existing traditional methods of processing and preservation were surveyed. The goal was to formulate future research priorities in the postharvest technology of root and tuber crops in Cameroon.
This survey indicates that postharvest technology research should focus on the following aspects. Simple storage techniques and structures must be developed. The production of root and tuber crops is indirectly constrained by the lack of effective storage techniques and structures. Most farmers are easily discouraged when, after a bumper harvest, most of the crop is lost during storage. With the growth of cities and the higher demand for food in the rural areas, any effective techniques and structures for the storage of root and tuber crops will promote increased production.
Improved handling and processing techniques must be developed with emphasis on nutrition, hygiene, and quality standards. There is a wide range of traditional skill for handling and processing root and tuber crops; however, these techniques need improvement. As people become aware of nutrition, hygiene, and quality standards, traditionally processed foods tend to be less desirable than imported foods. The emphasis, therefore, should be on developing existing local technologies.
Root crops could serve as raw materials for the development of industrial products. Cassava, for example, is a source of good-quality starch for the pharmaceutical, textile, and food industries, and the aroids contain chemicals that are important in medicine.
New, competitive, fast-food products should be developed. Most traditional products require a lot of time to prepare. Therefore, the general tendency is to buy imported foods that are easier to prepare. Root and tuber crops, show good base for the development of fast-food products.
Animal feeds must be developed. Root and tuber crops, particularly their shoots, offer useful material for animal feeds. Traditionally, the shoots of these plants have been used minimally, although they are rich in good-quality proteins and vitamins.
Basic data on root and tuber crops are required. Some information exists on the approximate composition of root crops. More information is needed, however, on the variability of these data with crop variety, environment, age, and storage and processing. Nutritional studies are also needed.

II FARMING SYSTEMS RESEARCH AND DEVELOPMENT

271 89 - 2/31

Farming systems research and development
Africa, Kenya, farming systems, strategies, subsistence, marginal area, beekeeping, livestock, crops
ABELLA, J.C. et al.
The farming system in Tharaka: Strategies for subsistence in a marginal area of Kenya.

ICRA, Bulletin 15, 1984, 55 p.

The study aims to identify and evaluate development options and research recommendations which are likely to meet the objectives of both the farmers and the Government in the Tharaka region.
The study area comprises 80% of the total 370,000 acres 150,000 ha of Tharaka Division, making up the arid and semi-arid parts of the Division.
The physical and natural resources of Tharaka present an unsuitable environment for arable farming, but the density of population makes mixed farming inevitable.
Population growth in Tharaka is around 3,3% per year (1969-1984). If this growth rate continues, it will result in a decrease of landholdings from 20 acres at the moment to 10 acres per household by the year 2005, far too small to support a household if the land is predominantly cultivated under a bush fallow system with fallow lenghts of mainly 2-5 years.
Labour is almost entirely provided by family members. Cash is required in certain periods to buy food and make up for a poor harvest. It is also needed for school fees, especially for secondary education. Small amounts of cash are also required for domestic needs. The economy in Tharaka is still largely run without cash. Sales match purchases in a way that is only a short step from a barter economy. Goats almost function as commodity money.
Cropping is undertaken in a situation of severe erosion and decreasing fertility of soils because the measures undertaken to prevent erosion are very poor. 83% of the cultivated area is devoted to food crops, mainly millet, sorghum, green gram and cowpeas. The remaining 17% is devoted to the cash crops, cotton and sunflower. Some farmers occasionally use ox ploughs but handtools are mainly used in cropping.
Livestock (sheep, goats and cattle) are owned by 85% of the farmers surveyed for a variety of socio-economic reasons. They are regarded as a source of wealth and prestige.
Beekeeping is the most promising way of earning money other than from sale of crops and/or livestock. More sales of honey or wax could provide a significant increase in income for a wide range of farmers. There is very little prospect of charcoal-burning, basket-making or other income-earning activities being able to make a significant impact in Tharaka.

For arable agriculture the emphasis is on reducing risk. Proposals are directed to soil and water conservation measures in order to maximize the use of rainfall and minimize soil and water losses; to the introduction of more reliable cropping patterns; to more efficient use of labour; and to food insurance through specific measures to improve the marketing systems. Research recommendations concentrate on improving the reliability of crop yields.
The recommendations for livestock are directed less to research than to institutional and organizational developments. The most appropriate solution to the problem of over-grazing is seen as the establishment of small group ranches. The encouragement of cooperatives is proposed to act as a channel for improved health services and husbandry advice and to provide a more reliable external outlet for livestock sales. The only recommendation for additional research relating to livestock is to evaluate the browse and grazing in the area.
While marginal improvements can be made at the moment the basic problems of populations growth and the limiting agro-ecological circumstances remain.

272 89 - 2/32

Farming systems research and development
Africa, Nigeria, farming systems, yam, smallholder
DIEHL, L.
Smallholder farming systems with yam in the Southern Guinea Savannah of Nigeria.

Schriftenreihe, GTZ, 1982, 226 pp., ISBN 3-88085-135-2, 36,- DM

Yam is traditionally the most important food-crop in much of Africa. Yet, detailed knowledge about the large variation of production systems and their respective economics has been scarce. The present study examines smallholder farming systems with yam in Nigeria.
The study's hypothesis assumes that yam production is bound to decline due to unfavourable input/output relations and in particular low return to labour when compared with other crops.
This hypothesis is investigated on the basis of an intensive socio-economic survey including 68 yam producing farms in three locations of Nigeria's Middle Belt. During a period of 14 months all agricultural activities on the farm were enumerated in 2-3 interviews per week. Agricultural inputs and outputs were recorded, samples of local units being weighted and cultivated farm land being measured.
By means of statistical analysis on the farm as well as on the enterprise level similarities and differences among groups of farms in respect to resource endowment, factor allocation and income were investigated. The studied farms being subdivided into according to ethnological differences and varying distances between their farming locations and the village. Factor productivity on the enterprise level was analysed by budgeting,

enterprises being grouped into crop mixtures with and without yam and hydromorphic or well drained soil types.
The husbandry practices and cropping principles of the studied farms are described and explained in detail, emphasis being laid on the agronomy of yam. The interactions between yam and other crops have been analysed with particular respect to labour requirements over time.
Defining yam production enterprises it is important to differentiate between upland- and lowland-yam systems. The comparison of crop mixtures including yam with non-yam mixtures reveals the following characteristics of yam production:
- labour input to yam production is fairly stable and on an average amounts to 1300 man-hours per hectare in upland-yam systems and 2100 man-hours per hectare in lowland-yam systems,
- labour input to non-yam mixtures is extremely variable and on an average ranges from 660 to 1300 man-hours per hectare,
- yam production requires high capital inputs in the form of planting material due to extremely unfavourable physical input/output relations which range from ½ to ¼ in the survey area.

In spite of these unfavourable characteristics the analysis of factor productivity reveals that yam is by far the most profitable crop grown in the survey area as:
- the gross margins per hectare achieved in yam production are 4-6 times higher than those of non-yam mixtures,
- the gross margins per hectare of lowland-yam enterprises are 2060% higher than those of upland-yam enterprises,
- the returns per man-hour of labour input are between 2-6 times higher in yam production than in non-yam-mixtures. They are lower in lowland-yam systems than in upland-yam systems.

In spite of high requirements, labour was not a constraint to yam production due to the complementary distribution of labour requirements over time among yam and non-yam systems.
Yam production is, however, seriously constrained by:
- a physical shortage of planting material, and
- an increasing scarcity of suitable land.

The availability of yam sets is not only limited by the low rate of reproduction but also by the households' subsistence demands as yam makes significant and vital contributions to the food supplies and cash incomes of the farm households.
Symptoms of an acute shortage of fertile farm land were observed in four of the five distinguished strata in spite of the generally low population density in the survey area. The constraints on the availability of farm land are imposed by:
- the topographical limitations to arable land, and
- the clustering of farming in road-side locations due to social and economic advantages.

The observed scarcity of land has led to an intensification of farming. This process may well reflect the generally expected development of farming systems in the tropics, being characterised by:
- higher plant densities,
- increased diversity of land use,

- higher labour inputs, and
- higher inputs of cash for hired labour as well as fertilizer.

In this development of the farming systems yam production will gain rather than lose importance as it is tailored to the envisaged development of smallholder farming towards labour and capital intensive farming with high returns to land and labour.
The economic superiority of yam production is based on the present farmprice-relations. This situation is fairly stable unless major changes in these price relations occur. Such changes would imply marked alterations in the composition of production costs or the structure of demand for agricultural commodities. Both, however, are not to be expected in the near future.
The possible development of yam production technology and the implications of agricultural research show that yam may well maintain its position in the farming systems of the future. The yield potential of this crop as well as the possibilities of breeding and agronomic improvements are far from being exploited. Therefore more research is needed in respect to yam production. Any significant improvement of the input/output relation in particular is likely to have a drastic and lasting impact on the income of a large number of smallholder farms in much of West Africa.
Author's summary, amended

273 89 2/33

Farming systems research and development
Africa, Ghana, dry savannah, farming systems, compound farms, bush farm, livestock, crops, soil fertility, socio-economic analysis
PANIN, A.
Hoe and bullock farming systems in Northern Ghana.

Nyankpala Agric. Res. Report 1, 1988, 182 p. + Ann. ISBN 3-8236-1128-3, GTZ-Project Nyankpala, Ghana; Distributor: Triops, Raiffeisenstr. 24, D-6070 Langen, FR Germany

The use of bullock traction technology for crop cultivation in some areas in Northern Ghana has a long history which dates back to the early 1930's. Yet its overall impact on the farming systems in the area is not known. This study was therefore undertaken to assess the impact of the technology on the farming systems of the rural communities.
Following the main objective of this study, the analysis is based on the following hypotheses:
- Bullock farmers are more endowed with land, capital, and labour capacity than hoe farmers.
- The bullock traction technology is superior to handhoe technique in turning out increased food and cash crops per unit of land in the dryland farming systems. This is attributable to the increases in the productivity of labour and land that characterise the bullock traction technology.
- Bullock farmers realise higher net income and greater security of subsistence than their hoe counterparts.

- The rise in the factor productivity of bullock farmers is positively related to the experience in the use of the technology. These hypotheses are investigated on the basis of an intensive socio economic survey of 42 households selected from three villages in one part of Northern Ghana. During a period of one year from April 1982 to March 1983, data on various aspects of farm households activities were collected.

