

Publication de l'Antenne 30

## MULCHING IN BURKINA FASO

In: Indigenous Knowledge and  
Development Monitor, Volume 4,  
Issue 2, August 1996, pp. 3-5

Maja Slingerland

Aménagement et Gestion

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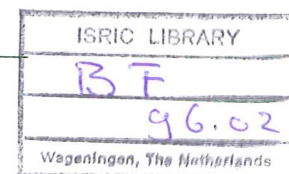
Wageningen  
The Netherlands

Sylvo-Pastoral au Sahel

Antenne de l'Université Agronomique Wageningen Pays-Bas  
Université de Ouagadougou Burkina Faso



# Mulching in Burkina Faso



In the Central Mossi-dominated area of Burkina Faso, most fields have become semi-permanently or permanently cultivated under conditions of increased demographic pressure. At the end of the dry season most crop residues are used as animal feeds, fuel or thatching material. The bare soils, largely loamy in texture, lack protection and are thus susceptible to crust formation, runoff and soil erosion. Mulching with grasses, one of the traditional soil and water conservation techniques in the region, is used to cover these soils, and at the same time to enrich them with organic matter and nutrients. Mulching consists of covering the soil by a layer of about 2 cm of dry grasses which equals 3 to 6 tonnes/ha. This article gives extended details on the technic of mulching in a village on the Mossi plateau.

## Study in Tagalla

In Tagalla, a village in Samatenga Province on the Mossi plateau, an in-depth study on mulching was done which involved 49 households (Slingerland and Masdewel, 1994). The research was triggered by observations on the part of the staff of Antenne Sahélienne<sup>1</sup>. The study, carried out between April and November of 1994, consisted of three parts:

- Interviews with 49 households, to determine the reasons people had for mulching, as well as their assessment of the effectiveness of the measure and the various techniques used.
- Monitoring of fields with and without mulching, in order to measure the effects on yields, and to clarify these effects by measuring the water content and nutrient composition of the soil.
- Measurement of the time it took to cut, transport and lay out grasses as mulch, in order to calculate labour input.

Farmers distinguished four dominant soil types in the village: *bolé* (clay), *baongo* (valley bottoms, much water), *zipele* (simple sandy-loamy soils) and *zegdega* (stony, usually on slopes). It is only in Tanghin, one-quarter of the area of the village, that some sandy soils (*bissiga*) are found. All 49 farmers agreed that *zipele* soils suffer most from erosion, while 24% of them rated *zikadega* soils second. All the farmers listed rain, wind and human activity as the major causes of erosion. The main effects of erosion are changes—usually a decline—in vegetation cover, notably the progressive disappearance of trees (50%), resulting in bare, hot soils (6%), reduced rainfall (10%) and more dry soils (10%). The results of erosion include smaller crop production and weight loss among cattle.

The farmers employ several methods to fight erosion. Stone lining and mulching were mentioned by 36% and 38% of the farmers respectively, while no fewer than 25% listed vegetated strips. Most farmers (63%) mentioned all three methods, 31% only two. Mulching and installing vegetated strips are traditional practices, while stone lining was introduced into the province less than five years ago by a local agricultural extension service (CRPA) with the help of an integrated development project (PEDI)<sup>2</sup>.

## Mulching in Tagalla

Mulching consists of covering the soil with a layer of about 2 cm of dry grasses (3 to 6 tonnes/ha). Four different types of mulching were observed in the village: mulching without any other input, mulching with manure, mulching with a chemical fertilizer, and mulching with both manure and a chemical fertilizer.

Cutting and mulching is done during the

month of May, although some farmers (16%) start in April. In this period the grass is completely dry and of no use as fodder. The only species of grass which is used is *Loudetia togoensis*: quite large quantities are found as homogeneous layers on very poor soils, especially on the slopes of nearby hills. Its alternative use as fodder ends as soon as it starts flowering, since it grows needles which livestock find unpalatable. Other grasses are not available in the same quantity, either because they are eaten by the free-grazing livestock or because they are cut and used for handicrafts, or as roof thatch or animal feed.

Farmers said they mulch every year, but do not include all their fields. In over 60% of cases, mulching takes about two weeks, including cutting and transport. This investment of time means that none of the farmers managed to cover all their fields: several said that they did only about 1 ha. In deciding which field was going to be mulched, they used the following criteria: low soil fertility (47%), need to prevent soil degradation (23%), need to increase/maintain soil humidity (17%), and a general decline in crop production (10%). There was general agreement that the ultimate goal of mulching was to increase crop yields. The following results were recorded by the farmers: continuing increased level of moisture in the soil (30%), increased soil fertility (23%), protection against wind, rain and sun (5%), and a general increase

Bare soils are susceptible to crust formation and loss of soil fertility.

