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# SOCIOLOGICAL AND ANTHROPOLOGICAL ASPECTS IN PREPRODUCTION TESTING AND PRODUCTION PROGRAMMES INVOLVING UPLAND RICE

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## 1. THE PROBLEM

The development of agricultural technology for upland rice environments confronts researchers with particular problems. In irrigated and to a lesser extent in rainfed lowland production environments,soil-water-plant relations are relatively homogeneous and predictable;physical and biological regularities have been held to justify the use of rather simple research tools and concepts such as constraints analysis and cropping systems research.But the diversity of upland rice environements,ranging from "favourable to unfavourable" and with great variation in growing season (IRRI 1984),does not easily allow the transfer of research methods developed for other conditions.

The gap between research station yields and small farmers' yields is not really diminishing outside a few exceptional areas in southeast Asia.In fact,the difficulties involved in the development of upland rice technology reveal some of the inadequacies underlying the whole technology design process as it has been practised at the IARCs.Inadequacies at the pre-production testing stages of the process reflect and are in part the consequence of inadequacies at earlier stages;for example,in the derivation of design criteria and the specification of what is to be tested.Attempting to address sociological and anthropological issues <u>only</u> at the later stages thus would be ineffective.

## 2. THE DIMENSIONS OF THE PROBLEM

The large-scale application of public funds to science-led agricultural production increases is a recent phenomenon in human history.For centuries,producers and consumers have developed ,through a delicately-balanced process of purposive experimentation,trial-and-error,imitation and serendipity, specific (rather than general) combinations of cultivation practices and land races;in agricultural science terminology,through a mix of improvements to crop genotype,G,and environment,E, and through GE interactions (Simmonds,1981).Only recently have outsiders with little practical knowledge of cultivators'and consumers' environments been involved in designing new technology.Their design criteria, demonstrably, are a reflection both of the scientific concepts brought to the definition of the problem statement and of the organisation of the research process.The concepts and the process in

turn are founded on assumptions derived from underlying normative values which are rarely made explicit.Some of the key assumptions might be stated as follows:

- the definition of technology: technology usually is seen by researchers as a product which changes physical input-output relations. Improved genotypes have always received the most attention;recently,researchers have concentrated on cultivars which are "resource neutral" as well as "scale neutral" which,(for example,because they incorporate disease resistance) are said to be appropriate for a wide range of farming systems.Unfortunately,the criterion of neutrality holds within only extremely narrow specifications ,precisely because THE BENEFITS OF THE NEW CULTIVARS ARE NOT TOTALLY EMBODIED IN THE SEED OR FERTILISER;they require changes in labour allocation and inputs and crop management and hence in household management and in the organisational and institutional infrastructure.Thus,a definition of "technology" must encompass the social organisation of production,whether at farm,household,regional or other levels.Moreover,since technology is an artefact of its time and environment,neither an increase in supply per se nor in the range of technological choice nor the existence of an opportunity or need perceived as acute by policy makers and researchers,are sufficient to generate items which are significant and meaningful to users.

- adaptation: fitting technology to users or users to technology ? The history of purposive technological innovation suggests that success requires the closest of attention to innovation processes,that is,to utilisation and to users,from the beginning of the research process. But IARC researchers have tended to define adaptation as eliminating "error of fit" at the end of the technology development process.

- the illusion of the smorgasbord: researchers have aimed at producing two types of choice: a range of characteristics built into plant genotypes and a wide range of cultivars. Implicitly,it is assumed that (1) what is on offer is appropriate and highly desired by users;(2) producers and consumers are in a position to make informed choices;and (3),the range of choice effectively is accessible to users. Rarely,and then only for particular minorities,do these conditions hold simultaneously (Fresco,1985;Pearse,1980).

- the myth of the entrepreneur: researchers have tended to predicate their work on a model of "the farmer" and "the farm" as a petty capitalist enterprise managed by an independent entrepreneur.They have assumed a single decision-maker,usually male,and have ignored the limits to free individual action set by the networks of intrahousehold and interhousehold relations in which small scale production and consumption in developing countries are still largely embedded.

