

Agricultural Administration Unit
Occasional Paper 8

Training and Visit Extension In Practice

edited by John Howell

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Gershon Feder and **Roger Slade** are economists at the World Bank. They have jointly authored several other papers on agricultural extension and both are widely published in other fields of agricultural economics.

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Introduction

John Howell

In the literature on agricultural development in tropical countries, the role and performance of extension services warranted relatively little attention (relative, for example, to the role of credit, land reform or research) until the late 1970s when donors, particularly the World Bank, encouraged higher levels of investment. This investment was largely in the area of publicly-provided advisory services to small farmers cultivating a wide range of crops.

We need to dwell on the previous sentence for a moment as it defines the subject of this book. The recent level of interest has been in *Ministry of Agriculture field services*, which has meant a strong emphasis upon crop production activities: other, frequently non-Ministry, activities (livestock, fisheries, soil conservation, forestry, food processing, for example) have been less subject to investment in extension activities. Interest in extension has also focussed on *technical aspects of agriculture*. Although there is still a strong tradition of 'rural extension' (in Francophone Africa and Latin America for example), the general trend has been away from the multi-purpose extension activity which has stressed community development, adult education and the wider welfare and non-farm income aspects of agricultural development. Finally, there has been little *new* emphasis upon what have been the most successful agricultural 'extension' efforts — those which involve the integrated provision of extension, input supply, marketing and processing services for specific commodities and registered growers (ie the tea, cotton, rubber schemes often operating *outside* the Ministry of Agriculture).

In his seminal work on agricultural extension, Ted Rice drew the distinction between the extension *function* (involving many more agents than Ministry field staff in the process of disseminating

information) and the extension *service* itself (which may undertake, in practice, a wide range of 'non-extension' activities). The term 'agricultural extension' in this book is primarily used in the context of Ministry of Agriculture field services and it concentrates on the technical advisory, or 'extension', work of those field services.

Over the last ten years, agricultural extension has undergone major changes as a large number of countries, led by India, have reorganised their extension services. This reorganisation has been based on the view that most countries have a large, poorly-utilised, resource of field-level workers whose productivity — and thus impact on farm production — could be substantially enhanced by regular upgrading of technical skills, concentration upon a narrow range of tasks, and more regular contact with farmers. This approach — the Training and Visit approach — has also involved external donor support for the *infrastructure* of extension. Ministry facilities have been upgraded, research and specialist services become securely financed and input supply mechanisms improved.

However, as Judd, Boyce and Evensen have shown, it is not the case that all low-income countries previously neglected investment in extension. Using as an indicator the percentage of spending on extension to the domestic value of agricultural product, they have shown, for example, that sub-Saharan Africa — until the early 1970s — was investing more heavily than any other region, including North America. Yet the decline in importance of extension in the 1970s was only partly a matter of public expenditure priorities. More important had been the perception of the declining effectiveness of extension services. This decline is impossible to quantify, although the weight of first-hand assessment in the 1980s is difficult to contradict. In country after country the views of donor missions and Ministry of Agriculture officials (see Chapter 3) showed that extension services had been failing to support farmers adequately because staff were deficient in technical knowledge and lacking in the facilities to provide regular support.

In Africa, the major shift into extension investment was led by the Nigerian Government which used World Bank loans to instigate a series of extension-credit-input supply projects from the late 1970s. In the 1980s, governments in Eastern and Central Africa have used loan and grant finance to support more extension-specific projects, normally employing the Training and Visit approach. By 1985, the World Bank alone was financing over 50 projects in sub-Saharan Africa (Baxter) with a substantial extension component for which

bilateral donors such as ODA and USAID have provided parallel grant support.

What has been the impact of this new level of investment? In looking at the economic returns to public investment in extension, it is difficult to attribute increases in production or incomes to extension *per se*, especially where investments are accompanied by changes in pricing policy or, for example, by the release of a number of new varieties. It is even more difficult to attribute, within the factor of 'improved extension', the precise weight to be attached to management — regular farm visits, narrowing of duties, organised training sessions etc. Some evidence of improved agricultural output exists (see Slade *et al.* and Chapman for example) and only the severest sceptic would claim that recorded increases have been entirely unaffected by improvements in the deployment and management of field staff. Yet any arguments are unlikely to be conclusive. Even if extension in the broadest sense can be shown to have had a major impact on output, it remains very difficult to argue that the critical factor has been the particular mechanisms of publicly-provided technical advice (rather than the farmer-to-farmer promotion of newly-available technologies for example).

