The role of livestock in sustaining soil fertility in northern Ghana

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In the northern Guinea savanna zone of Ghana, the predominant farming system is mixed crop-livestock production in smallholdings (Atengdem & Dery p 38). In the gently rolling landscape, cropping and animal grazing are concentrated mainly in the middle and lower slopes and valley bottoms. Growing population pressure has led to continuous cropping and decreasing periods of fallow. The major concern is the decline in the fertility of arable land. Here we look at the role of livestock in the integrated management of soil fertility. This is largely neglected in development efforts, although crop-livestock systems have existed for decades in the zone.

Some history

Before Independence, the colonial government established agricultural research and extension stations in different parts of northern Ghana. The Tamale station was set up 1909, but the majority began operations in the late 1930s. All these stations dealt mainly with crops. Bullock traction was also introduced in the late 1930s and cattle and sheep were introduced later to address the problem of low soil fertility in these areas, which were known as 'farmed out' lands. Soil conservation techniques promoted prior to Independence included contour farming, grass bunding and stone terracing, in addition to the fallow rotation and mixed cropping practised by farmers. Crop yields could be sustained.

In the two to three decades after Independence, government policy sought to achieve a 'Green Revolution' and initially crop yields per unit area increased considerably. Many farmers adopted and relied heavily on external inputs little knowing that conditions would change and sustainability would become a critical issue.

Recent experiences

In the 1980s the market price of external inputs soared as subsidies were removed. Many smallholders could no longer afford to buy them. From 1979 to 1986, the relative increase in input price was 106%. In concrete terms, a bag of maize that could be sold to buy about 7 bags of compound fertiliser between 1979 and 1982 was enough for only 3.5 bags in 1986 (Langyintuo & Karbo 1996). Even with the same rate of application, some soils in the zone do not give the high yields recorded when chemical fertilisers were first introduced. In most cases, application rates dropped. A survey in 1992 showed manuring to be the most popular technique to regenerate soil fertility, followed by chemical fertilisation and bush fallowing (Gyasi 1995). A survey of over 4000 fields in northern Ghana in 1993 revealed that only 16% received some mineral fertiliser (Albert 1995).

During the late 1980s and in the 1990s, most bilateral projects such as the IFAD-supported Smallholder Rehabilitation and Development Project (SRDP), the Land Conservation and Smallholder Rehabilitation Project (LACOSREP) and the Upper West Agricultural ▶

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Development Project (UWADEP) took an integrated development approach, one component of which was small ruminant husbandry.

All these projects, including the current National Livestock Services Project (NLSP), if sustained after project closing, could increase the contribution of livestock to the sustainable management of natural resources in the zone. Animals play an important role in the way farm households manage risk. Animal traction could improve the quality and timeliness of farming operations now done by hand and raise crop yields and incomes, the manure could improve soil fertility, and the livestock sales could generate cash to purchase other inputs.

In farmer-led experimentation in the ILEIA/NGLWG collaboration, various soil conditioners were tested. This confirmed that farmyard manure could increase crop yields, but that yields could be even higher if manure were combined with some chemical fertilisers. Nevertheless, farmers, researchers and development workers in the zone still saw constraints to the contribution of livestock to soil fertility management.

Constraints and coping strategies

During our interactions with farmers and development workers in the field, it became obvious that the use of manure to improve soil fertility varies from one location to the other. It is more important where human population pressure is high and land is scarce, such as in densely populated village settlements and peri-urban areas. The most common constraints and the ways in which farmers are trying to deal with them are summarised in Table 1. Although some farmers mentioned that manuring leads to more weeds, they felt it was easier to pull out the weeds from manured fields than from non-manured fields.

These coping strategies are backed by farmers' rich knowledge of manure quality, soil types and crops cultivated. In terms of nutrient 'strength' or power, the farmers ranked the manure types as follows: poultry → pig → sheep/goat → cattle. Manure from poultry and pigs releases nutrients faster than that from ruminants. Nutrient release to crops is slowest in the case of cattle manure, but its residual effect appears to be higher than in the case of the manure from other livestock species. Farmers said that a field fertilised with cow dung may need re-fertilisation after two or three years whereas when pig and poultry manure are used, yearly applications are necessary. This manure is preferred by farmers who grow vegetable crops because these have a relatively high level of growth energy and need instant releases of nutrients.

Similarly, farmers in Upper East Region explained that sheep and goat manure is most suitable for early millet and sorghum. It was interesting to learn from the farmers that the cow dung obtained in the dry season is of lower quality and is most suitable for trapping termites to feed to poultry. Thus, another link is made in the recycling of nutrients by animals for soil fertility management. Cattle that graze low-quality grass and cereal crop residues in the dry season produce low-quality dung, which is fed to termites, which are, in turn, fed to poultry, which produce not only meat and eggs but also leave concentrated droppings that improve soil fertility.

Poorer people, among whom are many women have few animals and they collect animal droppings to improve the condition of their soil. However, there are more and more competitive uses for cow dung for example, to plaster house walls and as a cooking fuel (both are women's tasks). Some cow dung is also applied in liquid form to crops where it acts as a repellent that protects the plants from being eaten by straying animals.

In most parts of the zone, Fulani herdsmen are hired by farmers to care for their cattle. This makes it possible for the farmers' children to attend school. In most cases, depending on the nature of the contract, the Fulani have the right to the manure. They either sell it or use it to fertilise plots leased out to them for maize cropping by their landlords. In our interviews, such land-cultivating Fulani stated that a maize yield of over 3.0 t/ha could be obtained from manured and continuously cropped plots.

Generally, dynamic kraaling is practised: the cattle are tethered overnight on the field to be fertilised and their location within the field is shifted at certain intervals. The number of nights on each spot varies with the season. Farmers indicated an average of three nights' kraaling in the wet season and ten nights in the dry. This method reduces the labour required to transport the manure. In parts of Upper East and Upper West Regions, widespread cattle theft does not make this an attractive system of manure management. In these areas, head loads of manure are transported to the fields, usually by women.

Things to try in PTD activities

The use of manure in composting has already received much attention in the PTD sites of the ILEIA/NGLWG. The quantitative and qualitative aspects of manure raised earlier have been well addressed. Livestock will continue to play a significant role in integrated soil fertility management in the farming systems of northern Ghana. There is a great need to encourage farmer groups and individuals to also try out other technological options that could be adopted and further developed. These could include:

- Introduction of forage legumes (for example, *Stylosanthes* spp) and dual-purpose food legumes (for example, pigeon pea) into the cropping systems to enhance soil fertility and produce good fodder to generate high-quality manure.
- Minimum daytime (3-4 hours) and overnight confinement of small ruminants with some feed supplementation to increase the manure harvest.
- Development of fodder banks (protected areas of grass and sown legumes used for strategic grazing in the dry season) to address the seasonal shortage of feed.
- Strategic animal health-care management to reduce mortality and increase herd sizes
- Animal traction to address labour constraints.

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Table 1: Constraints to manure use and coping strategies in northern Ghana

1.0 Insufficient manure	1.1 Manure collection
	1.2 Composting
	1.3 Alternating plot application
	1.4 Crop-specific application
	1.5 Soil-specific application
2.0 Low quality of dry-season manure	2.1 Integrating poultry and termites in nutrient cycling with manure
	2.2 Grazing orbits involving crop residues and wet valleys
3.0 Insufficient labour to collect manure	3.1 Division of labour by gender
	3.2 Dynamic kraaling

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