5. Indigenous Soil Classification Systems in Northern Zambia

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Introduction

AGRICULTURAL ON-FARM and extension must be based on a knowledge of local soils to be useful to the farming clientele. In Zambia, as elsewhere in the Third World, highly technical methods for describing and classifying soils have been developed, which, however, often have little practical value and are therefore rarely used for research and extension aimed at small-scale peasant farmers. There are several reasons why this is the case. First, the criteria used by technical scientists for classifying the soil may not match the criteria considered by farmers – the latter being concerned with the soil's usefulness for cropping. Second, sampling and analysis required to classify a soil using conventional technical methods are often too laborious, time-consuming, and costly for applied ('on-farm') researchers and extensionists to carry out. Third, researchers and extensionists may lack the skills and training required to identify and analyse a soil in the field. Fourth, interpretation of conventional soil classification manuals may be beyond the technical ability of some researchers and extensionists.

It was recently noted in Zambia's Northern Province that for all these reasons, very little, if any, attempt to relate different soils and their characteristics to local farming practices was made by applied researchers and extensionists in their work with peasant farmers. At the same time it was noted that considerable soils field research had been undertaken and was still being undertaken by technical scientists attached to the Soil Survey Unit of the Ministry of Agriculture and Water Development (now Ministry of Agriculture and Cooperatives). This data source was simply not being used by those concerned with the subsistence and semi-commercial peasant farming population. Finally, it was noted, in the course of anthropological field research being conducted as part of an applied on-farm agricultural research project (Adaptive Research Planning Team [ARPT], Misamfu Regional Research Station, Kasama, Northern Province, Zambia), that members of the peasant farming communities had a breadth of knowledge and opinions about the local soils they used for farming. This was not a new finding – in the 1930s vernacular soil terms and indigenous knowledge on soils had been recorded both by an anthropologist (Richards 1939) and an ecologist (Trapnell 1953).

A curious situation has occurred in which two quite distinct and unrelated systems for describing soils coexist but are unknown to each other, and neither is being used by the agents for agricultural development. Clearly, farmers, soil scientists and agriculturalists have information on soils of value to each other; the problem is to transfer the information from each group to the others. It was therefore proposed to carry out a joint study involving farmers, social scientists, soil scientists and agriculturalists to collect information on indigenous terms, descriptions and uses of local soils, and to compare this information to that available from technical soils research in Zambia.

This research program has evolved into several phases, the first two of which are reported here. As may be expected with any unconventional, multidisciplinary research, the program has met with opposition and criticism in some quarters, and has also changed its focus since beginning in 1987. A major challenge has been to gain acceptance by some local Zambian scientists of the validity of an indigenous knowledge system regarding soils. Perhaps this notion was resisted because the existence of an indigenous classification system was perceived as inimical to the adoption of the technical classification system by agricultural researchers.

More fundamentally, acceptance of an indigenous system, as articulated by uneducated peasant farmers, seemed to question the scientific credentials of formally educated local scientists. Furthermore, the indigenous system is still very imperfectly recorded and understood, and much more research is required. Questions about the validity of data on the indigenous system were therefore raised and hotly debated. However, these challenges have highlighted the need for soil scientists, social scientists, farmers, extensionists and agriculturalists to create a bridge between the discrete systems of soil classification in Zambia. Until the different knowledge about soils can be transmitted between farmers and technical scientists, (and this can only happen when more conclusive data are available) members of these groups will not be able to communicate effectively about the soil upon which agriculture is based.

Research on indigenous soil classification in Northern Province, Zambia

A multidisciplinary field program was essential to the research objectives, which were initially to:

- collect vernacular terms, descriptions and uses of soils used by farmers;
- determine the criteria used by farmers to identify a soil;
- compare the technical and indigenous soil classification systems;
- test the hypothesis that farmers' indigenous classification systems were non-hierarchical, based on contextual and definitive features of soil and landscape, and that this system could be correlated to the technical Zambian soil classification system.

The first phase of field research consisted of several case studies in communities located within different agro-ecological zones of Zambia's Northern Province. These case studies used anthropological interviewing techniques to elicit local knowledge about soils and micro land systems exploited by farmers in each community (Kerven and Sikana 1988). These studies were part of a diagnostic study of farming systems and production constraints undertaken for a farming systems research project (ARPT), and revealed an extensive local knowledge of soil variation and of the responses of the various local crops to different soils. As a result, it was felt by the ARPT social scientists that interpretation of data from on-farm agronomic trials and extension demonstrations being implemented by other ARPT professionals could benefit by using farmers' local knowledge on soils.

Crop performance was clearly site-sensitive. Farmers selected field sites according to soil characteristics which, in their experience, were particularly suited to individual crops. Moreover, on-station soil productivity research in Zambia's northern region (a high rainfall area), which had been carried out for the past decade, could become more relevant to the client group by replicating on-station trials on similar soils to those selected by farmers. In this event, research on soil productivity could investigate more closely the soil–crop interactions already noted by the farmers, rather than siting trials on 'bench-mark' soils as classified under the technical system.