- the reification of technology: in the process of agricultural technology generation, the IARCs have tended to abstract items of technology from their production or consumption context. It is this abstraction which allows the belief that technical instruments by themselves bring about development. A.N. Whitehead labelled this kind of scientific reductionism "the fallacy of misplaced concreteness" (1926) and it has received much attention from social scientists disturbed by an approach to material development which treats people as objects of manipulation rather than as human beings.

Given these kinds of underlying assumptions, researchers have tended to react to the difficulties of upland rice environments by increasing the complexity of the research process, elaborating more detailed procedures, widening the number of experimental factors and the components in component technologies. Multidisciplinary exploratory and validation surveys, the inclusion of social scientists in design teams, recognition of multiple objectives within the farm household, the evolution of multi-phased, multi-locational trials, have led to research structures and processes which are more difficult to manage, less transparent to the end beneficiaries or to researchers themselves, and scarcely cost-effective.

Farming systems research (FSR) has emphasised the detailed definition of homogeneous producer categories (or recommendation domains -RDs) so as to reduce diversity to manageable proportions and, recognising the limitations of a purely technocratic view of the world, has sought the participation of social scientists. However, their participation has been confined largely to ex-post evaluation and testing of finished or semi-finished technologies whose fundamental architecture is already set. Where they have been let loose in the diagnostic phases of FSR, there have been major problems of incorporating their insights into agricultural scientists' work, especially in translating their description of social factors and farmers' priorities into agronomic definitions. Social scientists have been assigned the role of "those who know what farmers' want" in contrast to agricultural scientists - "those who know what farmers' need" and both the information itself and the methodologies used by social scientists have appeared inacessible and often illegitimate to the latter.

## 3. REFORMULATING RESEARCH CONCEPTS

Developing diversified technology for upland rice farming systems thus forces us to look again at agricultural research concepts and processes and to formulate new paradigms. To be effective in terms

of research process,reformulated concepts and new paradigms necessarily involve changes in mentalities. These are not easily achieved but they are not beyond reach (Chambers,1983). The following three points would seem to describe the more important shifts in outlook required:

- upland rice technology development,unlike pure plant science,encompasses what in mathematic jargon are termed 'ill-posed problems',i.e. to be resolved,they require knowledge derived from methodologies other than science (mathematics) and from spheres other than that which is the focus of attention.
- upland rice agriculture represents more than primary production in the rural areas of developing countries;it is the source of livelihoods for many who have no direct role either in management or labour.A concern for livelihood potential necessarily involves a concern for biomass and biomass utilisation.This implies that yield must be measured in terms of total usable matter,including grain,fibres,stalks,forage etc.
- 'development' is undoubtedly associated with increased efficiencies; the IARCs have concentrated on increasing production efficiencies rather than human or societal efficiencies.In irrigated and a few lowland rainfed environments,it has been possible for researchers to assume as given or as inducible the concomitant efficiencies in human and institutional behaviour required for the optimal performance of the new technologies (although these have been rather less impressively forthcoming than researchers' models assumed and subject to instability over time,to the extent that the validity of the assumption itself has been brought into question).In the socially and economically more marginal environments where upland rice is grown,the assumption clearly is unreasonable,even as a theoretical entry point.Both the existing efficiencies of human and social behviour in upland rice areas and awareness of the limits to induced change would seem to offer more fruitful perspectives.

It does not seem either sensible or practically possible for these conceptual formulations to be regarded merely as areas of research and analysis which might be <u>added on</u> to existing assumptions and outlooks.Their value-orientation,and the breeding criteria and research process which might flow from the,are distinct from the main body of current thinkinn and practice at the IARCs.Nor will recruiting a few sociologists and anthropologists in itself achieve very much. What is needed is a willingness on the part of researchers to move towards an integrative rather than additive approach to problem definition and problem solving.