Lack of labour and means of transport are major constraints on the mulching of fields.

Map: *Map of Kaya*



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Photo: Ron Gilling/Linear.

Only one-third of the Mossi families interviewed do not mulch any of their fields.

Mulching is a traditional soil and water conservation technique which is well adapted to farmers' means.

in crop production (36%). No clear reasons were given for the use of the various kinds of mulch.

In 1995 a follow-up study was done on how decisions are made with respect to such inputs as mulch, manure and stone lines (Lafay and Ranson, 1995). This study, in which 36 farmers participated, revealed that there was no connection between the crop and the choice of soil and water conservation technique, or indeed any other input. Only corn was generally seen as a nutrient-demanding crop and thus fertilised. The distance between the field and the house was an important factor. The closer to the house, the more household waste and manure were applied; mulch was used only on fields that were further away. Mulching was more important in the case of 'hot' soils (*zipele* and *zegdega*) than 'cold' soils (*bolé* and *baongo*). In addition, time was seen as a limiting factor for mulching, a problem that could only be solved by improved transport. Mulching was also said to promote weeds and parasites; to combat this problem, the mulch was normally burnt two days after sowing, especially in the case of 'cold' soils.

Farmers found the actual realization of anti-erosion measures difficult. In the case of mulching, 36% saw the scarcity of the grasses and the distance that had to be covered to fetch them as the main constraints. Only 12% of the farmers said that they were able to find grasses nearby; the others had to travel much further from their fields. However, since the grasses are light and are carried in small quantities, they can even be transported by old women. The grasses are usually carried on the head; only 10% of the farmers use animal-drawn carts.

#### Objective effects of mulching

In cooperation with the farmers, the researchers selected a field for each form of mulching, plus one 'blank' field. At the beginning and end of the growing season, soil samples were taken and the chemical composition analysed, in order to determine whether mulching had added any nutrients to the soil. No

effect could be proved. Other soil samples were taken in order to ascertain whether the physical properties of the soils had changed as a result of mulching. Bulk density and porosity were measured, together with water content at different soil depths. Mulching seemed to improve the infiltration of water, due to a higher porosity. However, no statistically significant effect was found.

It was difficult to obtain accurate information on the yields. During the interviews the farmers had all expressed their willingness to sow a certain crop. However, due to such factors as the rainfall pattern during 1994, many farmers did not keep to that agreement, and ultimately sowed different crops. This meant that it was impossible to compare yields or to interpret soil chemistry: peanuts, for example, do not extract the same amount of nutrients from the soil as sorgho or millet.

Since the farmers were so 'flexible', it was almost impossible to make a statistically sound choice of fields, a complete set-up is to be carried out in the course of 1996. Each farmer will use four different treatments (blank, mulch only, mulch plus burkina phosphate<sup>3</sup>, mulch plus manure) and 6 repetitions. The water content of the soil will be measured, as well as the evaporation rate and runoff for all treatments. This time nutrient availability will be measured in plant samples instead of in soil samples.

#### Further research

Although farmers are aware of the advantages of mulching fields, they are not prepared to apply mulch on soils other than the present fields. Some 13% fear that the grasses will be eaten by free-grazing animals, and thus have no positive effect on the soils. Moreover, access to these mulched soils cannot be guaranteed next year. Many farmers (40%) say that none of their fields lie fallow: applying mulch to other soils is a waste of time, as no crop will ever benefit from the treatment. Other problems are the lack of time (10%) and the shortage of grass (10%). Many farmers tend to



see a parallel between stone lining and mulching, saying that both are done only on fields. However, some collective stone lining is done on slopes outside fields.

In order to arrive at a better assessment of mulching in comparison with other soil conservation techniques, a cost-benefit analysis should be done for each of the techniques. This could include the following parameters:

- time needed to cut, carry and spread the grasses (cost per hectare);
- labour costs;
- yield (difference between fields with and without mulch, given the same crop and soil type);
- transport costs when wheelbarrows are used (written off in 5 to 10 years);
- extra weeding time required for mulched fields.

Normally the cost of transferring nutrients, in the form of dry grasses, from the sylvo-pastoral area to the agricultural area is allocated to the former. However, there is no way of knowing if this extraction has a negative effect on the sylvo-pastoral area and, if so, how to estimate that effect in financial terms. In the case of stone lines, for example, the surface occupied by the stones, plus about one metre on either side, can be considered a cost, as it means a loss of soil and therefore yield. This loss is about 2-3% a hectare, depending on the number of stone lines. Other costs include repairs to the stone lines previously installed. The benefits appeared to be an increase of around 20% in yield during normal rainy seasons, and 30% in dry years. When stones had to be collected from further away than 2 km, the costs exceeded the benefits (Kempkes, 1994).