The selected households studied were stratified into two main groups:
- farmers who use the hoe as a major tool for cultivation and
- those using bullock traction as a method of cultivation.

The major findings of the analysis of the two farming systems (hoe and bullock) are summarily presented as follows:
Resource endowments: Bullock farmers are better equipped with land, labour capacity, and livestock than hoe farmers. But whether or not the higher resource endowment is partly the product of using bullock traction technology could not be established. The heads of bullock households were far older than their counterparts in the hoe households.
Land use:
- Effects on cultivated area: There was an increase of 4 percent in total area cultivated per active worker for bullock farmers compared to hoe farmers. But among the bullock households, the area cultivated per active worker was inversely related with years of bullock traction experience.
- Effects on cropping emphasis: The effects of bullock traction on the cropping systems were very small. The area allocated to the major food crops by hoe and bullock households accounted for 80 and 74 percent of their respective total cultivated areas. The overall shift to cash crop cultivation was therefore very slight, with bullock farmers growing slightly more cash crops than hoe farmers. However, there were remarkable changes in the cropping systems of the various bullock subsamples. These changes took the form of systematic shifts from the production of major food crops to cash crops as the years of traction experience increased.
- Effects on mixed cropping systems: Bullock traction technology led to increases in the number of different types of crops in the mixed cropping systems. Among the bullock subsamples however, these increases were negatively related to the years of bullock traction experience.
- Effects on crop yields: There were substantially higher yields per hectare from all the major cropping patterns for bullock farmers except one. Yield increases ranging from 16 to 35 percent were found among the bullock farmers. Total output of all crops per hectare was also considerably higher for bullock than hoe farming. According to the results of the production function analysis, bullock traction technology has a positive effect on total crop yield.

Effects on labour use:
- Labour use per hectare: The average labour input per hectare for all major farming operations together increased with the introduction of bullock traction technology. The increase in labour input per hectare was also positively related to the

years of bullock traction experience. As regards labour requirements per hectare for individual farming operations, the use of bullock traction technology increased those of clearing, weeding and harvesting, while those of ridging and planting were reduced. Moreover, in terms of labour use for the respective cropping patterns, bullock traction had different effects. Whereas it raised the labour intensity for some crop mixtures (e.g. groundnut-grains), it reduced it for others (e.g. cornmillet-beans).

- Seasonal variations in labour inputs: Survey data indicate that farming in the area is highly seasonal for both hoe and bullock households. The seasonal constraints are extreme, as agriculture is virtuallly impossible during the slack season in the year. Data indicated that the current use of the traction technology did not make any impact on the distribution of labour over the year.
- Labour input by household members: Survey data indicate a reduction in annual field labour use for small children of 6-9 years (both male and female), adult women, on heads of households in bullock households. But at the same time, annual labour input for field work contributed by boys, male adults, and both elderly women and men increased with the adoption of bullock traction technology. Further, there was an increase in labour input per man equivalent of household labour for bullock households.

Effects on income and production costs

- Net farm income: Based on either income per man equivalent of household labour or per active worker, the income effect of bullock traction technology was great. A substantial increase in net farm income of 32 and 40 percent per man equivalent of household labour and per active worker respectively was found for bullock farmers. The respective increase is attributable to increased crop production, on which the use of bullock traction has a positive significant impact.
- Annual cash income: The study indicates substantially higher disposable annual cash income among bullock households than hoe households. An increase of 151 percent in net annual cash income per household member was found for bullock households. The use of bullock traction contributed substantially to this increase through increased crop production and revenue from contract ridging.
- Farm investment analysis: The general performance of bullock traction technology (ridging) at the individual farm level as shown by the ten-year income projections is substantial. Over the ten-year investment period, bullock ridging produces an internal rate of return (IRR) of 65,5% which is quite appreciable. Further, it provides substantial increases of 17,5% and 16,8% of the net present worth (NPW) of the incremental net benefits respectively, before and after financing over the NPW of income from hoe farming.

Finally, the analysis shows that the performance potential of bullock ridging sets in quickly, and hence, the investment does not pose any severe problem on the cash flow positions of the adoptive farmer.

The findings of this analysis confirm the validity of the study hypotheses. For the analysis has shown that there were substantial increases in total crop production under the bullock farming systems. This was possible through the increase in factor productivity. Further, the net incomes of bullock farmers were high relative to those of hoe farmers, thus enabling the former to achieve greater security. Finally, the analysis revealed that bullock farmers were better endowed with resources than their hoe counterparts.

In conclusion, bullock traction technology offers a clear solution to the problem of low productivity which characterizes agriculture in the study area.

Although its use was limited to ridging only, the bullock household were able to realise higher crop production, higher income and a generally higher living standard compared to hoe households.

Therefore, if the use of the technology is expanded to cover all the major farming operations, the benefits to bullock households will increase even further. These benefits will then spread among the farming population, if the number of farmers using the technology increases.

Author's summary

274 89 - 2/34

Farming systems research and development
Africa, Botswana, study, farming systems research, crop production
JONES, R.B.
Crop production systems in Ngamiland West, Botswana.

Farming Systems Newsletter, CIMMYT, 1987, 17-31

The Republic of Botswana is a landlocked country in the centre of the Southern African Plateau.

An important aspect of the country is the harsh climatic environment, often described as semi-arid.

Precipitation occurs almost entirely in the summer months from November through to April and is unreliable, in that the annual total and seasonal distribution vary, and is of poor quality in that it usually falls in heavy showers of short duration leading to runoff and erosion. As a consequence of this, arable agriculture is a risky undertaking, the country being better suited for extensive grazing by ruminant livestock.

Although this paper focuses on crop production systems it is important to realize that livestock systems cannot be ignored because the two types of production are linked together. Livestock is essential for the provision of draft power and also play an important role in the cycling of nutrients.

It should be realized that production systems not only evolve in response to physical and environmental constraints but also in response to government policies.

Molapo Farming System:
Three major ecotypes have been distinguished in the Okavango Delta according to their lack or abundance of water.
A complex land tenure system has developed which takes into account the necessity to shift cultivation in response to the changing flood regime. With the drying up of the Thagoe River the areas available for molapo cultivation have become scarse with the result that the overall productivity from the area has declined. Molapo fields need several seasons of cultivation with the traditional ox-drawn mouldboard plough before weeds are controlled and smooth even seedbed is produced. Without this, germination is patchy reducing yields and making weed control almost impossible.
During the same period livestock numbers have increased drammatically due to campaigns carried out by the veterinary services, which provid free vaccinations against the major livestock diseases, and the control of tsetse fly. Conflicts between the two production systems have increased because both are competing for areas with more favourable conditions.
Dryland Farming System:
The Hambukushu grow millet, their staple food crop, together with sorghum, maize, mellons, groundnuts and a variety of beans on the soils which surround the Okavango Delta.
Farmers clear land burning the brusch but leaving stumps in the ground. Areas with dense vegetation are chosen with preference for clearing as they are considered to be more fertile. However after approximately 10 years the fields are abandoned and new lands cleared. At the beginning of the cropping season any remaining crop residues which have not been grazed by cattle in the field are collected an burnt. Land preparation and planting is done either by single furrow moulboard plough or by hand hoe. Plough teams are composed of only two oxen with donkeys being used very occasionally. Planting takes place by dropping seeds in every other furrow at carefully spaced intervals of 50-100 cm. Planting is done into both dry and moist soil although the latter is preferred. Often farmers will separate planting and ploughing preferring to plant into the ploughed seedbed when moisture conditions are optimal either using a hand hoe or the feet to knock over the ridge of the furrow thereby covering the seeds. If oxen are not being used land preparation is carried out by clearing an area of weeds using a hoe followed by planting at carefully spaced intervals.

275 89 2/35

Farming systems research and development
Africa, Liberia, tropical rainforest climate, survey, farming systems research, smallholders, labour, socio-economics, project, monitoring and evaluation
WESTPHAL, U. et al.
Baseline survey on smallholders in Nimba County to facilitate decision taking in project planning.

Schriftenreihe des FB Int. Agrarentwicklung (FIA) Nr. 109, SLE, 1987, 187 p.+ C1-C6, ISBN 3-924333-66-1, DM 19,-, Verlag J. Markgraf, Postf. 105, D-6992 Weikersheim, F.R.G.

The purpose of the study was to gain information about smallholders in Nimba County, placing emphasis on labour requirements and socio-economic data in order to facilitate further decision taking in project planning. It should also create a basis, in the form of indicators, for the monitoring and evaluation unit to measure the impact of project activities.
- The results of the baseline survey led to criteria in order to facilitate decision taking in project planning. The criteria cover the subjects of socio-economics, labour and ecology.

In order to demonstrate the use of criteria seven proposals for project activities have been developed. The proposals include programmes already practised but have been supplemented with components neglected so far. These proposals have been ranked according to more positive or negative aspects in regard to the criteria.
For the proposals which were rated feasible in comparison to the others M & E indicators have been developed.

276 89 2/36

Farming systems research and development
Africa, Ghana, study, dry savannah, farming systems, farm households, agronomic practices, cropping systems, yields, farm income, socioeconomic parameters
RUNGE-METZGER, A.
Variability in agronomic practices and allocative efficiency among farm households in Northern Ghana - a case study in on-farm research.

Nyankpala Agric. Res. Report, 2, 1988, p. 121, ISBN 3-8236-1134-8; CRI/GTZ Joint Project, Tamale, Ghana; Distributor: Verlag J. Markgraf, Postfach 105, D-6992 Weikersheim, F.R. Germany

Agricultural production in the Guinea Savannah in Northern Ghana is mainly done by small farmers. The high population growth of 3,6% p.a. in this region basically increases the pressure on arable land.
In the past, farmers of Wantugu, the study village which is located close to the regional capital, Tamale, tended to prefer

the first two solutions, so that ratio between cropping period and the length of the whole cultivation cycle decreased steadily. But recently farmers also extend their farms into virgin areas, which indicates that the soils located around the villages are exhausted. Farmers did not establish measures which could efficiently prevent soil mining.
Morever the destabilization of the fragile agroecosystems is accelerated by the increasing demand for firewood and the annual recurrence of burning the bush. In the long run soil fertility will further decrease so that self-sufficiency will become uncertain.
Consequently, the goal of the Nyankpala Agricultural Experiment Station is to develop sustainable cropping systems giving higher yields and improving soil fertility, so that also in future farm incomes will cover at least the basic needs of the family members.
This is followed up with two research strategies:
- On-station research for identifying the effects of improved agronomic practices and for identifying new varieties.
- On-farm research for testing the recommended practices and for developing new technologies in close cooperation with the farmers.