A more interesting outcome of the new level of investment has been the way that attention has shifted from some of the earlier controversies over Training and Visit (such as the use of contact farmers, and the insistence on dropping input supply responsibilities from extension agents' work programmes) towards questions of the appropriate role of extension in different environments, the financing of services and the links between extension, research, and farmer knowledge. In this way, the interest in extension has also moved from simply looking at extension impact, towards examining the wider context in which extension operates and towards some of the specific conditions under which extension is likely to prove effective and capable of being sustained financially.

For example, much of the literature on extension has assumed the major challenge is in the relatively low-input, traditional systems of production operating on the margins of the supply or modern technologies. As Byerlee's paper shows, there is likely to be a much more buoyant demand for technical and farm management advisory services in post- 'green revolution' agriculture. On the other hand, in the papers by Cousins and Sutherland, there is particular interest in the role of extension where the major agricultural challenge appears to be in the design and conduct of research in agricultural systems which

remain poorly-understood and, in some respects, resistant to conventional extension approaches based on a series of crop recommendations.

In the final chapter, I attempt to set out what appears to be the general consensus on the role and management of agricultural extension which has emerged following a period of controversy over the T and V system (and the role of the World Bank in promoting it). The 'general consensus', however, does not represent much more than a clearing of the ground so that attention can be focussed where it properly belongs — on the complementary measures, in the system of public support for agriculture as a whole, that are necessary to sustain any improvements in extension services. These 'external' measures concern particularly the areas of research and extension collaboration, the development of support services to extension, and mechanisms to ensure that extension is appropriately financed. The management of extension services themselves nonetheless remains an area of considerable importance not least because it often provides an entry point for external assistance and because it is often a condition for financial support. In the concluding chapter I also attempt, therefore, to set out what appears to be a measure of agreement on the 'internal' conditions of effective extension.

The book as a whole reflects the work of members of ODI's Agricultural Administration (Research and Extension) network which I organised until 1987 and which, over the previous five years, concentrated on agricultural extension management. Two of the five papers (Sutherland, Slade *et al.*) first appeared as network discussion papers, and some of my own ideas first appeared as a discussion paper in 1984 as 'Conditions for the Design and Management of Agricultural Extension'. The paper by Cousins appears for the first time and Byerlee's paper is adapted from work originally undertaken at Michigan State. Some parts of the concluding chapter are drawn from a paper I prepared in 1984 for a World Bank workshop on Extension and Research in Kenya.

1

Agricultural Extension and the Development of Farmers' Management Skills¹

Derek Byerlee

An enduring theme in agricultural development theory over the past two decades has been Schultz's (1964) contribution on the efficiency of small farmers in traditional agriculture in allocating their resources and responding to price incentives — the poor-but-efficient hypothesis. This laid the theoretical justification for the high pay-off input, or science-based model of agricultural development, exemplified by the green revolution. A further implication of the hypothesis was that there were low pay-offs in traditional agriculture to extension and farm management efforts to encourage farmers to use existing technology more efficiently (Staatz and Eicher, 1984). In the two decades since Schultz's book was published, the rapid uptake of improved varieties and fertilizer technology has transformed the agricultural landscape in large areas of Asia where the image of a traditional subsistence agriculture no longer holds. The green revolution has also highlighted the role of agricultural research — especially plant breeding research — in stimulating technological change.

But the very success of the green revolution with its emphasis on technical change may have drawn attention away from the importance of the human element in agricultural development (Jones, 1978). In particular, the widespread acceptance of the Schultz hypothesis has led to a relative neglect of efforts by research, extension and farm management to increase economic efficiency in farmers' resource use, and insufficient emphasis on upgrading farmers' technical skills and managerial ability.² The very assumptions underlying the hypothesis — that farmers in traditional agriculture have evolved over a long period an efficient system through accumulation of experiences and an intimate knowledge of their environment — have become outmoded

by the rapid process of change introduced by the green revolution. Indeed, Schultz himself has persuasively argued that in a dynamic agriculture, farmers are continually in a state of disequilibrium and that there are high returns to better information and skills to improve farmers' economic efficiency (Schultz, 1975).