The second phase of the field research was broader in scope. It consisted of detailed data collection at five sample sites representing different major soil and land regions within the Northern Province of Zambia. The study was conducted by a team of agriculturalists, soil surveyors and social scientists drawn from the Soil Productivity Research Project (SPRP), the Soil Survey Unit and the Adaptive Research Planning Team (ARPT), all under the Research Branch of the Ministry of Agriculture and Water Development, in collaboration with the Agricultural University of Norway (Dolva, Mwale, Renna and Simute 1988).

Briefly, the research at this phase involved comparing technical analysis of indigenously named soils with the farmers' own evaluations of these soils. This was done by digging auger pits to a depth of 1.5 m, followed by chemical and physical laboratory analysis to correlate these data with farmers' statements about the soils. The results of this research phase are discussed later, but overall it revealed little correlation between soils as classified by the Zambian soil series technical method and those as defined by farmers in the indigenous classification (Dolva and Renna 1989).

Both the researchers and government soil and agricultural scientists concurred, after the second phase, that the research objectives and scope should be expanded in a third phase of field work. It was agreed to increase the number of sample soil observations and the number of farmers interviewed per site in order to validate the findings and to be able to generalise the use of an indigenous classification system to the northern region as a whole. In particular, any practical application of indigenous soil terms by researchers and extensionists in carrying out work with local farmers needed to have an adequate data base.

The new objective of the third research phase was to produce a Field Guide Handbook, listing all vernacular soil terms (including the different language groups occurring in the region), the chemical and physical properties of these locally named soils, and finally, the soil-crop interactions both from farmers' and technical scientists' perspectives. This third phase is currently being implemented by the Soil Surveyor for Northern Province and several social scientists from the Adaptive Research Planning Team. The Field Guide Handbook will provide a reference for applied on-farm agricultural work, which combines for the first time the indigenous and technical knowledge systems regarding soils in Northern Zambia.

The third phase began with a sample survey of farmers participating in ARPT on-farm agronomic trials, located in six distinct agro-ecological zones. The farmers were asked to describe the soils they had selected for different crops, then to comment on the suitability of the soil for each crop on fertility indicators before and after fallowing, and lastly to describe vegetation associated with each locally distinguished soil type. The main purpose of this survey was to link ARPT agronomic trial results with soil conditions as viewed by farmers on specific sites, without having to use technical soil analysis methods. A second purpose was to examine the pattern of fallowing in relation to particular soil types, cropping histories and vegetation species, as part of a longer-term joint study on soil fertility monitoring and management being carried out by the Soil Productivity Research Project (SPRP).

The nature of the indigenous classification system

Farmers identify soils in Zambia's northern region along several axes of a classification system, the primary axis being that of land systems comprising micro-ecological zones, typically on a slope. Since settlements are usually within walk-

ing distance of a stream or river, cultivation occurs along valley bottoms, slopes, and on uplands or crests associated with river valleys. Cropping systems depend on the specialised use of different parts of the terrain, in relation to drainage patterns and soil changes along the slope.

An illustration of this system of land and soil classification in relation to agriculture is from one of the case studies (Kerven and Sikana 1988). Farmers in one community use two dimensions, slope and predominant vegetation, to describe the their land systems. From these two dimensions, two main land systems are identified, namely an upland forest zone *(mulundu/mpanga)* and an open-wooded valley zone *(chipiya/mumana)*. The soils of the upland area are described as sandy, light soils which are 'hungry' (requiring fertilisers), with other soils described as red and clayey or again, other soils which are gravelly and heavy, dry up quickly but are more fertile than the sandy light soils. The soils of the slopes and plains, in contrast, are designated by farmers as clayish, dark in colour and more fertile than the upland soils. Small pockets of an especially fertile dark soil occur within the plains area.

Present-day cropping patterns within these two land systems reflect the limitations and advantages offered by each type of soil, as well as reflecting recent technological and economic changes at the national level in Zambia. The settlements within this community lie along the valley crest, at the junction of the two land systems. The hinterland, in the more thickly forested upland, is reserved for the slash-and-burn system for cultivation of finger millet and beans.

Farmers prefer not to use the heavier soils for the finger millet subsistence crop, but instead, since the introduction of a 'technical package' involving cultivation of hybrid maize with fertiliser as a cash crop, have begun growing maize on the heavier, more fertile valley soils. These richer soils were avoided before the introduction of the hybrid maize cash crop package. They are harder to cultivate and their greater fertility leads to thick growth of grass and weeds, which farmers view as the major limiting factor due to the labour required for weeding. The lighter, less fertile sandy soils of the forest, on the other hand, while not fertile enough for maize, are suitable for finger millet and beans, with the enhanced fertility and need for weeding eliminated through the effect of burning in the densely wooded upland area.