The disadvantage of both approaches is that they are very time consuming. Therefore a study which follows another approach was conducted in 1984.
The study was undertaken with the main aim to test a methodology for investigating the variability of agronomic practices and of factor allocation and their influence on yields and farm income. Therefore, farm sizes and other data were not selected to be representative for the whole region.
Furthermore the results of the agronomic analysis are strictly derived from on-farm observations. They are not an outcome of an on-station experiment where environment can normally be better controlled. Hence, the results have to be interpreted facing this empirical background.
In general, the results of the study show that the method of investigating the variability of the current farming system is a possible way to provide appropriate solutions for smallholder farm families to increase yields and incomes in a short period of time. Another advantage of this approach is that this method could easily be taken up by the extension services in order to generate extension messages in the field. This bottom-up approach promises to be more successful than the top-down oriented approach which is still widely practised in West Africa. The latter seems to fail in these countries where the research network is obviously too wide. This implies that agricultural research is not able to cover the whole range of ecological systems of a single country.
Therefore the bottom-up approach is recommended which comprises two steps. Firstly the actual socioeconomic situation of a household should be analyzed, while in a second step it should be looked for adequate technical innovations. Necessarily the extension agents have to be educated extensively in the techniques of data collection and microeconomic data analysis of small scale farm households.

277 89 - 2/37

Farming systems research and development
Developing countries, farming systems research, review
DOROGI, J. and R. RICHTER
Farming system research in developing countries.

Beiträge trop. Landw. Vetrinärmed. 26, 1, 1988, pp. 5-9

The role of the FSR is based on the recognition that farmers use farming systems which are researchable and can be improved at the farm, cropping, or crop system level. The FSR is essentially a multi-disciplinary activity, and it is envisaged that the programme will have both upstream and downstream roles. The upstream activities comprise the analysis of resources, the politico-socio-economic environment, and existing farming systems. This will improve the understanding of the natural resource base, farm producers' skill and production methods, and of reasons for the wide gap between the results demonstrated at the research stations and those obtained at the farms. Further, these investigations will enable users to identify major constraints in production, priority technical problems, and policy issues limiting the production and income. In a downstream context, the FSR programme will be an important complement to crop improvement and other discipline-oriented research programmes and would provide structures for fitting new findings into production systems and evaluating these under realistic farm conditions. The primary objective of FSR is to improve the well-being of individual farm families by increasing the overall productivity in the context of the entire range of private and social goals and given the potential and constraints imposed by the technical and human elements which determine the existing farming systems.
FSR can be divided into four stages:

the descriptive and diagnostic stage
The objective of this stage is to understand the farming systems practised in the target area. This enables the FSR team to determine the constraints that the decision-making households face and the flexibility that exists in the current farming system - timing, skill, slack resources etc.

the design stage
In this stage, improved technologies thought to be relevant to overcoming or avoiding the constraints identified in the fist stage are specified.

the testing stage
The objective of the testing stage is to evaluate a few of the more promising technologies arising from the design stage on farmers' fields.

the extension stage
In this stage, technologies found during the design and testing stages to best overcome the constraints outlined in the descriptive and diagnostic stage are widely extended to other farmers. Problems in the extension stage should be monitored - perhaps accompanied by a new round of descriptive

and diagnostic work. This process is dynamic and iterative because there is a frequent return to previous stages.
The distribution between the stages is not sharply defined as there is much overlap, and several stages are tackled simultaneously. The process is flexible and adaptable to many circumstances and different problems.
The essence of the FSR's methodology is that it analyses and assesses the original situation, the present level and results of production, and in this way learns in the constraints and elaborates alternatives of development. It is necessary to test these alternatives and chose the most suitable. After introducing the new system, or system components, it is necessary to test and compare the new system's level and results with the original one.
FSR can be the first step of an important development, but it must not be conceived in an isolated way. It should then be part of an agricultural policy which includes the necessary social and economic reforms. A farming system is not only a summary of crops and animals to which one can apply this or that input and expect immediate results. Rather, it is a complicated interwoven mesh of soils, plants, animals, implements, workers, other inputs, and environmental influences. The farmer's understanding of his environment, both natural and socio-economic, affects his farm system.

278 89 - 2/38

Farming systems research and development
Review, book, developing countries, food security, poverty, policy study
THE WORLD BANK
Poverty and hunger: Issues and options for food security in developing countries.

The World Bank, 1986, pp. 69 + xi, USD 7.50 (softcover)

A publication as important as this by the World Bank has to be viewed in the context of the Bank's shift over the last six years to a much more conservative outlook. A lot has been heard from the Bank about "getting prices right", allowing market forces to have a free hand and so on, and much less of the talk heard during the 1970s about direct measures to eradicate poverty. Given the political climate in the Bank, this is an exceptional document; given what needs to be done about reducing poverty and hunger by improved food security.
Such chapter headings as "National measures to reduce chronic food insecurity" and "International support for food security" create the impression that insufficient attention has been given to household and community level factors and how those should be taken into consideration in designing food security policy. The document is one which can form the basis for promoting the argument that issues of national economic growth and equity can and do overlap in improving food security.

The policy study is essentially split into three parts. After a definition of terms and an overview, there is a discussion of whether food security is a problem of supply or purchasing power. That is reviewed by reference to two aspects - chronic and transitory food insecurity. The former is defined as continously inadequate diet caused by the inability to acquire food; the latter is a temporary decline in a household's access to enough food, resulting from instability in food prices, food production or household incomes. Inadequate production, household purchasing power and unstable world and domestic prices are all reviewed as causative factors.
The second part discusses national measures to reduce both chronic and transitory food insecurity. The former includes increasing the food supply (by trade interventions, production subsidies), subsidizing food prices (by targeted subsidies, marketwide subsidies) and augmenting incomes. The national measures to reduce transitory food insecurity are given as stabilizing domestic food supply (production, buffer stocks, trade), stabilizing domestic demand and protecting vulnerable population groups. The third section concentrates on international measures: external finance including food aid and international trade.
They should be tried to take household characteristics and priorities and see how those can be built up into national programmes that are technically, and politically, feasible. Many projects and policy studies have failed because inadequate attention was paid to the target group itself.

279 89 - 2/39

Farming systems research and development
Asia, Philippines, study, technology transfer, farmers, rice, language differences, IRRI,
CABANILLA, V.L. and T.R. HARGROVE
The Effectiveness Among Farmers of a Farmer's Primer on Growing Rice in two Philippine Dialects.

IRPS No. 127, 1987, pp. 11

Language differences inhibit the flow of agriculture information not only among scientists but even more so from research institutions to farmers, the ultimate users of technology. To alleviate the language barrier in technology transfer, the International Rice Research Institute (IRRI) has developed its copublication program - cooperative ventures with national agencies and private publishers in which the cooperator translates IRRI books and handles most distribution. IRRI designs certain publications to make them easy and inexpensive for cooperators to copublish.
The Tagalog and Hiligaynon editions of "A farmers's primer on growing rice", which is published in 30 languages, were evaluated for their effectiveness in transferring rice technology information to 84 farmers in Cavite and Negros Occidental, two provinces in the Philippines. Relationship among farmers'

sociodemographic characteristics, communication variables, and the Primer's effectiveness in terms of knowledge gain were also tested.
A 73-item test was used to measure initial knowledge level. The farmers were then given copies of the Primer in Tagalog (Cavite farmers) or Hiligaynon (Negros farmers). A post-test was given 45 days later to measure knowledge gain.
On both tests, farmers who answered less than 50% of the test questions correctly were defined as having "low"levels of knowledge, and those with 50% or more correct answers as having "high"knowledge. Only 4% of the farmers had high knowledge in the pretest, but 46% had high scores after reading the book. The t-test also showed that, although farmers who finished the book and those who did not were not significantly different in initial rice knowledge, the difference in post-test scores was highly significant. The farmers' knowledge gain concerning fertilizer was highest. In the pretest, only 15% knew the meaning of "24-12-12" on a fertilizer sack, but half knew after the treatment. Of 14 independent variables tested, only 4 were significantly related to knowledge gain: previous participation in rice training courses, land tenure, number of years in rice farming, and exposure to newspapers. The Cavite and Negros farmers generally matched well in most variables.
Farmers evaluated the Primer's design, packaging, and message content favorably but suggested improvement to increase its effectiveness, such as the deletion or substitution of abstractions and symbols that they found confusing or hard to understand.
IRRI is using the findings of this study to make forthcoming publications, designed on the Primer concept, more effective.

280 89 - 2/40

Farming systems research and developing
Latin America, Mexico, livestock, crops, smallholders
ALUJA, A. et al.
Decision making by livestock/crop smallholders in the state of Veracruz, Mexico
Cornell international agriculture mimeograph, 105, 1984, pp. 44

Prior to proposed agricultural development program in the Mexico State of Veracruz, 13 farms were surveyed in an effort to identify and quantify factors in farmer's decisionmaking. Data were collected in physical resources, (land, facilities and equipment, cropping), livestock, pasture management (grazing systems, pastures, quality of forages, supplementary feeding), milk output, livestock reproductive performance, animal health, selected indicators of livestock performance, marketing, labor, and economic factors. It was found that the farmers'decisionmaking in regard to both crop and livestock systems was rational. Farmers appreciated that to increase animal and milk production from modest to high levels would not be supportable under present marketing conditions. It is concluded that the government should

recognize that farms in Veracruz State are supplying local needs through low inputs and contribute to state and regional food supplies than is generally recognized. A 3-page bibliography (1955-84) is appended.
Abstract from FSR

281 89 - 2/41

Farming systems research and development
Africa, Zambia, adaptive research, farmers, scientists, farming systems research
KEAN, S.A.
Developing a partnership between farmers and scientists: The example of Zambia's Adaptive Research Planning Team.