## 4. RESTRUCTURING THE RESEARCH PROCESS

What is required,if sociological and anthropological issues are to be addressed, is that the research process be directed towards increasing users' options for responding profitably to - and surviving - changes in opportunity: technology thus described is that which increases resilience and flexibility over time rather than a one-time 'hit' which monopolises resources to the point where only a limited range of options can be pursued profitably within rather inflexible boundary conditions.The research process which might produce the preferred technology has been well proven in spheres outside agricultural technology generation in the IARCs.Its characteristic features are as follows:

Trying Out By 'trying out ' is meant a preference for testing g over analysis,a preference for testing diagnostic conclusions over increasingly detailed specification of what the problems and opportunities might be. ['Getting on with it,especially in the face of complexity,does simply come down to trying something.'(Peters and Waterman,1984 ed.,134)].There seems to be abounding virtue in numerous,iterative cycles with producers and consumers, of experimental action,analysis,reflection and,in the sphere of technological innovation,comparatively little in linear and deterministic models and experiments which do not include users.Obviously,it is more cost-effective to try something out than to try to analyse everything in advance,hoping among numerous potential products to hit on a few at least which might have utility for someone,somewhere.Yet the IARCs' testing and evaluation procedures are largely after-the-fact experiments determined by scientists; IRRI's constraints (yield gap) analysis explicitly excludes plant materials not yet released and available locally: sound logic in terms of its own model but unhelpful in the cost-effective development of technologies.

Quick,Numerous and Cheap If upland rice breeding programmes are to base their design more closely on 'markets',then the willingness to submit semi-finished products to user trials must commensurately increase.Studies of technological innovation,both historical and contemporary,suggest that opportunities exist,if they exist at all,in the present,and that the identifiable starting point is an immediate application within a specific (even if wide scale) context.In order to capture these opportunities,then,successful experimentation is based on the frequency in time and location of tests of numerous technologies in numerous agricultural (as opposed to experimental and research station) trials i.e.it is the overall number of technologies tested which counts and not the number of replication experiments for any one technology. Suppose the chances of any one trial proving a cultivar to be useful are only 10 per cent.If trials of ten cultivars are conducted,by the laws of probability the chance that at least one will prove useful rises to 65 per cent.If twenty-five trials

are conducted,the chance of at least one proving useful rises to 90 per cent and the odds that two will prove so are almost 75 per cent.However small the odds seem that any one technology will work,the odds of one technology striking home are the higher the larger the total number of trials.IRRI,for example,has access through its seed collection and testing programme and the Asian Farming System Network,to an unmatched resource with which to conduct quick,numerous on-farm agricultural trials with users.It also has a large stock of partially developed cultivars which have never been tested with users for their agricultural potential.Outside the IARC circuit,much has been done at the local level to improve the productivity of farming systems by swopping plant materials and husbandry practices between users,exploiting the genetic variability which exists and is available.

A Return to the Simple and Idiosyncratic "Trying out" is not an approach easily managed by a large scientific bureaucracy;it is predicated on multiple actions conducted by small,flexible units of dedicated staff elaborating and testing ideas and technologies against agricultural realities.Formality,organisational rationality and intellectual tidiness are not its hallmarks.It requires an efficient administrative and scientific back-up service.It requires intensive,person-to-person communication and reporting of trial results.It requires disciplined adherence to schedules at which results are reviewed,and trials continued or aborted.Mistakes in initial judgements and diagnosis must be seen to be tolerable,inevitable,acceptable.

The User Linkage In general,the IARCs have two outlets: i.national agricultural research structures and,through them,farmers;and ii.,national seed mulitplication programmes.Each encompasses a range of specialised,distinct end uses and users i.e."markets".The more that interest is focussed on the poor,the remote,and the unstable climatic and agronomic conditions which characterise the majority of upland rice areas,the more diversified are these markets.What is needed,then,are procedures for identifying and specifying the boundaries of homogeneous uses and groups of user (i.e.recommendation domains).The only cost-effective way to do this is by 'market research' on the ground.Office analysis of census-type data collected through instruments such as quantitative surveys is also necessary but will never by itself provide enough of the right kind of information in a timely fashion to support technology development and innovation.

