

The Mambwe mound cultivation system

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In the Northern Province of Zambia, many small scale farmers practise shifting cultivation (known locally as *chitemene*) in the *miombo* woodlands. Though farmers are able to grow an average of three successive crops under this practice, soil fertility and crop yields decline after the third year, meaning that farmers have to open new fields. Studies have shown that the *chitemene* system can be sustained so long as the population density does not exceed seven persons per square kilometre. However, with improvements in health and nutrition, rural populations have been growing. Farmers are no longer able to wait for up to 25 years, the length of time fields were traditionally left fallow to restore their natural fertility, before returning to fallowed fields. They now wait around 10 years. This has led to a breakdown in the effectiveness of the *chitemene* system. This breakdown is also due to increased tree felling, which leaves less available biomass to help restore fertility.



Planting beans brings additional benefits to the system and provides an early crop for farmers.

secondary grassland that succeeds *miombo* woodland after repeated clearing for cultivation. Mounds of around one metre in height and one metre in diameter are constructed at the end of the cropping season. A heap of grass and other vegetation is made from an area of about one square metre, onto which soil is cut and thrown to make the mound. This is then covered with about 10 cm of topsoil, cut with hoes from the surrounding area. There is never a shortage of ordinary weeds, grasses and vegetation to incorporate in the mounds which are set perpendicular to the slope, along the contour. This system, also known locally as *fundikila* and in Tanzania as *ntumba*, depends on the release of nutrients by the decaying grasses buried in the mounds. In this way farmers can take advantage of the few available resources to benefit their soils.

In households with male labour, the mounds are constructed by men. In other cases, women are able to construct the mounds or hire men to do this work, paying them either in cash or in kind, with beer and food through a traditional Mambwe system called *kulimya*. In the following rainy season, the mounds are flattened, the soil inside is spread and important food crops such as finger millet are planted. This may be followed in the second season by other crops such as maize, sweet potatoes, groundnuts, and pumpkins (see box).

The Mambwe mound cultivation system is carefully managed, paying attention to the needs of the soil and the requirements for sustaining the productivity of the entire farming system, rather than any individual crop. Care is exercised when planning which crops to grow in the system. They are chosen according to their nutrient requirements; with heavy feeders such as maize and finger millet (*Eleusine coracana*) being planted in the system earlier, and less nutrient demanding species like common beans (*Phaseolus vulgaris*) and cassava being introduced later in the cropping cycle. Crops are inter-planted: for example, beans are planted between the cassava plants, as the cassava crop remains in the field for up to three years and is selectively harvested. Maize and beans are never grown between the mounds, as there would be inadequate fertility to support their growth. The cropping cycle is most commonly over a period of four or five years.

Improving the mound system

Increasing population pressure in the Northern Province led agricultural scientists working at the Misamfu Regional Research Centre, in the provincial capital Kasama, to begin exploring ways of maintaining soil productivity. Mambwe people keep cattle but livestock numbers have declined due to tick-borne diseases after a serious breakdown in animal disease control programmes. Those farmers who do still own cattle use manure to fertilise their fields. However, most farmers rely heavily on other ways of managing soil fertility. This realisation led to research based on the features of the Mambwe mound system, attempting to improve the quality of the mounds at farm level. This research work was supported by the Norwegian Agency for International Development (NORAD), which funded two research programmes on soil productivity, over a 15 year period (1981-1996). Research showed that the quality of organic material for the mounds could be improved by incorporating easily degradable leguminous plant residues into the mounds. On-farm experiments, conducted in collaboration with farmers, tested the suitability of various leguminous species for the Mambwe mound cultivation system. It was found that the most suitable plant species were those that could be planted with the first rains, in November, and cut and incorporated in the mounds at the end of the season. One useful species was *Stylosanthes guianensis*, a perennial legume which can grow in

Photo: Peter Strømgård

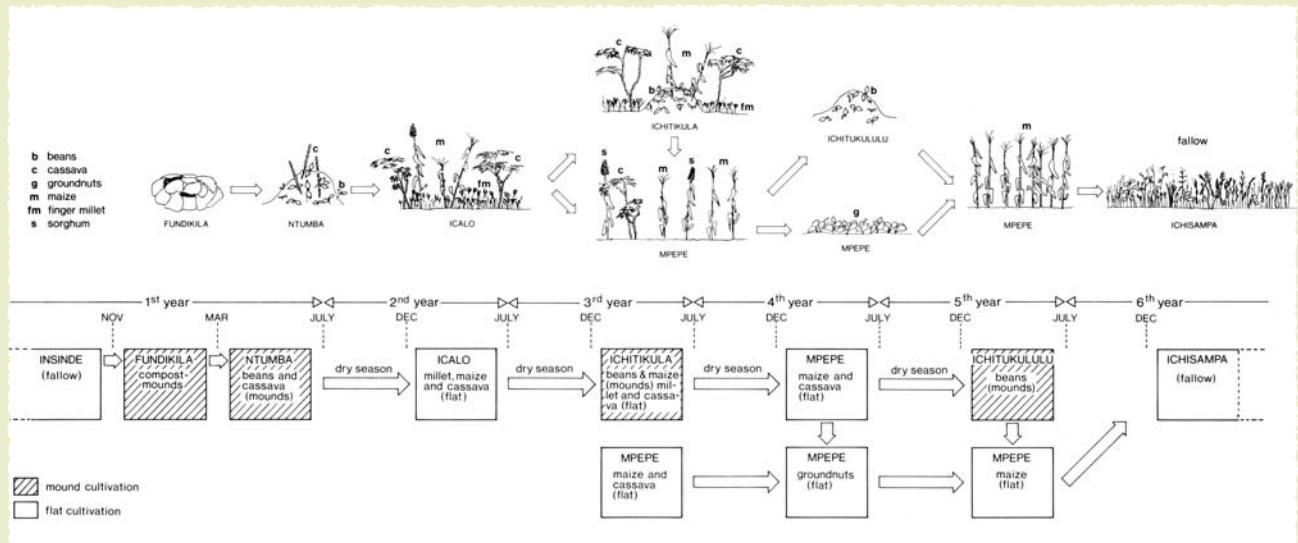
Restoring and maintaining soil fertility is therefore a major challenge for sustaining crop and soil productivity in this area. Slash and burn is still widely practiced because it improves soils, although this effect is only short term. One of the problems of practising slash and burn is that the annual cutting of trees to open new areas for cultivation within the *miombo* woodland increases the distances to the fields, and will eventually lead to the disappearance of all the forests. Farmers have had to find alternative cultivation methods, which minimise the walking time to the fields, which can sustain soil and crop productivity from one generation to another, and preserve what is left of the forests.