The indigenous classification system briefly outlined here is typical of the northern region of Zambia, in that a matrix of factors is considered by the farmers in identifying and selecting different soils for particular crops. Soils are viewed in relation to drainage, associated vegetation, crop suitability, labour constraints, available technology, and proximity to settlements.

A second aspect of the indigenous soil classification system is the farmers' method of naming and describing individual soils. Here one must distinguish analytically between the names versus descriptors used by farmers to refer to soils. Names are terms used to identify or label a particular soil type, whereas descriptors may either be used in place of a specific name, or as qualifiers to a name. Thus, farmers call a certain soil *nkanka*, by which they refer to an upland red clayey fertile soil, defined by its red colour. *Nkanka* is preferred for cereals and some legumes and, indeed, for most of the crops, due to its fertility. Technical observations on this named soil were largely uniform and thus corroborated farmers' descriptions (Dolva and Renna 1989). The term *nkanka* is also used in association with descriptive terms translating as sandy, really red, big, small, and moldable (in the hands), to refer to what farmers may view as subsets or variations of *nkanka* soil.

Some descriptive terms, however, such as red and sandy, are also used as the sole referents for other non-*nkanka* soils. Thus, in the farmers' terminology *nkanka* soils are also sometimes sandy but not all sandy soils are necessarily *nkanka*. In contrast, an important widely-occurring group of soils are termed as sandy *(muchanga)*, with various qualifiers added by the farmers such as fine, mixed with black or hard soil, dusty and small. Variation of properties within the sandy-named *muchanga* group is wide on *some* technical criteria (such as colour and chemical properties) but uniform on texture (sandy loam) and drainage (well drained) (Dolva and Renna 1989).

From this evidence we can conclude that farmers primarily consider the definitive features, *from their perspective*, in naming or describing a soil. Some soils in the farmers' experience are sufficiently discrete in their visible properties to warrant an exclusive name, such as *nkanka*. Other soils merge under a general characteristic such as sandy *(muchanga),* but with significant visible variations which constitute subsets of all sandy soils – such as particle size (hence, 'dusty', 'coarse', 'small', 'fine' used as qualifiers to separate the classes of *muchanga*). These qualifiers are important as a means of identifying poorer quality from better quality sandy soils, from the farmer's viewpoint.

The lack of a comprehensive taxonomic hierarchy in the indigenous system is clear. Farmers do not necessarily group soils according to logical subsets but according to the soil's most significant and empirical features from a farming perspective. In particular, many farmers were able to provide detailed information on how a specific soil performed according to the various crops planted on that soil, and during, as well as, after fallowing. In the example just given, many of the soils named as *muchanga* (with qualifiers) would, technically, be differentiated on the basis of colour and chemical properties into sub-groups, but in this class farmers have 'lumped' categories together which share the overriding characteristic of having a sandy texture. Texture alone would not be a sufficient criterion for distinguishing a separate soil type in the technical classification system.

Conclusions

An outline has been presented of how a research program on indigenous soil classification systems in Northern Zambia has developed as part of a larger set of research programs on soil and agriculture aimed at small-scale peasant farmers. To date, some 73 different types of soil named in the vernacular languages have been recorded and analysed. These 73 terms could probably be combined into about 27 major soil groups, not all of which are used for cultivation (Dolva and Renna 1989). Samples of each named soil type have been tested using standard laboratory techniques. A low degree of correlation with the official Zambian Soil Series classification on most indices was obtained. This indicates that the indigenous criteria for classifying a soil type differ radically from the technical criteria.

Reasons for this divergence in criteria can be summarised as follows. First, farmers mainly consider topsoil in describing a soil, while soil scientists use subsoil and parent material as one criterion for classification. Second, farmers judge their soils empirically, while soil surveyors identify soils deductively based on predetermined indices. Third, farmers consider limiting factors such as hardness, stoniness, and presence of weeds in assessing soils; these factors are not included in conventional soil classification, but are considered in land evalua-

tion studies. Soil classification is a contentious subject, but as one soil surveyor has remarked, 'There is no point in...defining classes [of soils] that do not correspond to the differences which the farmer or other users perceive to be important.' (Butler 1980: 9).

It is to discover what these differences are that led to research on indigenous soil classification systems in northern Zambia. Agricultural researchers and extensionists were not only unable to communicate with farmers about their soils, lacking a common terminology, but were unaware of what farmers viewed as important differences in the properties of the soils they selected for particular crops. The ultimate objective of the research outlined here is to facilitate communication between farmers and scientists by interposing the indigenous and technical bodies of knowledge, following the advice of the ecologist Trapnell who first recorded indigenous terms for land and soil in Zambia during the 1930s: '...it may be held that improvements in African agriculture are likely to have their best prospect of general adoption where it is possible to build on the foundations of the existing system or on what is best in their practice.'

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