In terms of the research and development processs itself,once recommendation domains have been identified,"user participation" fits into the following phases:

1.The diagnostic phase: with homogeneous groups of ultimate users (producers and consumers).

2. The testing and evaluation phase: with users in on-farm and in-the-kitchen producer and consumer trials.The practice has been to select 'typical' producers and consumers,by which is meant the average,modal or 'representative'. Others have pointed to the importance of selecting users who represent the range of conditions within the RD. Yet others have stressed the additional necessity of identifying at any point on the range the 'lead users',by which they mean those who have in their own practice a preference for experimentation.It should be added that there is no reason to believe that experimentation is not normally distributed among producers and consumers;unfortnately,the inventions of the poor and needy have tended to be unsought and unperceived by researchers.(Furthermore,the propensity to experiment has usually been conflated with the propensity to adopt and,specifically,to adopt the technologies offered by outsiders.The two are distinct.Until experimentation is grounded in the agricultural reality of the range of farmers,this distinction will continue to hold).

3. The production phase: once a technology has shown advantages for some users within an RD,it needs to be tested over a more extensive population ,including those in similar RDs. It is here that intermediate users and intermediate organisations might play in the future an important role (Roling,1984).Agricultural extension services have in some cases,for single commodities,played such a role in agriculrual technology generation.In French-speaking Africa,development organisations have successfully linked researchers and users at this stage of the process (Billaz and Dufumier,1980).Some FSR projects recently have played intermediary roles but their contribution necessarily remains small-scale,unless and until they can in turn link to government extension or community development services or to non-government and community organisations (Jiggins,1983;Bunch,1982).

5. IMPLEMENTATION: Changing Day-to-Day Practice

The reformulation of research paradigms and the restructuring of the research process must be translated into day-to-day practice.For upland rice research,it includes the following:

a. RDs and Diagnosis The definition of upland rice environments and evaluation mainly on the basis of agronomic (IRRI,1980,1984) or economic criteria (De Datta et al.,1978;Zandstra et al.,1981) implicitly assumes that technology problems and opportunities lie solely or determinantly in those spheres.IARC researchers recently have come up with a number of 'key' socioeconomic variables (Rhoades,1984; Chapman,1984).Helpful as these checklist guidelines are,they not only raise doubts as to why some variables are included and not others; they each leave out some dimension which other social scientists no doubt would consider essential.Further eleboration would produce methodological handbooks of unusable complexity.To reduce complexity to the manageable,agronomists and other

researchers themselves need to pay attention to FOUR sets of relations extended over TWO dimensions,viz:ACCESS, AVAILABILITY, DISTRIBUTION, EXCHANGE, extended over TIME and SPACE:

i) the actual access of producers and consumers to resources and (decision-making) powers,within the household and in the wider community;

ii) the availability of resources to consumers and producers in any local situation and the transaction costs involved in making them available;

iii) the pattern of distribution of resources and outputs and the rules governing the allocation;

iv) the social and economic forces governing exchange of inputs and outputs within the household and between household members and the wider community.

The condition of any set of relations is held to be variable over time,which in itself has a number of aspects (such as the moment and duration of the domestic life cycle,the culturally-determined period for the intra-community settlement of debts,secular socio-economic trends,short-run climatic crises,seasonalities of various kinds,and so on).It is also held to modify its meaning and significance according to the level at which it is analysed ( eg. at the level of the individual,the household,the community,the national economy and so forth).Spatial variability includes variations in environment and natural resources.

Another approach to increasing the sensitivity of technology development to human environments,is to model the farm household but what is lacking is any general framework incorporating the diversity of household structures and formations ,and their internal and external relations.Overly simplistic models form the basis of most economic and FS research at the IARCs (eg. Collinson,1984).However,the idea is not to complicate the models by disaggregating data ,for example,by sex and age, but to accept that a model is only a guideline tool which must be tested for its utility.Testing a model against the four variables (acess etc.)and two dimensions,outlined above, produces more appropriate models without increasing complexity.