Expl. Agric., 24, 1988, pp. 289-299

This paper is based on the experiences of the Adaptive Research Planning Team in Luapula Province (ARPT-LP), which is one of the nine provincial ARPT teams conducting farming systems research (FSR) in Zambia. The ARPTs form a section within the Research Branch of the Ministry of Agriculture and Water Development. The Research Branch also includes 16 Commodity and Specialist Research Teams (CSRTs), who conduct research mainly at the provincial research stations. This paper shows how a government-operated national agricultural research system has attempted to involve farmers in the process of research and technology generation.
When ARPT was established in 1980 one of its primary function was to involve farmers, especially small scale farmers, more fully in the technology generation process. However, only a few evaluations of ARPT and the Research Branch have seriously considered what progress has been made in involving farmers as partners in research. This paper makes such an assessment.
ARPT started working in Luapula Province in 1982 and since then has become increasingly concerned to involve the farmers in both planning and implementing the team's research programme. The team has used several formal and informal opportunities to interact with farmers and involve them in decision making. These opportunities and several key factors affecting the evolution of this interaction are examined here.
The information was collected as part of a larger study, covering the work of ARPT in Zambia as a whole, and is being published in a nine country comparative study of organization and management of on-farm client oriented research by the International Service for National Agricultural Research.
Even though ARPT has a mandate to work with farmers, the experience of ARPT-LP indicates that it is easy to underestimate the amount of time and effort needed to explain the purpose of the team's work and its specific activities, and to build an effective partnership with farmers. It is very easy for scientists conducting farming systems research to regard farmers simply as recipients of new technologies rather than as partners and initiators in the research process.

Research priorities should be set taking great care to use information derived from surveys and discussions with farmers. Farmers' ability to suggest topics for research can be enhanced over the long term if scientists explain clearly the range of technological options available to meet a particular need. They should therefore have some basic training in communication skills. Informal opportunities for discussion between scientists and farmers have been as important as formal occasions. However, care has had to be taken to ensure that comments made by farmers have been properly recorded.
Various factors likely to enhance the level of farmer participation include involvement of local leaders, use of extension workers or scientist with experience of extension work, selection of farmers in close proximity to one another, and emphasis on greater farmer participation by senior research managers.
Monitoring the level of farmer involvement in decision making in a national research system is difficult because there can be many informal, as well as formal occasions when information and opinions can be passed from farmers to scientists. It is also difficult because it is usually possible for scientists to justify decisions they have made by referring to survey results or comments made by farmers on some occasion. But if research organizations or sections have been given specific mandates to involve farmers in the research process, it is important that such mandates are included in the monitoring and evaluation of the research system.

282

89 - 2/42

Farming systems research and development
Discussion, workshop paper, farming sytems research, socioeconomic models, ICRISAT, small farmers
ANDERSON, J.R. et al.
Socio-economic modelling of farming systems.

FSR Workshop, Richmond, New South Wales, 1985, 30 pp.

The types and role of socioeconomic models in FSR are discussed in this non-technical workshop paper. In basic type, models are either descriptive or optimizing; the latter are defined as those which incorporate an algorithm which directly generates a solution for a specified function in the model. Among the variants of these two types, budgeting and mathematical programming stand out respectively; the latter's relative advantage in eliminating bias is exemplified during an excursus on the experiences of one of the authors in an FSR program conducted by ICRISAT. Socioeconomic modeling permits detailed evaluation of the performance of a given farming system and identification of its strong and weak points and helps assess the viability of a proposed technology. Problems involved in the use of socioeconomic models include the difficulty of striking a suitable balance between data gathering, model building, and model exploitation, the physical and/or cultural

remoteness of modelers from farmers (or, by contrast, an excessively anthropological approach), and various sins of omission, of which the most serious is failure to recognize the crucial role of female farmers. A concluding section stresses the need for greater sensitivity to the ideas and needs of small farmers. A 4-page bibliography (1970-86) is appended.
Abstract from FSR

283

89 - 2/43

Farming systems research and development
Asia, Pakistan, sustainability, development, agroecosystem zoning, farming systems survey,rapid rural appraisal
CONWAY, G.R. et al.
Rapid rural appraisal for sustainable development: experiences from the northern areas of Pakistan.

Presentation to the IIED's Conf. on Sustainable Development, London, Earthscan, 1987, 30 pp.

The challenge for the designers and managers of development projects is to find ways of analysing situations that are rapid and cheap and that ensure their recommendations will lead to sustainable development. This paper describes several methods that go some way to meeting the challenge and how they are being applied in development project in the Northern Areas of Pakistan.
Rapid rural appraisal (RRA) aims to provide enough structure to the observation and analysis to ensure a relatively high degree of accuracy, without incurring lengthy or costly studies. RRA is also a response to dissatisfaction with many conventional socio-economic and agricultural surveys. Experience suggests that in addition to being time consuming and expensive they often do not ask the key questions or obtain the critical data. RRA recognises that the context of the data may be as important as the data themselves, and that variations may be more revealing than the averages that are often the sole output of conventional surveys. Above all, RRA is intended as a highly iterative process. Learning takes place in the field as part of a dialogue with the farmers and the other members of the RRA team. Accuracy is achived by triangulation, i.e. by repeated cross-checking of information from several different directions using different techniques. It follows that RRA is primarily a process of generating and refining hypotheses about rural development.
There is no single, standardised methodology for RRA. In each situation this depends on the objectives, local conditions, skills and resources. However there is a suite of techniques in existence which can be used in various combinations to produce appropriate RRA methods. The suite includes:

- Secondary data review
- Direct observation
- Conceptual tools
- Semi-structured interviews
- Analytical workshops.

Secondary data consist of reports, maps, aerial photographs etc. that already exist and are relevant to the project. The review process involves searching for relevant data and summarising these in diagrammatic models, simple tables and brief abstracts.
The aim is to be sceptical and critical and to look out for what has been missed, but not to spend time here that could be better spent in the field. **Direct observation** includes measurement and recording of objects, events, and processes in the field, either because they are important in their own right or because they are surrogates for other variables that are important. **Conceptual tools** consist of a wide variety of simple techniques for summarising information. An important set of such tools are diagrammatic models, including maps, transects, seasonal calendars, flow diagrams, bar diagrams, decision trees and venn diagrams.
One of the most important of RRA techniques is **semi-structured interviewing**, which is a form of guided interviewing where only some of the questions are predetermined and new questions or lines of questioning arise during the conduct of the interview, in response to answers from those interviewed. The information is thus derived from the interaction between the knowledge and experience of the interviewer and the interviewee(s). The latter may be groups, for example of village leaders, or key informants, such as school teachers or local government officals, or the farmers themselves, selected on one or more criteria.
The final RRA technique is the **analytical workshop**. This takes place very soon after field visits, is semi-structured and provides an opportunity for intensive multidisciplinary analysis of the information acquired in the field.
Over the past two years these various RRA techniques have been explored as means of determining priorities for the next phase of development in the Northern Areas of Pakistan. The outcome has been a series of RRA methods under the headings of agroecosystem zoning, agroecosystem analysis, topical rapid rural appraisal and farming systems survey. In practice they have been developed and refined and it is only recently that their logical relationship to one another, as presented in this paper, has become apparent.
Underlying the use of these appraisal methods are a number of basic concepts that provide a framework for analysis. The first is that agricultural land use in the Northern Areas of Pakistan can be represented as a set of more or less distinct agroecosystems, typically arranged in a hierarchic fashion. An agroecosystem can be defined as an ecological system partly modified by humans for the purpose of food or fibre production. The wheat field is an example of such a system.
Each agroecosystem has a characteristic behaviour that may be summarised by four interconnected properties:
Productivity, which is the output of valued product per unit of resource input (e.g. land, labour, energy or capital) and is commonly measured as annual yield or net income per hectare or per agroecosystem, or per man hour or unit of investment.
Stability, which is the constancy of productivity about its long term trend in the face of small disturbing forces arising from the normal fluctuations and cycles in the surrounding environment, for

example in the climate, or in the economic conditions of the market. Such forces affect the variability of production but leave the long term trend unchanged. Stability is most conveniently measured by the coefficient of variation in productivity.
Sustainability, which can be defined as the ability of an agroecosystem to maintain its productivity when subject to stress or shock. A stress is here defined as a frequent, sometimes continuous, relatively small and predictable disturbing force which has a large cumulative effect, for example salinity, toxicity, indebtedness or declining market demand. A shock, by contrast, is an irregular, infrequent, relatively large and unpredictable disturbing force, such as a rare drought or flood or a new pest or the sudden rise of an input price. Stresses and shocks have the potential of causing lower, or declining trends in production or even collapse.
Equitability, which is a measure of how evenly the productivity of the agroecosystem is distributed among its human beneficiaries. The more equitable the system the more evenly are the products, the food or the income, shared among the population of the farm, village, region or nation. It can be represented by a statistical distribution or by a measure such as the Gini coefficient.
These four properties are essentially descriptive in nature, summarising the status of the agroecosystem. But they can also be used in a normative fashion, as indicators of performance, both in the design of agricultural innovation and in its subsequent evaluation. Experience shows that in agricultural development there is almost inevitably some degree of trade-off between these different properties and the challenge for rapid rural appraisal is to accurately foresee these trade-offs and ensure they are taken into account in project planning and management.

89 - 2/44

284

Farming systems research and development
Review, tropics, developing countries, technology transfer, farmers, modelling system, decision support system, appropriate technology, data requirement, future outlook
UEHARA, G.
Technology transfer in the tropics.

Outlook on Agriculture, 18, 1, 1989, pp. 38-42

The purpose of this paper is to examine factors that govern technology transfer and describe how these factors can be incorporated into new efforts to accelerate agricultural technology transfer in the tropics.
There is a growing sense that a technology is appropriate only in the eye of the beholder. The certainty that only farmers can recognize appropriate technology has generated strong opposition to researcher-designed technology packages and has given rise to arguments that agricultural research should be conducted with farmers, for farmers' fields.

