Building on traditional resource use by cattle-keepers in central Nigeria

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Livestock development efforts in Africa have often involved attempts to introduce new production systems such as ranching or feedlots, and have largely failed (Jahnke, 1982). Greater emphasis is now being placed on improving existing production systems rather than trying to replace them.

This is reflected in the systems approach to livestock research and development (R & D) taken by the International Livestock Centre for Africa (ILCA): an interdisciplinary team of scientists analyses the existing production system and - in co-operation with livestock-keepers - designs and tests technologies for improving it. The work of the ILCA Subhumid Zone Programme in central Nigeria is an example of such participatory R & D, combining the knowledge and skills of local livestock-keepers and outside scientists.
Rather than working on an experimental station, the ILCA team worked directly with the livestock-keepers who were to benefit from the research. The first step was to investigate the existing production system - the techniques, strategies and productivity - and to identify areas where improvements could be made. It was soon recognized that production could best be increased by improving cattle nutrition. Ways were then sought to integrate a new grazing resource into the existing system of resource use.

Traditional resource use

The subhumid zone (SHZ) of Nigeria corresponds roughly to the 'Middle Belt', with 1000-1500 mm rainfall and a growing season of 180-270 days. The principal cattle-keepers are the Fulani, who are now tending to settle close to farming communities, and also do some cropping themselves.
The Fulani cattle-keepers comprise only 5-10% of the population in the Nigerian SHZ. Traditional land rights are held by numerous ethnic groups of farmers. The Fulani obtain land for cropping on loan from local farmers in return for only a token payment, although some purchase land or occupy unclaimed land. Grazing areas are communal and comprise uncropped areas, fallow land and harvested fields. The settled Fulani live year-round at one site but may move a short distance every few years. Their cattle usually graze within 5-6 km from the homestead but may be moved for short periods to more distant areas to exploit localized grazing resources. In the dry season, transhumant Fulani from the north compete with the settled Fulani for forage resources in the SHZ.
On average over the Nigerian SHZ, 20% of the land is cropped in the wet season. At this time, the cattle graze mainly upland range and fallow fields. The Fulani regard first- and second-year fallow in particular as better pasture than the range. In the dry season of 5-7 months, a wider variety of forage resources are used: crop residues, floodplain vegetation, grass regrowth in burnt areas, and leaves and fruits of particular trees and bushes *(e.g. Afzelia africana, Khaya senegalensis, Pterocarpus erinaceus, Daniella oliveri)*. In the two months after grain harvest, the cattle spend 2/3 of grazing time on crop residues, mainly millet and sorghum. Later they graze residues of rice and beans. The next most important dry-season forage is floodplain vegetation, which remains green after the upland range has dried and often also been burned by the farmers. The regrowth of perennial grasses after burning is valued by the Fulani as a fodder high in quality, but the yield is very low. Browse becomes important in the late dry season, when most savanna trees show a peak in growth. The new leaves are considerably more nutritious than the mature grasses (Bayer, 1986a).
Although cattle-keeping and cropping are each practiced by specialized producers, these activities are linked:
- crop residues and fallows provide valuable forage;
- the cattle apply manure to cropland, where they are camped overnight in the dry and early wet season;
- trade relations: the Fulani sell milk, animals and manure to the farmers, whereas these sell cereals to the Fulani;
- clearing land for farming destroys the tsetse-fly habitat and creates a healthier environment for cattle-keeping.

The Fulanis' herding techniques permit them great flexibility in using seasonally available and very localized forage, even small fallow areas directly beside unfenced crops and crop residues in fields still not completely harvested. Livestock-keeping and cropping as practiced by the Fulani and farmers, using the same land at different times of the year, can thus be complementary and mutually beneficial. Pastoral development policy in Nigeria had promoted the creation of grazing reserves and ranches, but the findings of the ILCA research team furnished arguments for trying to maintain a spatial integration of herding and farming.

Integrating a new forage resource

The team sought ways of increasing the diversity and quality of grazing resources available to Fulani settled in farming areas. The Fulani and scientists cooperated in simply designed on-farm ('in-herd') trials, initially involving technologies which scientists on Nigerian research stations had already found to be promising: supplementary feeding with agroindustrial by-products (molasses, cottonseed cake) and intercropping of forage legumes (Stylosanthes spp) in cereal crops. When one of the Fulani cooperators moved his sorghum cropping area to protect the style which re-emerged in the subsequent wet season, the idea of the 'fodder bank' was born (Taylor-Powell & Kaufmann, 1986). The fodder bank is a small protected area of concentrated style plants which can be grazed a few hours daily in the dry season as a supplement to the existing grazing resources. To gain access to an

Fulani herd camped overnight on farmer's field to deposit manure (Subhumid Zone, Central Nigeria)

area large enough for a fodder bank (ca 4 ha for an average herd of 50 cattle), the Fulani made conventional land use agreements with farmers or used land they had occupied according to traditional law or had bought or to which they had obtained occupancy rights under Nigeria's new land laws.
The researchers originally recommended that the fodder bank be grazed by selected animals (pregnant and lactating cows) throughout the dry season for ca 2 hours/day after normal grazing. The aim was to increase milk production. ILCA paid the establishment costs (stylo seed, superphosphate fertilizer, fencing) for the first few fodder banks established on a trial basis. Thereafter,the Fulani cooperants covered the costs themselves, either by selling animals or by obtaining government loans. The research team, particularly one of the social scientists, observed how the cooperants used their fodder banks, and discovered that the Fulani

- tended to save the fodder bank until the latter half of the dry season, preferring to take full advantage of crop residue grazing in the first half;
- allowed cattle to graze the fodder bank at the beginning rather than end of the grazing day;
- preferred to allow very weak animals or (at the end of the dry season) the entire herd to graze the fodder bank;
- used the fodder banks for survival feeding rather than milk production (Taylor-Powell & Kaufmann, 1986).

