ADAPTIVE RESEARCH AND PRE-EXTENSION TESTING: THE CASE OF UPLAND RICE IN WEST AFRICA

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ADAPTIVE RESEARCH AND PRE-EXTENSION TESTING: THE CASE OF UPLAND RICE IN WEST AFRICA 1/

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I. INTRODUCTION

When WARDA was established in 1971, it was assumed that IRRI's high yielding rice varieties could be imported and screened through the Coordinated Variety Trials (CVTs) carried out in member states. It was also assumed that IRAT's programme on upland rice at Bouake, Ivory Coast would produce improved varieties for WARDA and national programmes. (3) Because of its disappointing experience with the direct importation of new rice varieties from IRRI and heavy reliance on IRAT/IDESSA's programme at Bouake, WARDA launched in 1981 the Technology Assessment and Transfer (TAT) programme at all the special research project sites in Sierra Leone, Mali, Senegal and Ivory Coast[1/]. It was for the first time recognized that improved rice development programmes cannot be successful if they do not take into consideration the existing cultural and socio-economic situation under which the farmers operate. Also as part of the technology development process, it was found necessary that potential techniques be tried out on farmer's fields to see if they can be economically adopted by farmers. (7) By this process, technology appropriate to farmers conditions and packages for "easy" transfer could be developed.

II. OBJECTIVES OF THE TAT PROGRAMME

An important factor in the improvement of rice production in West Africa is to develop improved technology and to get it effectively

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1/ Because of staffing and funding problems, all the TAT programmes did not start at the same time in all the sites; e.g. the TAT programme at Bouake didn't start until June, 1983.

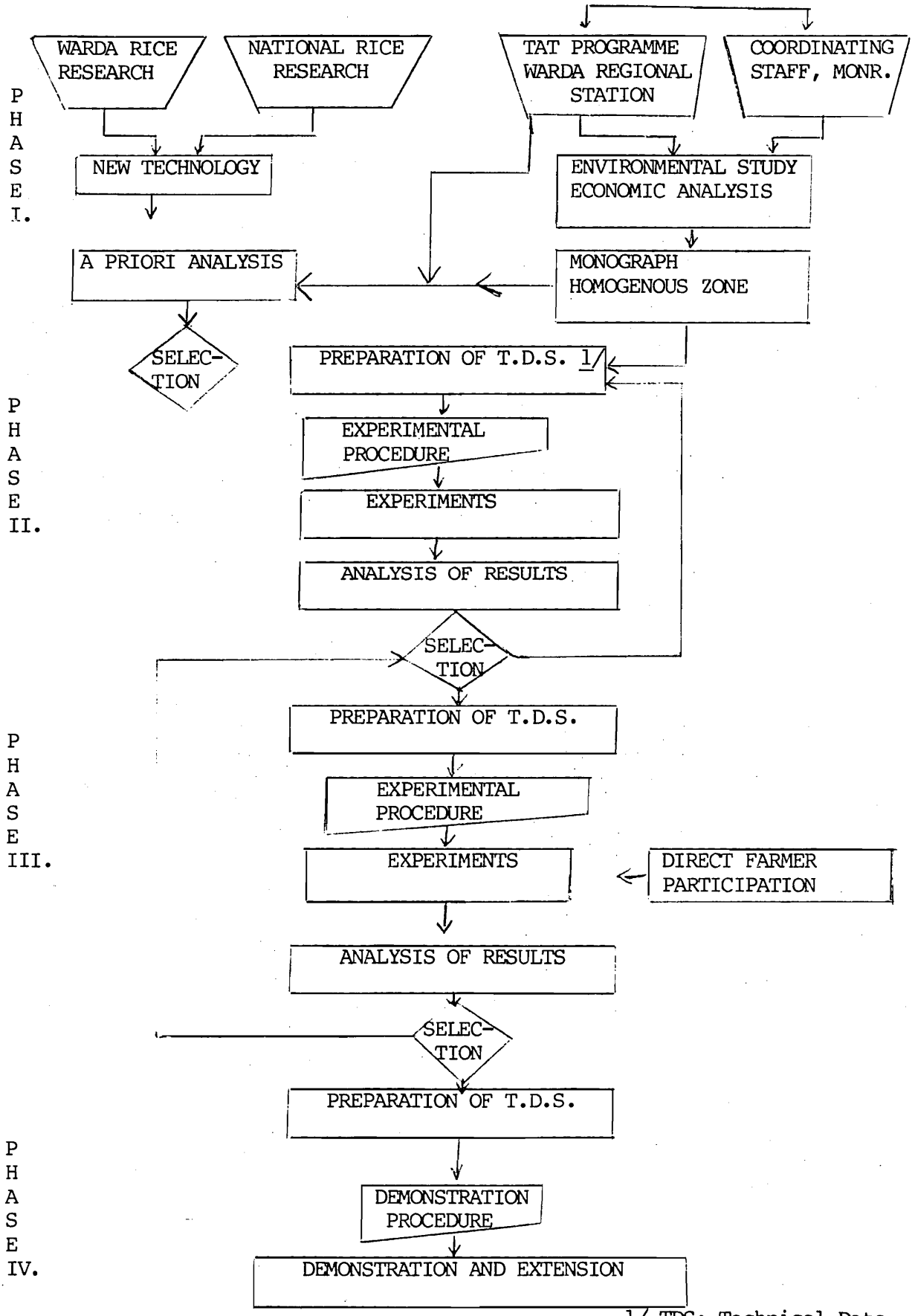
used by the rice farmers. Research scientists are becoming more conscious of the fact that the impact of a new technology is measured not by its excellence in experimental plots but by the extent to which it is adopted by farmers on their farms.