Most researchers concede that the user must participate in the selection, design, and testing of a new technology, but in practice few farmers are involved in technology assessment. The problem with the well-intentioned aim of involving farmers in technology development is that it is too slow, too expensive, and unreliable.
It is not so easy to propose a better method. But it is abundantly clear that the current methods must be supplemented with a fresh approach.
An international group of agricultural and systems scientists met to design a decision support system for agrotechnology transfer (DSSAT). The participants were asked to focus on systems analysis and crop simulation models as the primary means to match crop requirements to land characteristics. The aim was to develop a solid foundation for dealing with the soil-plant-atmosphere continuum so that strong links between the biophysical and socioeconomic processes could be later forged. The scope of work was limited to ten food crops including four cereals (maize, rice, sorghum, and wheat); the grain legumes (dry beans, groundnut, and soybean); and three root crops (aroid, cassava, and potato). The first approximation of the minimum data set needed to stimulate crop performance was prepared. This report has since undergone two revisions and continues to serve as a guide to design field experiments for model validation and refinement.
The DSSAT is microcomputer software designed to provide users with easy access to soil, weather, crop, and experimental data as well as simulation models and expert systems to simulate outcomes of alternative management strategies. The system now includes a weather generator which provides the model with daily weather data to stimulate crop performance for 10 to 50 years. The weather generator uses historical weather data to compute coefficients with which to reproduce statistically similar weather data.
This paper is based on the experiences of an international team of agricultural and systems scientists which has been involved in the development and validation of a DSSAT. More information about the software and users' guide can be obtained from:
IBSNAT Project, Department of Agronomy & Soil Science, 2500 Dole Street, Krauss Hall 22, University of Hawaii, Honolulu, Hawaii 96822, USA.

285 89 - 2/45

Farming systems research and development
Review, humid tropics, IITA, farming systems development, models, ecosystems, conservation, utilization, food needs, sustainable farming systems
JUO, A.S.R.
New farming systems development in the wetter tropics.

Expl. Agric., 25, 1989, pp. 145-163

This paper highlights some of the unique features of the tropical forest environment and assesses some promising technologies that

may lead to the development of new farming systems in the wetter tropics.
Except for some densely populated urban areas in the coastal regions of south Asia and west Africa, the supply of basic foods has not been a real problem in the wetter tropics. Rice, cassava, sweet potato, cocoyams, small ruminants and a wide range of forest products have provided nearly all the basic needs of the indigenous population.
In tropical forest regions, most soils, for example, are inherently less fertile; the climate is continuously hot and humid; and the average farm worker is less well educated and less skilled.
Farming systems may be devided into three simplified models: the irrigated paddy-rice multistorey homestead garden complex of Asia, the tree and cash crop plantations of Latin America, and the mixed root-bush fallow systems of Africa.
Farming systems in the wetter tropics may be illustrated by simplified models, the main features of which reflect their natural resource base, their cultural and social characteristics and, above all, the path of agricultural development taken during past centuries.
An overriding factor guiding future agricultural development in the wetter tropics is probably the fragility of its upland ecosystems, particularly in areas where acid and kaolinitic or lateritic soils predominate. Agricultural development in the region should, therefore, be based on long-term environmental stability rather than short-term economic returns. Thus, high priority should be given to developing ecologically sustainable mixed systems involving annual food crops, trees and perennials on small family farms. Achieving household security for food and nutritions would remain the most important goal in such systems; family income would be derived mainly from cash crops and off-farm activities.
However, new farming system development does not explicitly imply inventing new systems or component technologies. To prevent further destruction of the earth's remaining tropical forests, there is an urgent need to develop or introduce new farming systems that are more in harmony with natural ecosystems and better suited to be cultural heritage of the indigenous societies in the wetter tropics:
- Multistorey homestead gardens
- Alley cropping
- Rotation with cover crops
- Food crop improvement
- Tree and perennial crop plantations
- Livestock range farming
- Farm units along a toposequence

Because of the fragility of the natural resource base, sustainable farming systems in the wetter tropics rest on a delicate balance between conservation and utilization. Much more research is needed to understand the dynamics of tropical forest ecosystems better and to assess their biological potential for future agricultural development. The current knowledge clearly indicates that predominantly acid and nutrient-depleted soils in the low altitude

wet tropics are unsuited to energy-intensive and market-oriented food crop agriculture. However, to meet the food and nutritional needs of the indigenous population, there is enormous potential for the development of more productive and stable multistorey homestead gardens and mixed systems including tree, perennial and annual crops.
The principle and practice of "alley cropping" provide an ecologically sound basis for future farming systems research and development in the wet tropics.

286 89 - 2/46

Farming systems research and development
Review, tropics, developing countries, farming systems, on-farm research, requirements, framework, design, execution
CAMEOENS, J.K.
Farming systems and their on-farm research requirements.

In: Proc. of on-farm animal research/extension and its economic analysis, Los Baños, Laguna, Philippines, 1987, pp. 19-24 + app., Distr.: Winrock Int. Inst. for Agric. Development, Petit Jean Mountain, Route 3, Morrilton, AR 72110, USA

A historical perspective tracing the development and application of on-farm research is presented.
The historical setting permits the classification of on-farm research needs into five broad categories: human, technical/technological, production economics, marketing linkages.
For purposes of identifying on-farm research needs, ten types of agricultural systems can be described:
- swidden agriculture
- shifting cultivation
- nomadic herding
- transhumant farming
- rainfed agriculture
- irrigated agriculture
- plantation farming
- contract farming
- commercial livestock production
- nontraditional livestock farming

Major characteristics of these systems are presented in this paper.
On-farm research should be planned, designed, executed, and analyzed within the framework of some important operational principles:
- Principle one: (Ask-the Farmer). Find out what the farmers are doing and design research to help them do it a little better.
- Principle two: Assemble on-farm resource data; determine their quantities; analyze on-farm resources' allocative efficiency; program on-farm research to optimize resource allocation and test the results for repeatability.
- Principle three: Determine the value of the research to the farmer and to the national economy.

- Principle four: Do not implement the change until the success of the research can be demonstrated as being repeatable.
  Principle five : On-farm research could awake the slumbering tiger. Beware of the consequences!

On-farm research is expensive and is becoming more difficult to fund because so much previous research was unsuccessful, and because it employs highly qualified scientists. Over 75% of research budgets are for personal payments. It is a luxury for developing countries; hence, it must be practiced with utmost care and economy, it must demonstrate a favorable benefit cost ratio, and its results must have effects in the shortest possible time. No scientist must yield to the temptation of doing research for its own sake, for the sake of a publication, or to add another decimal point to a statistic. On-farm research must have the farmer at its aim. Its objectives are to find out what the farmer is doing, help him do it a little better, and enhance the farm and national economies.

287 89 - 2/47

Farming systems research and development
Review, on-farm research, IITA, farming systems research, research procedures, farmer, productivity
MUTSAERS, H.J.W. and D.S.C. SPENCER
On-farm research - a necessary tool in the development of innovations.

entwicklung + ländlicher raum, 22,3, 1988, pp. 10-12

This article reviews some of IITA's recent experiences with on-farm research (OFR) as well as its current thrust in this area.
OFR is rightly considered as primarily a function of national research institutes. International institutes should develop prototype technologies to be adapted and tested for local conditions by national institutes.
Prototype innovations cannot be effectively developed without direct exposure to farmers conditions, particularly in Africa where national research institutes are weaker than in Asia or Latin America. Scientists in the International Agricultural Research Centers (IARC's) need direct contact with the farmers to test how realistic their ideas really are. Furthermore, there is a strong demand from national institutes for training in OFR. It is inconceivable for IARC's to respond to such training demands unless they have first-hand experience in OFR.
One important element of OFR in which it differs from conventional extension demonstration methods is its adoption of a stepwise approach. Farmers have often been found to resist the adoption of multielement packages as they are commonly offered by extension agencies. New crop varieties for example, are often introduced with a set of recommended practices attached such as sole cropping, row planting, recommended fertilizer, timely weeding etc. This requires a large number of changes in farmers' habits all at the same time, which they are unlikely to make.

The OFR - approach would break down the package into its constituents and test them one or two at a time while leaving everything else unchanged. This not only allows the researchers to observe their technologies under more realistic conditions but it also enables them to study the farmers' current practices and how they affect their yields. This is almost impossible when complete packages are tested: farmers will quickly leave everything to the researchers and even loose interest when the innovations are too different from their usual practices. The "one-farm trials" then degenerate into replicas of station trials.
In order to illustrate these points the paper briefly reviews some of the experiences with the introduction of a new maize variety and a moderate dose of fertilizer in farmers' conventional maize + cassava intercrop system and with alley cropping.
The paper concludes that IITA is becoming increasingly involved in OFR, both in its outreach projects and from its Ibadan main station. It enables to expose the technologies to realistic conditions which is a necessary step in the development of prototype technologies. It also provides with an opportunity to observe farmers' constraints and problems at first hand. Finally, it provides a field laboratory for the further development of appropriate OFR methods.

288 89 - 2/48

Farming systems research and development
Review, tropics, Asia, farming systems research, economics, measurement methods
BARLOW, C. and S.K. JAYASURIYA
Improving the economic impact of farming systems research.

Agricultural Systems, 22, 1986, pp. 109-125

Improvements in the economic impact of farming systems research are considered in this paper in two main and related senses. One sense concerns measurement of the extent to which a new technology affects in the incomes and resource use of farmers, and thus has wider economics and social significance at regional and higher levels. The other sense involves adjustment of farming systems research per se.
The focus of this paper is on what are judged to be key practical issues in each of these senses of impact analysis. Wider aspects of such analysis are already well covered in other literature, to which due reference is made. The concentration is on farming systems research in its commonest application on national sites, where the aim is to secure new technologies directly improving the economic viability of local agriculture. This is often termed "downstream" research, in contrast to the less direct "upstream" work undertaken by some international and regional centres. The prime concern is with the Southeast Asian area where are today several hundred crop and livestock sites. The rapid spread of such sites, with their usually fragile resources, emphasizes the need

to recognize limits on research possibilities, and, within these, to pinpoint ways of maximizing the value of what is done.
Some practical issues in the measurement of impact at the three stages of farming systems research are discussed. While most issues are seemingly obvious, the fact that they persist as serious deficiencies in so many research contexts indicates that they deserve important consideration.
With the ex ante stage the needs of securing representativeness of the target area and of benchmarking the wider initial situation, including economic, social and agroclimatic features, are emphasized. With the ongoing stage, the importance of using suitable partial budgeting techniques is stressed. With the ex post stage, an assessment of wider technological and economic effects is called for, together with the identification of enabling factors and constraints in technological progress.
The adjustment of the farming systems research process itself is finally considered, and the desirability of simplifying the process, further training junior field-level researchers and securing better interaction between workers at the various research levels, is highlighted.
The theme in this paper is that the effectiveness of such research could be substantially improved through a revised analysis of the impact of designed and actual new technologies, supported by certain adjustments to the farming systems research arrangements per se. The essential argument is for a broader analysis of technology effects, where the "total" environment, theoretically recognized as pertinent to farming systems studies, is better taken into account at successive stages. Achieving this goal is difficult under the poorly endowed conditions of most research sites, and will demand substantial revision of the current approaches of junior economic staff, accompanied by improved training and much better interaction with senior researchers.
The goal of this paper is to pinpoint deficiencies in current analysis, in the hope that an already valuable study technique may be thereby enhanced.

