadvantages in non-burning were:

- fewer dead trees for woman to collect as firewood
- inaccessibility, with limited mobility and visibility; bushes become hideouts for thieves
- proliferation of pests such as rodents and insects which destroy crops.

### Successful fire control

Conservation of natural vegetation and the protection of other plant material can provide the organic matter needed to enhance soil fertility. This can be achieved by reducing the frequency and extent of burning.

The success story of Goziire in this respect was a result of awareness creation that led the local people to mobilise themselves into a volunteer group to control fire. The community instituted locally endorsed by-laws. Culprits are sanctioned and must pay fines. The community also has the support of the Paramount Chief of Nandom to enforce the by-laws. The heightened awareness spread to surrounding villages, which have now also adopted non-burning.

### More action needed

Farmers are seeking improved crop yields with low levels of external inputs. The study has shown that yields are higher

where non-burning and organic manuring are practised. The sustainability of soil fertility depends on the availability of organic matter and this is possible only if crop residues and bush vegetation, the major sources of organic matter, are not burnt. We therefore recommend that:

- More education be given by environmental NGOs, government organisations, MOFA and District Assemblies to enhance awareness of the implications of bush burning.
- Traditional rulers, in consultation with their communities, institute bush fire bye-laws endorsed by the District Assemblies.
- Non-burning and organic-manuring practices be incorporated into school curricula.
- Fire-fighting volunteers be trained and supported by the Ghana National Fire Service and the District Assemblies.
- Communities be organised into groups to facilitate the training and adoption of non-burning and organic manuring.
- Workshops, seminars, video shows, and field visits be part of the educational programmes
- Farmers be encouraged to adopt technologies such as oversowing, cover cropping, improved fallow and agroforestry as complementary measures to increase organic matter.

Long-term monitoring of non-burning and organic-manuring practices would allow the quantification of their short- and long-term impact on agricultural production and environmental quality. Comparisons should be made on the basis of simple economic analyses.

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