Upland rice lends itself to analytic models of intra-household and inter-household dynamics because of the diversity of labour allocation and decision-making arangements and control mechanisms in production (see Metzner,1977,for a Timorese example).Dey (1984) has documented some of these for West Africa. There,the general trend appears to be that ,in forest areas,men are responsible for clearing and fencing,whilst women select and store seeds and carry out all remaining cultivation,including that of interplanted crops.Among the Gourou,for example,rice is stored in the husband's granary;he

dispenses rations of rice to his wife. If there is a surplus,women will sell the rice but they are expected to surrender the money to their husband (who might return to their wife a percentage).In some cases,women might also clear a separate field for themselves to grow rice which they primarily keep for themselves but which they might also give in part to their husbnd in return for other services. Similar ambiguity (regarding,for example,the determination of any single "decision-maker") is evident also with respect to disposal of the output among the Bete,among whom both men and women sell rice but at different moments throughout the season and for different purposes.

Exploring the suggested four sets of relations over two dimensions for the case briefly outlined above might raise the following kinds of question:

- do female producers have equivalent access to production resources as males ? If not,how does this condition their management and crop performance ? Does access to resources vary,for either men or women,over time? (e.g.is access conditional on the age of marriage ?).
- are there any cycles in resource utilisation (e.g. tied to household life cycles or to the season)?
- what rules govern distribution of resources and product among household members and between households ? Are they stable or do they depend on,for example (autonomous or state-induced) changes in the rules governing land tenure and membership of marketing organisations ?
- which arrangements governing intrahousehold and interhousehold exchange of goods and services are inflexible and which are already being modified by secular changes in roles and expectations ?

These kinds of question may be asked by agronomists themselves.While more specialised (social) scientists might be needed to test which investigative diagnostic tools "work" in any particular context,a simple tool such as the diagnostic matrix may help to refine diagnosis of upland rice production at the household level at an early stage (Fig.1).

Figure 1: AN EXAMPLE OF A DIAGNOSTIC MATRIX FOR THE DEFINITION OF UPLAND RICE RDs

| Upland Rice Growing environments: | Socioeconomic Criteria | | | (etc). |
|---|---|---|---|---|
| | SDL* etc. | Access to inputs | Acces to services | Distribution of output |
| LF | | | | |
| SF | | | | |
| LU | | | | |
| SU | | | | |

*SDL: sexual division of labour (decison-making,income and expenditure...)

With the help of such a matrix,applied locally at different sites,both the boundaries of recommendation domains and preliminary diagnostic patterns are made apparent.

b. Breeding Criteria Recent advances in bio-technology and in in-vitro techniques can be expected to change the role of plant breeding in the overall process of agricultural technology development (Sneep and Hendriksen,1979).There will be more scope to diversify the breeding process and to bring it physically closer to local circumstances and,thereby,to facilitate the inclusio of users' own criteria alongside 'objective' agronomic criteria in the development of new cultivars.Yet methods have hardly been developed for translating users' criteria with respect to the crops they grow and consume into agronomic criteria and this is one area where social scientists might usefullyto collaborate i.e.in the development and testing of procedures.(Ashby,1984,illustrates one set of usable techniques).

In any recommendation domain,it is possible to find a mixture of rice crops grown for different end uses and under different management regimes.By far the major effort in breeding programmes has been devoted to only a few of these uses and to genotypes which are both highly responsive to their environment and which have high input requirements.Translated into social terms,the major efffort has concentrated on marketed production of male-controlled crops.Yet by applying the kind of diagnostic approach advocated here,very differnt kinds of breeding criteria might be expected to emerge (Fig.2).

