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The Silent Ontology of Farmers' Experimentation: Getting it Aloud for Promoting Innovations in Nigeria and Benin

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Introduction

Farmers' independent experimentation (FIE) is also referred to as lay, local, informal, indigenous experimentation as well as to folk, ethno-, or citizen science (SAAD, 2002; AGRAWAL, 1995). These attributes reflect the widespread willingness in the literature to differentiate FIE from researcher methods, thus to evaluate farmer experimentation. FIE is traditionally evaluated from the perspective of three classical schools of thoughts: While positivists seek the training of farmers to comply with the scientific standards of empirical experimentation, constructivists reject the universal claim of scientific standards and valuate the idiosyncrasy of FIE as a chance to decrypt and to nurture farmers' creativity. As proponents of a third intermediary school, pragmatists seek practical solutions to real problems and voice therefore the use of any type of knowledge, be it formal or informal, to reach the intended objectives.

Independently of the politico-moral concerns inherent to each of these three main positions, they all appear to be tentative approaches to an old problem, which is pervasive in FIE-related studies: the silent ontology of FIE. Farmers' experimentation is so inherently fluid and integrated in local farming strategies that it is hardly perceived as experimentation by the actors themselves; not to speak of researchers who desperately have to rely on systematised yardsticks to approach the *per-se* non-systematised process of FIE. It is not surprising that studies to elucidate local processes of farmers' experimentation are scarce in comparison with the great amount of literature on local knowledge (RHOADES, 1989; POTTS ET AL, 1992) and the ecological soundness thereof.

To shed some light on this domain and to keep its objectives realistic, the present study −which, as an example, is concerned with the utilisation of herbaceous legumes in Benin and Nigeria− opts for a pragmatic approach. It seeks to identify the tacit layer of FIE, which, if addressed, could improve the dissemination of farmers' utilisation of this technology.

Material and Methods

To insure that our observations were genuine manifestations of FIE, we restrained from suggesting any pre-conceived experiment layout to the participants. As a result, we ran into two majors methodological 'troubles': a) the fluidity of the FIE process that offers no tangible, conventionally shared points for documentation, and b) the *per-se* tacit character of FIE and farmers' sub-consciousness thereof.

To address the first challenge, we structured our observations following the universals of the human learning process (SCHÖN, 1983). This is known to follow two main phases: a) an activation stage where the existing/tacit knowledge of the new learner encounters breakdowns with conflicting situations, and b) a reflective stage where the cognitive dissonance experienced by the new learner during the activation stage is reduced to a new knowledge following a more or less explicit process of uncertainty reduction.

As potential indicators for the activation stage, changes in the number of participants and tested species were systematically monitored, for two years, at the sowing, middle, and harvest seasons. Field and focused group discussions as well as field days were organised to elicit farmers' reasons for observed changes. Additionally, the fields where farmers tested the legumes were –GIS aided– systematically mapped with respect to their crop arrangements and those of neighbouring fields.

To address the tacitness of farmers' experimentation (HOFFMANN ET AL., 2007), we restrained from direct questions about the whys of farmers' actions. Instead we contrasted farmers' behaviours with alternative options using contrastive elicitation techniques as follows: "*You could have chosen to plant legume L on plot/field B, why did you choose A instead...*?" Farmers' answers were sorted into two categories of reasons that hypothetically describe the normal course of FIE process: norm-conform reasons that explain what farmers normally do under normal FIE conditions and norm-deviating reasons for actions that were just situational responses to abnormal conditions, such as: "*I put the legume there because I have no other place left...*". Each type of answer was probed on a subsequent sample of participants and continuously refined until a clear "If-Then-Rule" emerged that described our observation in an internally consistent manner.

To account for the potential influence of environment constraints on FIE, the research villages (4 in Benin and 4 in Northern Nigeria) were selected based upon a stratified sampling method. The latter was to reflect the resource constraint/availability prevailing in the research area and to capture the different levels of food *vs.* cash priorities of the participants. In the same line, the introduced 'baskets' of legume options were selected to cover a broad range of resource availability and farm-household priorities. They included land-demanding cover and forage legumes as well as improved varieties of existing grain-food legumes. The participation –in total 498 farmers– to the experimentation was fully on a voluntary basis.

Results and Discussion

The results showed two patterns of learning activation at the beginning of the FIE. In Nigeria, where there was a relatively differentiated local taxonomy of forages (but not regarding differences between legumes and grasses), the participants valuated the introduced cover and forage legumes just as wild forages similar to those from their natural vegetation. Thus, there was no significant break-down between existing knowledge and the introduced forages. As a result, farmers' interest in experimenting with the introduced technologies was moderate. In contrast, in Benin the introduced cover and forage legumes were perceived not as wild grasses but as novelties worth of testing. The enthusiasm of the participants was correspondingly high in the activation stage as shown by the total number of participation of farmers (367 in Benin *vs.* 131 in Nigeria).