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In response to this situation, the Mambwe mound cultivation system has been developed in the north-eastern part of Mbala district, in the Northern Province of Zambia. This system was developed about 100 years ago by the Mambwe tribe, as a strategy for maintaining soil fertility and productivity, as they shifted away from the increasingly destructive *chitemene* cultivation system.

The Mambwe mound cultivation system is a system of in-field composting, on sites that have been left fallow, for example, the

The Mambwe mound garden cycle



The first stage involves breaking up the fallow or virgin land, before cultivation. The grasses are cut, piled up and later burned and the mounds are then made during the rainy season from November to March, when the soil is not hard to break but still too heavy to till. The mounds can be left to rot for the rest of the dry season or are planted with beans and cassava in the first year. Farmers who plant beans in these mounds are able to harvest a crop in May or June. The next year, the mounds are flattened and maize and millet are broadcast among the cassava from the first year. At the start of the next rainy season, in November, the mounds are remade and beans or groundnuts are grown on them, with millet and cassava planted between the mounds. Alternatively, if mounds are not made, maize and cassava are grown on the flat land. This is then followed by mpepe (see figure), with maize, cassava and groundnuts being grown on the flat. The farmer may then decide to make the mounds for a third time, to grow beans, or continue with the flat mpepe, this time with groundnuts. During the whole cycle, any weeds or residues from the previous crop are buried, taking care not to disturb any

existing cassava. Normally, the garden is left to fallow when it is flattened, as it is recognised locally that a garden abandoned in its mounded stage takes longer to regenerate than a garden abandoned in its flattened stage.

The effects of the mulching and compost-like processes of the system are considerable – they help conserve soil moisture, improve infiltration rate, reduce weeding and weed competition, lower soil temperatures and improve the soil structure. Biological changes include increased activity of soil micro-organisms and animals involved in the decomposition process, while the added organic matter also stimulates decomposition of the existing organic matter in the soil. The nitrogen in the buried organic matter is necessary for the growth of bacteria responsible for further decomposition.

Adapted from Stromgaard, P., 1989. *Adaptive strategies in the breakdown of shifting cultivation: The case of Mambwe, Lamba and Lala of northern Zambia*. Human Ecology, 17: 427-444.

less fertile soil, is adapted to drier conditions and fixes atmospheric nitrogen well. Research showed that this species has the potential to improve fertility and crop performance, through raising soil pH and the nutrient status of the soils. Another species tested was *Crotalaria zanzibarica*, known in many other countries as an agricultural weed. This also grew well, and both species decomposed rapidly within the mounds. The nutrients released supported crop growth during the next cropping season, after the mounds were levelled at the beginning of the rains.

Another key improvement was to plant a bean crop on the mounds once they have been prepared at the end of the rainy season. Planting at this time yields more than planting earlier, at the onset of rains. This is because the crop develops under relatively drier conditions and suffers less from foliar bacterial and fungal diseases. It draws its water requirements from late rains, residual moisture and morning dew. The crop is harvested around June/July each year, when the weather is generally cool and more suitable for harvesting beans, as bean pods shatter if they are overheated by the sun.

The research programmes also investigated the suitability of various treatments as alternatives to the *chitemene* system. Experiments, with finger millet and groundnut showed that the Mambwe mound cultivation system achieved similar yield levels to those obtained under the traditional *chitemene* system of cultivation, demonstrating that the Mambwe mound cultivation system is a suitable alternative to the *chitemene* system of

cultivation. Research results strongly supported the transition from slash and burn to a more settled type of agriculture for local inhabitants. The extension system of the Ministry of Agriculture and Cooperatives has worked closely with scientists and farmers to promote the Mambwe mound cultivation system.

The Mambwe mound cultivation system, which includes a cereal-legume rotation on mounds, alternating with cultivation on flat land, has been practiced for a long time. This shows that the system is resilient and can support intensive crop production to meet the food and nutritional security requirements of local inhabitants. It is an indigenous system and has proved to be a practical and sustainable alternative to the environmentally destructive slash and burn cultivation system.

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