Figure 2: AN EXAMPLE OF A BREEDING CRITERIA MATRIX: crop production criteria

| Type of Rice Crop | Upland Rice Growing Environment | | | |
|---|---|---|---|---|
| | LF | SF | LU | SU |
| Mainly Subsistence | yield stability | drought avoidance | adverse soils tolerance | no added investment in labour or land |
| Female crop * | ratoonability | (as above) | fitness for mixed cropping | (as above) |
| Male crop* | soil management | (as above) and recovery | short duration | (as above) |
| Cash crop only | semi-dwarf HYV | short duratiuon | (as above) | (as above) |

*"female" and "male" refer to management and resource utilisation during crop production.

Because great differences in end utilisation occur between upland rice grown by women and men,it is usually essential to complement agronomic (crop production) breeding criteria ,such as those defined

above,with criteria pertaining to post-harvest utilisation of the crops,covering their total biomass (Fig. 3).

Figure 3: AN EXAMPLE OF A BREEDING CRITERIA MATRIX; post-harvest uitlisation criteria

| Desired characteristics for post-harvest uses | Rice Biomass Uitilisation Men | Women |
|---|---|---|
| Brewing potential (rice wine) | X | - |
| On-farm storage | - | X |
| Puffing | - | X |
| Thatching straw | X | - |
| Threshing quality | X | - |
| Mat weaving | - | X |
| "Fit" with cooking technology | - | X |

Even this simple example illustrates the importance of recognising that producers are i) not necessarily primarily concerned with changing the input-output relations of grain production;and ii) that they might be satisfied with genotypes which exhibit more yield stability and less environmental responsiveness than modern cultivars typically offer,since they are selecting for other characteristics than yield maximisation.

c. Testing and Evaluaton Given the need for quick,numerous trials based in agricultural realities and strong user participation,the incorporation of the following principles is necessary:

i.representativeness: in their own experimental traditions,producers often are interested more in "representative" because purposive rather than random samples,concentrating their experiments on (a small number of) individual plants rather than on a whole field.They are usually acutely aware of individual plant performance and compare experimental growth with the norm in the same situation,treating contextual factors as exogeneous parameters.The underlying presumption is their interest in security within the limits of stabilty known to them through their own experience of their environment,rather than in statistical probabilities.

ii.replication: replication trials,used by researchers to sort out the influence of exogenous variables and to check regularities against a statistically respectable sample (and,often,implicitly as demonstrations),may have little meaning for users who in their own types of single split plot trials,designed to test factors important to themselves,are using different criteria for "success" than scientists typically use.

iii.low input environments: research station selection has produced survivors accustomed to high input environemnts.Since there are practical limits to simulating low input environments on research station

sites,experimental sites which offer low input environments rather than approximating research station conditions must be used for both selection and testing.

iv.recognising trade-offs: since there are differences in objectives,end uses and crop management between households and between household members in any RD,testing and evaluation explicitly has to recognise these differences.What is likely to emerge is not a single index of "success" or "profitability" but the identification of a range of niches and situations recurring over time in which the technologies usefully could be adopted.

v.Testing and Evaluating Institutional behaviours: The IARCs and national systems have been slow to recognise that access and availibility,distribution and exchange,are all seriously compromised by institutional design and that service structures which are necessary to the profitability of a new cultivar are as much in need of testing and experimentation as the cultivars themselves. There are precedents to draw on.The "Guided Change" project in northern Nigeria (Huizinga,1982) and French FSR in,for example,Senegal under the Unites Experimentales deliberately set out to test organisational and institutional design and the limits to the adaptations of human and institutional behaviours (Fresco,1984).

d. Intermediate Organisations: Just as there are factors and causative relations which are not perceivable by producers,so there are those which are not readily perceivable by agricultural researchers.Discerning the complementarities and bridging the gaps between producers and researchers seem activities in which intermediate organisations could usefully and cost-effectively participate. A prerequisite to their involvement is the breakdown of the institutional isolation with which many research stations have surrounded themselves.Intermediaries could be useful particularly in the conduct of integrated producer-consumer trials and evaluation.Usually these have been carried out via analysis of prices,sales and purchases.As a result,the important roles of intrahousehold and primary marketing networks and the influence of post-harvest technologies on biological technologies and crop husbandry have been ignored.

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