Independently of these differences between the two research areas in terms of learning activation, the participants showed surprisingly similar patterns of a knowledge generation process across the research sites and villages. We chose to document this learning process particularly on the introduced forage and cover legumes as these legume options were relatively new, and thus were challenging and potentially reflective of active learning processes. In a first stage, the participants chose their species to be tested upon morphological indicators of plant vigor –leaf and seed size, growth habit– from which they would anticipate the likely performance of the species for defined farm-household functions. Big-leafed and big-seeded species were assumed to have a potential higher soil-fertilising effect and thus lead to increased yields of a subsequent maize crop, than small-leafed and small-seeded species.

After this implicit hypothesis, a persuasion stage followed to verify the assumed performance of the promising species. It was at this experimentation stage that the fluid experimentation layout adopted by farmers could be concretely observed. The participants designed their test fields largely without side-by-side control, but the tested species had to cope with the hardship of environmental circumstances. In Benin, *Mucuna pruriens* was tested for soil fertility on exhausted fields without any other form of control or comparison with other introduced legume options such as *Stylosanthes guianensis*. Despite its small-leafed status, the latter proved to perform better on subsequent maize than big-leafed species such as *Pueraria phaseoloides*. The latter ranked third after *M. pruriens* and *S. guianensis* while the other rather small-leafed or small-seeded species –*Centrosema molle* and *Aeschynomene histrix*– ranked fourth and fifth, respectively, as predicted by the participants.

In Nigeria, farmers showed some preference for *Macrotyloma uniflorum* and *Centrosema pascuorum* as forages because of the 'spreading' growth habits of these species. The operationalisation of this 'spreading criterion' in quantifiable agronomic terms of 'ground cover' and 'biomass production' allowed us to compare farmers' findings with those of researchers. Surprisingly, farmers' observations proved consistent with earlier quantification of agronomic features of these legumes in comparative studies in the same research area (PETERS ET AL., 2000).

This large consistency between farmers' and researchers' findings does, however, not allow a qualitative equation of farmers' methods with those of researchers. Alone from the perspective of quality management of their institutions, researchers cannot afford to decide on their own which legumes are likely to perform better and then to go for these without using standardised, thus traceable procedures of investigation. This conclusion would suggest a certain superiority of researcher methods over those of farmers. Such suggestion is, however, not appropriate when considering farmers' third and most decisive experimentation stage.

At that third, decisive experimentation step to adopt promising legumes, the participants decided to extend the experimentation process into a larger spatio-temporal frame. They wanted to follow, in the real life, the pathways of adaptation of these species to their needs and circumstances. There was no measurable criterion to evaluate the adaptation of the legumes but rather there was a general description of this experimentation stage: 'W*e will wait and see how the promising species get adapted to our circumstances;…How they get to be known in local markets…*'. To make sure that these affirmations were not only synonymous of the assessment time lag that introduced cover and forage legumes understandably need to be adopted, we grounded our observations on introduced grain-legumes; particularly on those grain-legumes for which participants perceived yield advantages over local varieties. But again in these cases, farmers' reasoning remained the same: "*We want to wait and see before adopting them*".

We argue that the ultimately missing link for full adoption was not only a matter of legume trait, thus not only a question of plant breeding science. Rather it was the necessity for the participants to undergo an evolutionary learning process before taking the final decision whether or not to fully replace their local varieties by new ones. In this, there was no explicit evaluation criterion or stopping rule to this real-life investigation process, which is at odds with the very artefact of researcher processes of experimentation. Researchers do not follow a legume adaptation process in its historical flow but are trained to reduce real-life situations to the most determining factors, or to construct a simplified version of real-life circumstances, which is simulated under artificial conditions, such as in the form of laboratory, on-station, or even on-farm experimentation. Tools such as sampling, randomised experiment layout and statistical analysis methods are further short-cuts to reach reliable results without reproducing the reality in its whole complexity.

If legume research wants to more effectively promote technologies, it has to follow a process-oriented legume breeding procedure, which should ideally be executed concurrently with the adoption-diffusion process. This amounts to a co-evolutionary action-research jointly implemented by legume breeders/agronomists in perfect synchronisation with extension agents, while the latter are involved in dissemination processes. The reality is, however, far from allowing such research processes. Legume breeding projects are funded within a limited time frame and designed to follow explicitly formulated objectives and not indefinitely historical flow of phenomena.

Conclusions and Outlook

Farmers ultimately relied on a path-depending experimentation approach to make their legume choice, while legume breeding research relies on a scientifically well-conceived approach where breeding objectives, evaluation criteria and outcomes are documented within a defined spatio-temporal investigation frame. Thus, there is a spatio-temporal gap between the knowledge generation procedures of researchers and those of farmers. To close this gap a co-evolutive legume dissemination process with permanent ’feedback loops‘ between farmers, extension agents, and plant breeders is necessary. The business-as-usual strategy consisting in relying only on deterministic approaches and explicit legume adoption criteria is, in our view, misleading: it ignores the non-spoken third research step where farmers use to make their final choice. Ironically, this third stage is pigeonholed as ‘technology assessment time lag’ or as ‘risk adversity’ in diffusion studies and therefore largely ignored.

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