289 89 - 2/49

Farming systems research and development
Review, sustainable development, institution building, farmer organization, organizational structures, investments, agricultural development, project, socio-cultural compatibility, development strategies, social action, methodologies
CERNA, M.M.
Farmer organizations and institution building for sustainable development.

In: Sustainability Issues in Agricultural Development - Proc. of the Seventh Agric. Sector Symp., The World Bank, Washington, D.C., Eds. T.I. Davis and I.A. Schirmer, ISBN 0-8213-0909-9

This paper reports and discusses the findings of a recent systematic analysis of the correlation between the sustainability

of development projects and several factors assumed to affect it, including institutional and organizational factors. The analysis covered 25 largescale development projects financed by the World Bank. It sheds light on the premises of sustainability and, conversely, on the causes of non-sustainable development interventions.
The sections of the paper (i) present the empirical findings produced by the study, (ii) discusse implications of these findings, and (iii) define some issues and lessons relevant for designing strategies for sustainable development, particularly in agriculture. The issues refer to specific organization building and engineering approaches required in development programs and to the social science research and applied work needed for their realization.
The experience of many unsuccessful, or marginally effective, development projects has shown that the long-term sustainability or non-sustainability of such projects cannot be attributed only to factors of an economic and/or technological nature, but is related to institutional and organizational factors as well. The research devoted to this topic has been chronically insufficient.
The concept of sustainability of development interventions, while not new, is recently acquiring high visibility. Sustainability should be a sine-qua-non of every financially induced development program. Without the building bricks of sustainability, much financing is condemned to inducing only short-lived "development spurts".
The concern for sustainability is being powerfully reinforced now by the international debt crisis, which has thrown light on a profound paradox of both nationally and internationally financed development programs. Such programs are undertaken with the expectation that their benefits will not only allow recovering the investments and repaying the loans that made them possible, but will also generate a net surplus. However, if such projects do not foster sustainable development, then instead of surplus benefits the borrowing party ends up increasing its accumulated debts. In part, the international debt crisis is a product of repeated investments in non-sustainable development programs.
The definition of sustainability used was essentially an economic definition. Project sustainability over time was defined as the maintenance of an acceptable net flow of benefits from the project's investment after its completition, i.e. after the project ceased to receive Bank financial and technical support. The actual economic rate of return (ERR) was recalculated at the time of the in-depth impact evaluation studies (IES). The standard for determining economic sustainability has been to assess whether the ERR was equal to, or greater than the opportunity cost of capital.
The analysis concluded that 12 out of the 25 projects appeared to have successfully achieved long-term sustainability, while 13 did not. In 5 of the 12 successful projects, the flow of benefits at impact evaluation time was even significantly higher than the level of returns at completion time, while in the other 7 projects the level stayed constant. By area, the highest success durability rate was in East Asia (6 projects) and Latin America (4 projects);

the lowest rate was in East Africa and West Africa, with only 2 out of 15 projects able to sustain their initial good results.
The remaining 13 projects failed to sustain the minimum flow of benefits to qualify for an assessment of continued, lasting success. At the time of project completion, the rate of return projections for these 13 projects had been satisfactory and ranged between 15 percent and 30 percent. However, at impact evaluation they had all declined to less than 10 percent and in two projects the ERR had turned negative. The average rate of return assessed for these 13 projects at impact evaluation time was as low as 2.7 percent; this rate reflects the inability to sustain project activities in the post-completion period.
These are serious findings, even if they cannot be extrapolated, to the Bank's overall agricultural experience. Such a high number of unsustainable projects was certainly not expected.
Five main factors or sets of factors were found to have a decisive bearing on the sustainability of the 25 projects analyzed. These elements were derived by contrasting the experiences of the projects which performed significantly above expectations at audit against those which performed worst:
- institutional build-up and participation of beneficiaries;
- technological improvements;
- socio-economic compatibility;
- favourable policy environment;
- recurrent cost financing/recovery.

290 89 - 2/50

Farming systems research and development
Review, book, study, project maintaining, evaluation, agriculture, IFAD, FAO, WORLD BANK
CASLEY, D.J. and K. KUMAR
Project monitoring and evaluation in agriculture.

The Johns Hopkins University Press, Baltimore, Maryland 21211, USA; published for The World Bank, Washington, D.C., a joint study of the World Bank, IFAD and FAO; ISBN 0-8018-3615-8, 1987, 157 pp.

The accumulating experience and the growing consensus regarding concepts and definitions led the World Bank and IFAD in collaboration with the FAO to agree to produce a set of technical publications on the monitoring and evaluation of agriculture investment projects which would provide the basis for training programs at the regional and national levels.
This book provides a conceptual framework. A companion volume provides specific methodological guidance.
This book is based on the Task Force Guiding Principles and provides monitoring and evaluation concepts and definitions in the particular context of agriculture investment projects.

The book contains the following chapters:
1 Monitoring and Evaluation: A Management Perspective
2 Monitoring and the Management Information System
3 Monitoring of Physical and Financial Progress
4 Beneficiary Contact Monitoring
5 Follow-up Diagnostic Studies for Monitoring
6 Communicating Information
7 Evaluation: Substantive Focus and Types
8 Measurement of Production Increases: Methods and Limitations
9 Special Topics in Impact Evaluation
Suggested Readings
Index

Examples of actual monitoring and evaluation problems are interspersed in the text to illustrate significant points. These narratives have been edited and in some cases sharpened to dramatize the point being made. A full reference is given if the source document is available. In many cases, however, the source document is restricted and only the agency name is given.
It is necessary to stress what this book and its companion are not. This book does not deal with monitoring and evaluation of national programs and policies.
The framework proposed is put forward solely in the context of the monitoring and evaluation of agriculture and rural development investment projects, which are defined as interrelated and coordinated activities formulated and financed to achieve specific sets of objectives within a limited span of time and operated by an identifiable and formally responsible management team.
The primary intended audience comprises those in the developing world responsible for the design and implementation of monitoring and evaluation systems. Project managers may also benefit from this volume. It is hoped that this publication will be useful to those who provide training courses in this subject and to all who are interested in the issue of judging the success of the development effort in rural economies.

291 89 2/51

Farming systems research and development
Asia, Pakistan, study, rapid agroecosystem zoning, project, development strategies
PRETTY, J.N.
Rapid agroecosystem zoning of Alpuri sub-division, Swat District, North West Frontier Province, Pakistan.

Report of Malakand Fruit and Vegetable Development Project, MFVDP, Mingora, Pakistan and International Institute for Environment and Development, London, 1988, 67 pp.

At the request of Intercooperation (Switzerland) and the Pakistan-Swiss Malakand Fruit and Vegetable Development Project, an exercise in Rapid Agroecosystem Zoning and Rapid Rural Appraisal was conducted in Alpuri Sub-Division, Swat District, in July 1988.

The objectives were twofold: firstly to test the applicability of rapid zoning techniques to the work of the MFVDP and to identify different zones within Alpuri; secondly to produce a series of strategies for fruit and vegetable development and key questions for investigation in the identified zones of Alpuri Sub-Division.
This report has been written by the workshop participants and compiled and edited by Jules N. Pretty.
The dynamics of agroecosystems can also be described in terms of four interconnected properties - productivity, stability, sustainability and equitability.
These terms are defined as follows:
Productivity is the output of valued product of the zone per unit of resource input.
Stability is the constancy of production of the zone in the face of small disturbing forces arising from the normal fluctuations and cycles in the surrounding environment.
Sustainability is the ability of the zone to maintain production when subject to stress or shock. Stresses and shocks have the potential of causing declining trends in production of even collapse.
Equitability is the evenness of distribution of the production of the zone amongst the people.
These four properties are essentially descriptive in nature, but they can also be used as indicators of performance both in the design and evaluation of innovations. Experience has shown that in agricultural development there is almost inevitably some degree of trade-off between these different properties. The challenge for Agroecosystem Zoning is to foresee acurately these trade-offs and ensure they are taken into account during planning and subsequent management.
Methodology of Rapid Agroecosystem Zoning (RAZ):
The methodology makes use of a number of important techniques falling within the rubric of Rapid Rural Appraisal (RRA).
The key features of an RRA are as follows:
- it is iterative and involves "learning-as-you-go", enabling processes and decisions to be changed in the light of new generated information of analyses.
- it uses the farmers' perspectives to help define differences in field conditions.
- it is partly structured, flexible and adaptable,
- it reduces complexity to a few key problems and opportunities,
- it uses small teams of mixed disciplines and a system perspective to make communication easy,
- it is quick and relatively cheap,
- it emphasises not only productivity, but also other agroecosystem properties and the critical trade-offs between them.

This zoning of Alpuri used a number of important techniques of RRA, namely secondary data review, direct observation in the field, semi-structured interviews, drawing of diagrams, analytical games, portraits and stories and analytical workshops.
Secondary data and information are published or unpublished data, acquired by other people at an earlier time, that are relevant to the topic or target of the RRA. Time spent on quickly reviewing

and summarising secondary data can help avoid time wasted in repeating studies and, by revealing gaps or biases in the existing data, it can also stimulate ideas and suggest paths of investigation. Nonetheless it is important not to spend time on what could be better spent in the field.
Direct observation is relatively straightforward and encompasses any direct observation of field objects, events, processes, relationships or people that is recorded by the team in note or diagrammatic form. Innovative forms of direct observation rely on carefully chosen indicators. These are events, processes or relationships which are easily observed or measured but can be used as an indicator of some other variable that is more difficult or impossible to observe.
Semi-structured interviewing or semi-structured learning is probably the most powerful of RRA techniques. It takes place in informal,guided interview sessions.
Diagrams are simple, schematic devices which present information in a readily understandable visual form.
Analytical games are such techniques as ranking which are used as a quick means of finding out an individual's or group's list of priorities and preferences.
Portraits and stories are short, colourful descriptions situations encountered by the team in the field or stories recounted by people met there.
Analytical Workshops are means of bringing people together to participate actively in reviewing, analysing and evaluating the information gathered.
Throughout the RRA, whilst in the field or in the workshop, the team focussed on understanding the problems and opportunities particular to fruit and vegetables in each village or area under study. During field visits the team learnt from farmers of the important factors which characterised different zones.
The RAZ took a total of 11 days, alternating betwen analytical workshop sessions and visits to the field.
The Alpuri Sub-Division has been divided into 16 zones. These can be regarded, for planning purposes, as the basis for General Recommendation Domains. Each domain is characterised as having biophysical and socio-economic features sufficiently in common that a menu of diverse innovations and interventions can be appropriately recommended throughout the domain.
The zones were drawn up after considering a wide range of biophysical and socio-economic factors, both in the field and in an analytical workshop. Rapid agroecosystem zoning is, however, an iterative excercise, and boundaries for zones are expected to change in future as more information and knowledge on Alpuri is gathered.