More research into the effects of mulching will be needed, in order to assess the factors actually responsible for the increase in crop yield, and to calculate the input in labour, transport, etc. Alternative uses of the grasses should also be examined, as organic material is scarce in the research area. A cost-benefit analysis of various soil and water conservation practices is being carried out at the Antenne Sahélienne. Research is also continuing into the effects of soil and water conservation practices on soil properties, and the quantification of nutrient and water loss as a result of runoff. The results are not yet available, as soil erosion is a long-term process which can only be assessed on the basis of years of research.

Maja Slingerland  
Research coordinator  
Antenne Sahélienne  
Groupe bio-dynamique  
B.P. 5385  
Ouagadougou  
Burkina Faso

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#### Endnotes

<sup>1</sup> Antenne Sahélienne is an agricultural research cooperative set up by Wageningen Agricultural University and the University of Ouagadougou.

<sup>2</sup> In Sanmatenga province, the PEDI, in collaboration with the CRPA Centre Nord (Centre régional de la planification), has carried out an extensive study on farmers' typologies. Mulching formed part of the research (Barning and Dambé, 1994).

<sup>3</sup> Burkina phosphate is used as a fertilizer because a large programme to stimulate its use has recently gotten under way: the cost of  $\text{HF}$  is also lower than  $\text{NPK}$  fertilizers. An additional advantage is the fact that the effect of Burkina phosphate lasts for more than a year because it is released slowly. This means that it need not be applied yearly on the field.

#### Acknowledgement

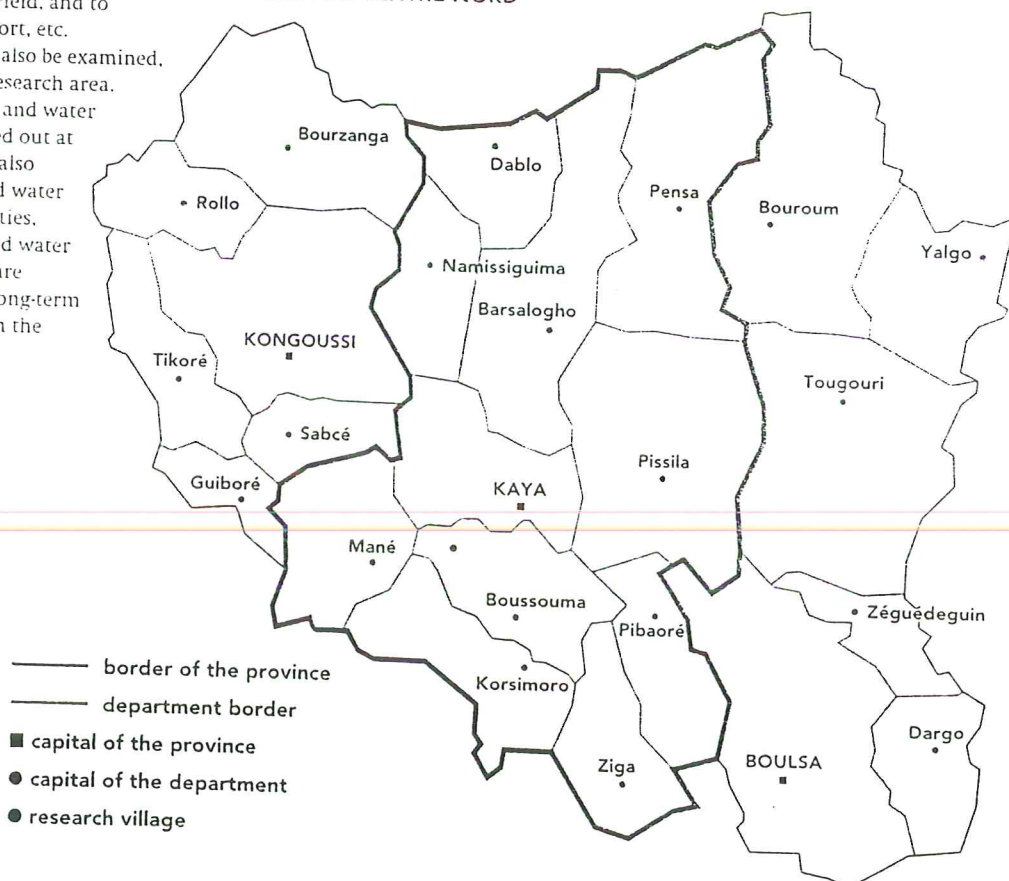
The first draft of this article was written in cooperation with Mouga Masdewel, and I am greatly indebted to him for his input and cooperation.

More information on traditional soil and water conservation in Africa can be found in the forthcoming book:

Reij, C., I. Scoones and C. Toulmin (eds) (1996) *Sustaining the soil: Traditional soil and water conservation in Africa*. London: Earthscan.

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