Empirical evidence exists that when agricultural research is undertaken on crops without high levels of environmental control, substantial yield variations can be expected between the experiment station and the farmers fields. Further, there also exists a gap between the availability of improved technology from research stations and its actual application on the farms. Many of the research recommendations are not adopted by farmers and those that are adopted often fail to yield as high as they had done on the research station (3).

Possible reasons for these gaps in the yield between the experimental station and the farms, and between the availability of the technology and its adoption, are vast and many. Although there is no agreement about the nature and relative importance of such causes, there is general consensus that some technologies being evolved by the agricultural scientists do not coincide with the farmers' objectives and may not fit into their his social, economic, and production constraints especially in view of his attitudes, risk potential, and limited availability of most production inputs like capital, labor etc (4).

Hence, there is growing concern regarding the need to extend the research process, to include assessment of the technology under farmers' socio-economic and production constraints. Feedback from farmers enables a direct farm-level input into technology design as well as testing the new technology under the variability of the farm conditions in the target area. This also helps improve understanding of the technology generating process. Such procedures are therefore very important in developing production packages to be put at the disposal of extension education agencies.

Fig. 1: FUNCTIONAL ANALYSIS OF TAT PROJECT



1/ TDS: Technical Data

Technology assessment is especially important in African countries where communication links between farm and research are weak, and farmers often do not have the information and management experience and risk orientation to conduct and modify various technology components to suit their own environment, production systems and socio-economic constraints and personal preferences. Since the extension education system in most African states is generally weak and inadequate, and lacks facilities for experimentation and research to evolve an extension strategy for communicating improved technology into the minds and actions of thousands of farmers spread throughout the countryside, it is necessary that the technology assessment phase should also include designing and testing an extension approach that could be successfully used by the national extension services, for the transfer of improved technology to farmers.

Thus the concept of technology assessment and transfer has twin objectives, of evaluating the improved technology for its suitability to farmers' socio-economic and production needs, and of devising and testing an extension education strategy for use by the extension organization of a country for its transfer to farmers (2). More especially, the objectives of the TAT programme can be summarize as follows:

(a) To systematically assemble information on the West African upland rice farmer.

(b) In collaboration with other scientists of the WARDA Station at Bouake, to design and test appropriate technological packages under farmers conditions for each rice production system and estimate the potential economic profitability of such technological packages.

(c) Monitor and evaluate the adoption of WARDA improved technology in development projects.

(d) To identify and examine major extension problems of the rice industries of member countries and work with national extension services in

the solution of such problems.

(e) To encourage the establishment and efficient functioning of national seed multiplication projects for production of certified upland rice seeds and to supply such projects with good quality foundation seeds.

III. METHODOLOGY

Based upon the above needs, the West Africa Rice Development Association (WARDA) has developed a TAT model as illustrated in Figure 1, which contains four phases.

Phase 1 concerns the conduct of a survey and analysis of basic background information in existing farming systems, especially on the social, economic and production constraints faced by rice farmers, as well as a prior evaluation of new technology.

In phases 2 and 3 the technological packages are identified for each rice ecology in the region, from amongst the research being done at the regional research station and various national programmes operating in the region, and tested under farm conditions against a set of evaluation criteria specifically developed for the purpose.

A three-point criteria for performance evaluation of the technology package was developed, consisting of yield comparison, economic benefits, and socio-personal consideration including labor use compatibility and general acceptance by the farmers. Furthermore, the package must prove that it has good prospects to qualify for governmental assistance as needed when taken up by national extension services, and that there are good propects that necessary inputs in sufficient quantities will be available to farmers at the time they are needed.

Phase 4 involves designing and testing extension education strategy and farm demonstration in conjunction with the national extension services in the member countries, to communicate the tested technology to farmers.

From here, the member countries take over the task of actual extension work, as this is their responsibility.