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Farming systems research and development
Study, Philippines, Peru, Mali, GTZ, ODI, participatory technology development, ecologically-oriented agriculture, sustainability, techniques, methods working models, institutions
WATERS-BAYER, A.
Participatory technology development in ecologically-oriented agriculture: Some approaches and tools.

Network Paper 7 of the Overseas Development Institute, Agric. Administr. Unit, Regent's College, Inner Circle, Regent's Park, London NW1 4NS, England, ISSN 0951-1873, 1989, pp. 62 + ii

This paper is an abridged version of a manuscript which was commissioned by the German Agency for Technical Cooperation (GTZ) and which is under review for publication as a "GTZ Working Paper for Rural Development".
Ecologically-oriented agriculture, organic farming, sustainable agriculture, alternative agriculture - the terms vary, but they all have some basic aims in common:
- developing land-use systems appropriate to site-specific physical, biological and socioeconomic conditions;
- making optimal use of locally available resources, and thus minimising dependence on external inputs;
- achieving productive, long-term sustainability. For the sake of brevity, this type of agriculture will be referred to here as "ecofarming".

The concern here is with the efforts of smallholders in the tropics to maintain and develop their farming systems and with the efforts of outsiders - agricultural researchers, extensionists, development project staff (nationals and expatriates) - to help them do so. As these outsiders have been trained in methods of formal agricultural science and are regarded by practical farmers as representatives of this science, they will all be referred to here as "scientists". The term "smallholders" refers to resource-poor farmers, i.e. persons who derive their livelihood mainly from agriculture and have very limited access to land and capital. They will usually be referred to here simply as "farmers". The central concept of this paper is "participatory technology development (PTD)": specifically, how farmers and scientists are collaborating to generate new ecofarming techniques and knowledge in Asia, Africa and Latin America.
The primary target group of this paper comprises planners and advisers in aid agencies or non-governmental organisations (NGOs) who are trying to help farmers improve their systems of land use and agricultural production. The aim is to increase awareness of how cooperation between scientists and farmers can lead to the development of farming techniques which are ecologically sustainable, economically feasible and socioculturally acceptable.
Specific aims are:
- to explain the concept of PTD and encourage incorporation of participatory methods into agricultural research and development (R & D);

- to indicate the place of PTD in the overall R & D process;
- to give concrete examples of PTD;
- to introduce tools which can be used to increase farmers' contribution to technology development in R & D programmes;
- to provide sources of further information so that those who recognise the potential of scientist-farmer collaboration in R & D can gain ideas and encouragement.

The focus is on the development of agricultural production technology. Although innovations in socioeconomic organisation on the village and regional levels are vital for "embedding" the new technology, i.e. for ensuring that smallholders can continue to apply and adapt it in response to changing conditions, the promotion of organisational innovation is not considered in detail here.

Emphasis is on the evolution of existing farming systems in areas of long-established land use by man. Here, resource-poor farmers are likely to regard completely new integrated ecofarming systems as too risky to adopt wholesale. They are more likely to try out small changes or new components which fit into and improve their existing farming systems, just as they have done in the past to evolve their present systems.

This paper is primarily concerned with actions which have been taken or are presently underway. The sources of information are the authors' own experience in a multidisciplinary research team which worked together with livestock-keepers in central Nigeria, reports on PTD given in two recent workshops on this theme, and personal contacts with scientists who attended these workshops and are/were directly involved in participatory R &D programmes.

The paper reviews the origins of participatory technology development, seeking ways in which conventional and participatory R & D can complement each other. Case studies are drawn from the Philippines, Peru and Mali. The bulk of the paper is allocated to a discussion of techniques for initial orientation (including village brainstorming, investigating indigenous innovations, studying farmers' informal trials, diagramming, crop histories, board games and preference ranking) for technology development (including participation in trial design, experimentation with working models, innovative workshops and group scoring) and dissemination (including farmer-to-farmer workshops, community video and farmers'field days). The final sections contain useful lists of institutions and individuals working in participatory technology development.

Author's Abstract, extended

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Farming systems research and development
Asia, Philippines, systems-problem research, participatory method, marginal uplands, rehabilitation
LIGHTFOOT, C. et al.
A participatory method for systems-problem research: Rehabilitating marginal uplands in the Philippines.

Expl. Agric., 24, 1988, pp. 301-309

To improve the adoption of research findings by resource-poor farmers, "farming systems research" and its variants "farmer-first-and last" and "farmer-back-to-farmer" provide an alternative approach.

Rapid diagnostic methods have been developed but do not use systems tools to link biological and socio-economic relationships. Systems tools are especially important to FSR because farmers' problems are systems problems. They usually involve many components of the whole farm system.

Methodological questions remain on how exactly one goes about identifying farmer systems-problems, how these systems problems can be analysed and how this understanding leads to experiments.

The experiments developed first identified farmer systems-problems, second, analysed a key problem, and third, elaborated experimental hypotheses. Farmers participated throughout.

Initially, farmers were self-selected but later on random selection was used. While the methods are presented as three stages, in practice they flowed uninterrupted.

The research was carried out in three villages in the Philippines. These villages, whose combined population does not exceed 150 households, are located among rolling hills of infertile Alfisols. These brown acid soils are very poor in organic matter (3.0%) and phosphorus (29 ppm). Although the annual rainfall reaches 3000 mm an irregular dry season occurs between January and June. Between valleys of bunded rice, small plots of upland rice, corn, cassava, sweet-potato, coconut and banana break up the hills that are otherwise dominated by *Imperata cyclindrica,* locally known as cogon.

An informal random sample survey, guided by topics of inquiry and biological measurements that employed systems analytical tools, was used to obtain a farmers' perception of "systems-problems". Systems diagrams also provided a framework for searching and screening solutions. A sequence of vining legumes was tested in rehabiliting the marginal uplands. For this experiment farmers elaborated hypotheses on control of Imperata, recovery of soil fertility, and reduced labour costs in re-cultivation. Extensive research activity among the farmers indicates the value of this participatory method.

The method used encourages farmer participation. It also encourages the use of systems logic in identifying systems-problems, analysing systems, and elaborating experiments. Consequently, these experiments are very different from typical

cropping pattern trials which place priority on maximizing crop grain yield per hectare with high cash inputs.
The priority lies in the long term rehabilitation of cogonal land and in saving labour.
A more holistic systems logic also leads to differences compared to conventional cropping pattern trials.
A wider view of upland farming systems reveals that upland farmers not only cultivate many agroecological zones, but they do so on a crop-fallow rotation. Thus farmers are interested in the management of cogonal fallow land and not just the cropped areas.
More participation and a wider systems view than in conventional cropping pattern research undoubtedly produced important differences in both research topic and orientation of intervention.
Participatory methods that use farmer knowledge and systems logic are now solving problems that conventional cropping pattern research was incapable of addressing.

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Farming systems research and development
Review, book, ILO, rural women, developing countries, development, status, domestic role, policy
FETHEROLF LOUTFI, M.
Rural women unequal partners in development.

Publ. of the Int. Labour Organization (ILO), CH-1211 Geneva 22, Switzerland, ISBN 92-2-102389-3, 1987, pp. 75 + ix

Rural women are the most silent participants in the economic life of developing countries. Women in the lowest classes and castes are deprived by their poverty, illiteracy and ill health of the means to escape from a short life of drudgery and fatigue. A majority of the poor is female.
To achieve substantial growth in production depends partly on women, and progress toward more just societies must include greater equality for women. Any acceptable definition of development should include both material improvement and greater equity.
What it is aimed to highlight in this study is the nature of forces and of interventions that can facilitate an upward progression of women in their roles as workers and managers wherever the location in the spectrum of socio-economic-political change and development.
Yet, in general, women still posses less education and training than men, and what they do have is less suited to the labour market. Average earnings still tend to be lower: occupations with a high proportion of women offer lower average earnings. This creates inequities not only between men and women as individuals, but also between female-headed and other households. In virtually all societies women work longer hours than men for smaller rewards, and a great many women accept and even defend the systems that ensure their dependence and even exploitation. But Third

World rural women in the lower classes and castes are the most disadvantaged in that their work is the hardest and yet the least rewarded. Some of the factors which sustain this, and those which could sustain an improved reality, are the subject of this study.
The first step is to examine the nature of rural women's work in developing countries. Perceptions of status are then reviewed and discussed with a view toward their interrelationship with and impact on rural women's work. The importance for benefiting women of looking beyond the household to the individuals inside is explained. Then the effects of official policies on rural women are highlighted. Where governments intend to attack rural poverty, the neglected necessity of taking particular account of the strains on female-headed households is observed. Possible constructive policies in various sectors are mentioned, as is the role of food-for-work. The urgency of providing opportunities for increased cash earnings along with reducing work burdens is stressed. And the dependence of effective policies on the participation of rural women is explained. Finally, a more abstract view of some general realities applicable to all countries with respect to the dynamics sustaining unequal wage and occupational structures and those that could sustain equality is taken.
This monograph draws together the principal themes arising with respect to rural women's work, while also discussing some general realities concerning women in all societies. It aims to place official policies in perspective as well as indicate constructive directions. The emphasis on the participation and organisation of poor rural women is characteristic of the programme on rural employment in general.

295 89 - 2/55

Farming systems research and development
Latin America, Brazil, Asia, Indonesia, Thailand, CEBEMO, RTI, study, review, self-help promotion, objectives, methodology, promotion instruments, economics, holistic development approach
VERHAGEN, K.
Self-help promotion.