These observations indicated gaps in the researchers' knowledge of the production system. Investigations then revealed that, in the early dry season, crop residues offered a diet much higher in quality then originally thought, as the cattle selected particularly nutritious plant parts such as immature seed heads, green leaves and upper stalks. Closer study of the daily pattern of labour availability revealed that adult men, who were best capable of separating out animals from the herd for fodder bank grazing, were most likely to be present at milking, which is done in the morning. Controlled trials within a subsequently established experimental herd revealed that an important effect of fodder bank grazing was to reduce animal mortality (Bayer, 1986b). In the average Fulani herd, 3-5 animals normally died or had to be sold each dry season, largely because of nutritional distress. The use of fodder banks for survival feeding of weak animals halved these losses (Taylor-Powell & Kaufmann, 1986). Investigation of income sources and the pattern of financial control in Fulani homes revealed that the income from animal sales/slaughters was double the income from milk sales/consumption, and that men controlled most of the income from cattle whereas women controlled the milk income. The men bought the herd inputs, including those for the fodder bank innovation, and depended mainly on animal sales to gain the cash (Waters-Bayer, 1986). This also helped to explain their emphasis on animal survival rather than milk output. Not only the Fulani reaction to the scientists' recommendations but also new ideas introduced by the Fulani influenced the design of the fodder bank innovation and directed further research. For example, some Fulani countered the problem of termite damage to fence posts by adapting an indigenous form of live fencing (using mainly *Ficus spp).* This also considerably reduces fencing costs, which - in the original fodder bank concept - represented 3/4 of the total costs of establishment (Taylor-Powell & Kaufmann, 1986). Other Fulani tried different ways of preparing land for fodder bank seeding, based on their traditional techniques of using cattle to trample ground in the early wet season for the broadcast sowing of rice and iburu *(Digitaria iburea).* Some Fulani began to collect their own stylo seed for subsequent expansion of their fodder banks, thus reducing seed costs.
Several Fulani started to cultivate part of the fodder bank with cereals, taking advantage of the protection the fence offers from crop damage by animals. Controlled trials now show that maize grown after stylo yields 2-3 t more grain than maize after fallow (ILCA, 1987). The result of the combined efforts of the Fulani and ILCA may be a form of ley farming suited to the circumstances of agropastoralists in the subhumid tropics.

Continuing the process of technology development

This example illustrates the mutual learning process which is central to participatory systems research. The scientists suggest promising innovations on the basis of preliminary research. The livestock-keepers modify the new ideas in line with their own knowledge of animal husbandry and local conditions and opportunities. Rather than spending years trying to understand every aspect of the complicated production system, the research team closely monitors the livestock-keepers' reactions during cooperative on-farm trials. These observations pinpoint areas in which the team requires more information, also through on-station research. By means of this constant exchange of ideas, the innovations become increasingly refined and better adapted to the situation of the livestock-keepers. In this case, by conducting trials together with the Fulani, the ILCA team gained a better understanding of how the cattle-keepers make use of available forage resources and how an additional source of fodder can be most effectively used.
Fulani efforts to reduce fodder bank costs deserve further attention from the scientists, who still need to clarify the relative contribution of different benefits

Fulani herd grazing sorghum residues in a farmer's field (Subhumid Zone, Central Nigeria)

of the fodder bank package. For example, any one factor - the protection of an area by fencing, breaking the soil surface by cattle trampling, application of superphosphate fertilizer - or a combination of these factors may promote the spread of indigenous legume species. This would eliminate the necessity of introducing legume seed from other continents. Also grass growth may be encouraged, resulting in an increase in feed bulk which may be just as, if not more, important than the protein supplement offered by the legumes. This would be particularly the case in more densely cultivated parts of the SHZ where grazing areas are more confined during the growing season and wet-season supplementation is needed. Also worthy of testing would be incorporation of indigenous multipurpose tree or shrub species in the fodder bank, so that additional browse is available to the animals and other produce (e.g. fruit, leaves for vegetables, firewood) to the Fulani. The appropriateness of these ideas would depend, above all, on the loan land tenure agreements, as planting trees is a means of claiming land in many parts of Africa and may not be accepted by farmers who have granted only temporary land use rights to cattle-keepers.

Throughout this on-going process of selecting, designing, testing and evaluating new technologies, the scientists can continue to build on the knowledge and ideas of the local livestock-keepers, as reflected in their ethnoscience: their system of resource use, their modifications of the scientists' ideas, and their own experimentation.

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Fulani man inserting a live pole in his fodder bank fence (Subhumid Zone, Central Nigeria)

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