Because most upland rice environments common in West Africa are found in the Ivory Coast, this country was used extensively (but not exclusively) during the first two phases of the TAT programme. With regard to the constraint identification phase, a three-pronged approach was used:

(a) collection of background information on farmers' environment using secondary sources such as research institutes and government reports.

(b) exploratory field surveys involving personal interviewing with farmers and input suppliers and meeting with local and regional institutions as well as observations in farmers' fields and their surroundings to obtain information on the rice production processes.

(c) detailed socio-economic surveys involving multiple visits with the farmers throughout the cropping season to complete the survey questionnaire. The frequency with which the farmers were formally interviewed depended on the type of information sought.

With respect to the test of innovations (i.e., design and analysis of on-farm trials) a series of steps was involved with the objective of submitting the technology being tested to all the good and the bad that farmers are going to give it, when, and if, they adopt it. The steps involved were designed to protect the collaborating farmers from risk when they participate in the evaluation of new technology. Initially, researchers managed the trials (verification trials) and in final stages, farmers will be the primary managers of the trials (adaptive trials). The nature and design of on-farm trials will change as we move from verification to adaptive trials (6). Critical variables to be considered will include: number of treatments, plot size, number of replications, number of sites, type of management, control of variation, measurement of sources of variation, biologic precision and discrimination among

variables, ability to test socio-economic interaction, number of farmers, farmer investment, extension inter-action with research, etc.

Table 1 illustrates the differences between verification trials (VT) and adaptive trials (AT) with respect to the above named variables.

Table 1 : Difference between Verification Trials and Adaptive Trials

Variables	VT	AT
1. number of treatments	high	low
2. number of replications	high	low
3. number of sites	low	high
4. number of farmers	low	high
5. plot size	low	high
6. farmer investment	low	high
7. extension interaction with research	low	high
8. control of variation	high	low
9. measurement of source of variation	low	high
10. researcher management	high	low
11. farmers management	low	high
12. biologic precision and discrimination among variables	high	low
13. ability to test socio-economic interaction	low	high

The design of the AT is simple so that the farmer can do essentially all the management. And the year following the AT, the TAT team can return to find out whether farmers collaborating the previous year have utilized the new technology on their own initiative. Based on this simple survey, an "acceptability index" can be calculated. For the analysis of data from VT and AT, techniques to be used will include modified stability analysis, budgeting and partial budgeting; in some instances, linear programming tools will be used.

IV. MAJOR CONSTRAINTS TO INCREASED UPLAND RICE PRODUCTION IN WEST AFRICA

1. Factors or problems related to land cultivated

A) Soil erosion is a problem throughout the sub-region. Soil erosion forces farmers to abandon their fields after cultivating them for a few seasons.

B) Lack of sufficient water to grow rice due to the drought has been recurring in some parts of the sub-region. Some farmers, particularly in the Sahel areas have therefore abandoned rice cultivation in favour of such crops as sorghum and millet which can better withstand inadequate water.

C) Lack of inputs in some countries: in Ghana and Senegal, for example, some farmers have abandoned rice cultivation primarily due to unavailability of farm inputs, particularly implements and fertilizers.

2. Problems Related to Paddy Yield

All the problems affecting riceland cultivating above also affect paddy yield. In addition there are several other factors responsible for the low paddy yield in the sub-region.

A) Technical Problems

(i) Lack of improved cultural practices, for example,

inadequate weed control and poor land preparation (4).

(ii) Inadequate use of "modern" and improved inputs due to non-availability of such inputs, notably good quality seeds, fertilizers, chemicals for seed treatment, etc.

(iii) Widespread crop damages caused by pest and diseases resulting from inadequate crop protection.

B) Institutional, Infrastructural and Economic Problems

(i) Poor extension services.

(ii) Inadequate mechanization facilities to support land preparation.

(iii) Inadequate credit facilities for the predominant small scale farmers to purchase modern and improved inputs.

V. UPLAND RICE TECHNOLOGICAL PACKAGES UNDER TEST BY WARDA

WARDA has just established a regional upland rice research station at Bouake, Ivory Coast, to do research on upland rice for the West African region (March, 1983). However, the Association has been participating with IDESSA, whose Food Crop Department has been responsible for the rice improvement programme. As a result of this collaborative work, seven varieties of upland rice have been recommended: namely IRAT 144, IRAT 104, IRAT 112, IRAT 170, IRAT 136 and IRAT 13. Some of these varieties are now being multiplied by Development Corporations in the Ivory Coast for use by farmers who are still using Moroberekan, Iguape Cateto and Dourado. Elsewhere in the region, varieties recommended as a result of WARDA's research conducted in the region include: 63-83, DJ8-341, LAC 23 (white), IRAT 8, IRAT 9, IRAT 10 and OS6. But for most of these varieties, there is very little empirical evidence available as to the gap between existing practices on West African rice farms and available technologies. With the establishment of an upland rice research programme at Bouake, the TAT

programme is designed to provide information on the actual gap under farmer conditions, for the different ecologies and the different intensification levels (1,2). Research on all significant aspects including varietal improvement, agronomy, pests and diseases, weed control, etc. is being undertaken under farmer conditions (5). The following packages have been identified in 1983 for testing through verification trials (VT) in 1984.