Royal Trop. Institute, Amsterdam/Cebemo, Oegstgeest, ISBN 90 6832019 X, 1987, pp. 152, Distributer: Foris Publications, P.O.B. 509, 3000 AM Dordrecht, The Netherlands

This publication is an integrated report of a study conducted by three nongovernmental organizations in Brazil, Indonesia and Thailand, coordinated by CEBEMO, on the promotion of economic activities in rural areas.
Cebemo is a Dutch organization for development co-operation, which, on behalf of the Dutch Catholic Community, acts as a channel of the joint financing programme of the Dutch Government. Cebemo finances initiatives of a developmental nature at grassroot level.

The basis of the activities of the Royal Tropical Institute is the collection and dissemination of knowledge in tropical countries, concentrated in three main programmes: rural development, tropical hygiene and transfer of knowledge. The relevant development projects in these fields are carried out preferably in combination with scientific research, education and training.
The study was carried by local NGO's partner-organizations of Cebemo, which in the present study have been termed Self-Help Promotion Institutions (SHPIs).
Promotion refers to the development task these SHPIs have set themselves, namely to facilitate the emergence and foster the functioning of cooperative-type organizations at grassroots level, known as Self-Help Organizations (SHOs).
Since the rural poor have become too numerous to be helped from outside, "self-help" has emerged as a new paradigm for combating rural poverty, and "self-help promotion" as the main orientation for local NGOs in developing countries.
Two key elements in this approach are fundamental:
- building upon what the rural poor have, rather than what they lack;
- Facilitating and promoting their organization.

The study is divided in two parts and 10 chapters:

This book is the result of a lot of research, reflection and discussion. It should therefore be studied by all those interested in rural development in general and self-help promotion in special.

296 89 - 2/56

Farming systems research and development
Africa, Rwanda, farming systems improvement project, problem analysis, trials, field day, information transfer, cover crops, organic farming systems, soil fertility, leguminous shrubs
YAMOAH, C.F. and R. GROSZ
Linking on-station research with on-farm testing: The case of agroforestry and organic matter-based cropping systems for the Rwanda farming systems improvement project.

Agroforestry Systems, 6, 1988, pp. 271-281

The Rwanda Farming Systems Improvement Project (FSIP) is located in the Ruhengeri Province in the northwestern highlands of the country. This area is noted for its high potential in agricultural production. It is one of the most densely inhabited areas in the country, with about 372 people per square kilometer.
Hillside farming with its attendant erosion and decline in soil fertility is commonplace in the area served by the Farming Systems Improvement Project. The project is designing landuse systems that check erosion, increase soil organic matter and restore soil fertility.
Agroforestry and organic matter-based cropping systems, using leguminous plants, are some of the promising interventions recommended to deal with accelerated soil degradation problems on sloping lands.
This paper reports the approach used by the Rwanda FSIP to involve farmers in the entire research process.
Problems were identified through review of secondary data, exploratory surveys with farm families, consultations with scientists who have Rwanda experience and direct communication with local administrators and key informants.
The interventions suggested were:
- tillage (zero and minimum)
- mulch systems (live and in-situ)
- manures and composts
- agroforestry systems
- inorganic fertilizers

Farmers were exposed for the first time to technologies such as alley cropping, green manure and mulch systems using various cover crops.
This event was also an opportunity to show communal extension agents how to use a field day as an effective communication tool to integrate farmers into their activities. It was, thus, a learning experience and a linking event for all three partners in the FSR/E approach, researchers, farmers and extension agents.
The use of leguminous shrubs and cover crops as nutrient sources are options that land-use experts think might solve the problem. There is a dearth of knowledge about the biological feasibility of these interventions in the project area.

297 89 - 2/57

Farming systems research and development
Latin America, national programs, cassava, on-farm research, intercropping, evaluation, production constraints, small-scale farmers
CIAT
El programma de yuca amplia la investigación en fincas. (Cassava program expands on-farm research).

In: Informe CIAT 1988, Centro Internaciónal de Agricultura Tropical, Aportado Aéro 6713, Cali, Colombia, ISSN 01120-3169, pp. 35-38

Cassava in terms of calories is the fourth most important crop grown in the tropics after rice, sugarcane, and maize. Social and technological changes and the developments in recent decades make it desirable and possible for cassava to be used in nontraditional ways. CIAT's Cassava Program, in response to these changes, aims to exploit the staple's potential by developing ways to increase its production and to refine its processing and marketing.
In Latin America cassava is a small-farmer crop and is produced under a wide range of cropping systems of varying complexity. Understanding production constraints and what factors influence the adoption of new cassava technology, requires appraisal of the entire production system.
The Cassava Program has intensified its collaboration with national programs in onfarm research in selected areas in Latin America. The research is conducted in the areas where production, use, and marketing pilot projects are operating.
For example CIAT and the Colombian Agricultural Institute (CCA) are working with farmers to simultaneously evaluate new varieties of both cassava and maize. They are looking at how they perform when they are intercropped, as well as testing ways to improve the selection, treatment, and storage of the cassava planting stakes. Promising cassava varieties are routinely evaluated with farmers within their production systems. The farmers' participation helps scientists identify factors that influence the adoption of new technology.
Three years on on-farm testing have shown that cassava yields are greater when intercropped with the new ICA maize varieties than when grown with traditional maize types. Maize yields, too, are higher when intercropped with new cassava varieties than with old.
In Panama, CIAT is conducting with IDIAP's (Instituto de Investigaciónes Agropecúarias de Panamá) on-farm research. A cassava production package was developed which, in addition to adapted varieties, had recommendations on weed control, soil management, and fertilization. Because the crop has proved to be economically successful, the Banco de Desarrollo Agropecúario de Panama is using this package as the basis for loans to cassava growers in specific areas.
In an ecological study made with CIAT, Paraguay's SEAG (Secretaria de Estado de Agricultura y Ganadería) identified the main cassava production systems at Paraguari and Caaguazu. Analysis of the

production constraints showed that onfarm research should focus on soil management at Paraguari and on intercropping with maize at Caaguazu.
These examples show that in on-farm studies the evaluation of intercropping systems and the understanding of production constraints are inseparable if new technology is to be successfully adopted by small-scale farmers. CIAT and national programs see the need to conduct further research if efficiency of currently practiced intercropping systems is to be improved.

298 89 - 2/58

Farming systems research and development
Review, handbook, extension, theory, practice, methods, developing countries, GTZ, BMZ, CTA
Manuel de vulgarisation agricole - bases théoriques et méthodes (Handbook for agricultural extension - Vol. 1 - Theoretical bases and methods).

BMZ/GTZ/CTA-Publication, 1989; available at CTA, Postbus 380, 6700 A.J. Wageningen, Netherlands

The handbook is aimed at all professionals who try to improve agricultural advisory services through appropriate developing measures. "Manuels de développement rural" is a series published by the German Ministery of Cooperation (BMZ) and the German Agency of Technical Cooperation (GTZ).
"The handbook of agricultural advisory instructions" appeared in French with the help of CTA. It is the first of a serial collection which attempts to give short and precise informations about practical technical help. Based on acquired experiences, Vol. 1 gives theoretical informations about agricultural extension, how to plan and realize it.
Far from being a "book of recipes", this manual doesn't give instructions, but informs about ways leading to solutions. It aims in a practical way at filling a gap, i.e. the lack of information and advisory publications for smallholders.
Vol. 2 which consists in working documents is not yet available in French.
Abstract from SPORE

299 89 - 2/59

Farming systems research and development
Africa, Ethopia, farming systems research, on-station research, extension, appropriate technologies, small farmers, methodology, socio-economic condition
GEDENO, G.
Farming systems research linkages with on-station research and with extension at Bako, Western Ethiopia.

Farming Systems Newsletter, 33, 1988, pp. 10-25

Farming systems research and extension (FSR/E) is used to develop and adapt appropriate agricultural technologies for small farmers in order to increase their productivity.
The major reason for ineffectiveness of conventional, station based agricultural research is its reliance on a top-down approach which neglects the socio-economic conditions of small farmers.
Farmers in Ethiopia are often found to be reluctant to accept most of the technologies offered. The body of knowledge available from on-station research is useful for FSR/E. Some of the findings can be used with only slight modifications.
This paper describes the integration of OFR/E with on-station research and with extension, as they relate to Bako, Western Ethiopia.
The FSR/E programme's surveys and on-farm experiments have produced useful feed back for the on-station research programme and the on-station researchers are responding to the problems identified. From the on-farm experimentation there is a new recommendation available on fertilizer rate for maize and a tentative recommendation on intercropping forage crops with maize and sorghum varieties for producers' cooperatives. These recommendations were only possible due to on-station research results. Without a strong on-station research programme effective on-farm experimentation is not possible.
The collaboration and understanding between FSR/E and on-station researchers is progressively improving. For further improvement, the suggestions made to improve the integration of FSR/E with the on-centre research and extension should be given due attention. In contrast the progress made in FSR/E and extension linkage is limited.
The staff of the two organizations are physically separated and have their own programmes to follow. The organizations should develop a common interest and reconsider the importance of a strong institutional linkage to work out the problems.

300 89 - 2/60

Farming systems research and development
Report, farming systems research, extension, implementation, monitoring, women's contribution, subsistence farming, agricultural productivity
STRING, A.
Trials and errors: using farming systems research to reach farmers who are often neglected.

In: Farming Systems Reseach, Vol. III, No. 079, 1986, pp. 21

Although a large percentage of subsistence farming is conducted by women, agricultural extension and training programs have traditionally neglected them. This report suggests that because FSR is farmer-based, it may help researchers to recognize and nurture women's contributions to overall agricultural productivity.

In-depth analysis is made of soybean demonstrations and farmer trials in Malawi, where 50-70 of all smallholder farm operations are conducted by women, to determine whether the acceptance of new technologies is gender-related. Farmers were instructed in soybean cultivation techniques, and the level of acceptance and effects of the new technology were assessed. Constraints such as poorly adapted seeds and ineffective inoculants were not gender-related and affected all farmers equally; however, women had poorer crop yields than male farmers due, it is argued, to the lack of agronomic training given to women. The soybean project demonstrated: (1) that women are agriculturalists and interested in new technologies; (2) the importance of interaction between research and extension, farmer-oriented technical information, and an instruction methodology involving demonstrations and corrections; and (3) that further work is needed to include female farmers in agricultural development and training programs and to improve working relationships between female farmers and extension agents.