A) Low level input technology

(i) Land preparation: hand tools.

(ii) Varieties: IRAT 112, IRAT 104 and IAC 164.

(iii) Fertilizer: only urea (75 Kg/ha in two applications).

(iv) Other practices: all other practices may be followed as per farmers' practice in the area.

B) High level input technology

(i) Land preparation: animal traction or use of tractors.

(ii) Varieties: IRAT 109, IRAT 170, IAC 164.

(iii) Weeding: use of herbicide (4l of Ronstar per ha).

(iv) Fertilizer: NPK (10-18-18) (150 Kg/ha) and Urea (75 Kg/ha).

Note: In both levels of technology, 4 seed rate levels were used (60 Kg/ha, 80 Kg/ha, 100 Kg/ha and 120 Kg/ha).

(v) Other practices: all other practices may be followed as per farmers' practices in the area.

The trials were distributed as follows accross various ecological zones (see Table 2).

However, there are still a large number of problems and constraints that are not being tackled through on-going research (5). For example long term soil and crop management practices, long term yield maintenance studies, rice interaction with other crops, etc. Furthermore, during the 1985 cropping season, keeping in mind the fact that farmers

Table 2: Distribution of Trials in Ivory Coast in 1984

Sites	Latitude and vegetation	Rainfall pattern	# of trials	Input level
GUIGLO	6° 50' forest	1600 to 1800 mm bimodal	6	low
MAN	7° 20' forest	1600 to 1800 mm monomodal	6	low
TOUBA	8° savannah	1300 to 1500 mm monomodal	18 → 10 18 → 3	low high
ODIENNE	10° 20' 9° 40'	1200 to 1400 mm monomodal	12 → 4 12 → 8	low high
BOUNDIALI	9° 50'	1200 to 1400 mm monomodal	12 → 5 12 → 7	low high

often adopted new improved technology in bits and pieces, the technological packages to be tested will be broken into four sub-packages, namely: (i) improved variety only, (ii) improved variety + fertilizer; (iii) improved variety + fertilizer + herbicide; and (iv) improved variety + fertilizer + herbicide + mechanical land preparation (1).

VI. CONCLUSION AND FURTHER ISSUES

To meet the increased demand for rice in West Africa, WARDA is engaged in doing research on four major rice ecologies in the region, mainly mangrove swamp rice, deep water and flooded rice, upland rice and irrigated rice with a major emphasis now on the upland rice research programme. For each rice ecology, a multidisciplinary team is based, respectively, in Bouake for upland rice, in Saint-Louis for irrigated rice, in Rokupr for mangrove swamp rice and in Mopti, for floating rice.

Very promising results have been achieved in the mangrove swamp rice. Specific packages of improved technology have been identified and are being tested for their compatibility and acceptability by farmers with respect to their economic, social, cultural and production constraints. Similarly, results from the other ecologies, namely Irrigated Rice and Upland Rice have also started coming in through collaborative work with IRRI and IDESSA. Within a few years it is expected that WARDA's research in rice will show significant effect on rice-based production systems in the region. Even at present, where population is growing almost four times faster than food production in the region, rice is the only crop whose increase in production is still more than the population growth. The opportunity to increase upland rice production through the introduction of proper technology for upland rice farmers is great. But suitable and appropriate cropping technology should continously be developed through research and trials in farmers' fields. Strong government support will be needed to implement production programs involving upland rice in many areas.

Among issues raised by application of this farming systems research/per-spective to technology generation in upland rice-based cropping systems are:

- distinction between the conceptual approach in FSR work and actual operational approaches
- institutional linkages (formal and informal) among international agricultural research centers (e.g. IITA), regional research and development organizations (e.g. WARDA) and national research centers (IDESSA); and
- contribution of this approach to breeding work in upland rice (e.g. reassessment of the germplasm bank collected earlier but not evaluated and used to create desirable varieties for farmers).

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ACRONYMS

IDESSA:	Institut des Savanes (Savannah Research Institute)
IRAT :	Institut de la Recherche en Agronomie Tropicale (Tropical Agronomy Research Institute)
IRRI :	International Rice Research Institute
TAT :	Technology Assessment and Transfer
WARDA :	West Africa Rice Development Association