This paper argues that two of the major sources of agricultural growth in the past two decades in Asia — the spread of modern varieties and rapid increases in fertilizer use — have already been substantially exploited. A new and more complex second generation of inputs and management practices plays an increasing role in productivity growth, and investments in better information and skills of farmers to improve economic efficiency in using this wider array of inputs are needed to maintain the momentum in post-green revolution agriculture.

This paper is organised as follows. First, the increasing complexity of crop management issues facing small farmers in post-green revolution regions is described. Second, evidence of economic insufficiencies in resource use and the importance of farmers' information and skills in reducing these inefficiencies is briefly summarised. This leads to a discussion of institutional changes in research, extension and rural education aimed at improving information and skills of farmers and their implications for development strategy in the post-green revolution era.

Increasing Complexity of Crop Management

The green revolution involved widespread and rapid adoption of semi-dwarf wheat and rice varieties, especially in the decade 1967-77, that in turn, stimulated adoption of two other key inputs — nitrogenous fertilizer and improved supplies of irrigation water. By the mid to late 1970s, high yielding varieties had been fully adopted in many environments, especially in irrigated areas of Asia. However, genetic gains in *yield potential* in successive generations of improved varieties have slowed and an increasing proportion of plant breeding research in wheat and rice is now devoted to 'maintenance research' to protect yield gains against breakdown of pest resistance (Plucknett and Smith, 1986),³ and to adapt modern varieties to less favourable environments.

A similar situation also holds for the two other major inputs — nitrogenous fertilizer and water. Fertilizer levels steadily increased rapidly for several years after adoption of high yielding varieties and

explained much of the agricultural growth in the 1970s in Asia and Latin America (Scandizzo, 1984). Fertilizer levels are now increasing much more slowly. Investment to augment the resource base, especially irrigation facilities, is also slowing as only the more difficult and, hence, the more expensive investments remain.

Yet although the major sources of growth during the green revolution era have to a large extent been exploited, especially in better endowed irrigated areas, most observers agree that there are substantial opportunities to increase productivity through increased yields, reduced costs, and improved cropping systems. These opportunities largely depend on non-genetic gains in productivity through use of new inputs and more efficient use of existing inputs to exploit the genetic potential of existing varieties.

A wide array of 'second generation inputs' offers the opportunity to substantially increase productivity but at the same time greatly increase the complexity of crop management. For example, in irrigated wheat in Pakistan, farmers now commonly purchase five inputs — tubewell water, nitrogenous fertilizer, phosphatic fertilizer, tractor power and thresher services — none of which were in wide use two decades ago. In addition, an increasing number of farmers, especially in the Indian Punjab and in northwest Mexico use potash fertilizer and micro-nutrients, soil amendments, seed treatment for disease control, improved on-farm water management methods including precision land leveling, and more precise planting methods and spacing. Higher yields and increased cropping intensity also lead to increased crop losses from pests (in absolute terms) and pesticide use has become widespread, especially in rice.⁴ At the same time, improved water supplies, earlier maturing wheat and rice varieties, and in some cases, selective mechanisation, have greatly expanded the opportunities for multiple cropping which require management of complex double and triple cropping patterns that sometimes includes new and unfamiliar crops.

In these evolving production systems, crop management is generally complex. Changes in practices required to sustain increases in productivity, while still quite profitable, do not provide the spectacular economic returns characteristic of the first round of inputs adopted during the green revolution. Hence, their successful adoption is more sensitive to the efficiency with which they are used by farmers. The wider array of technological options available and the interactions between them, requires farmers to identify a logical stepwise sequence for adoption that fits their agro-climatic and socio-economic

circumstances. Interactions between technological components may also require adjustment in traditional inputs such as seed rates.

In multiple cropping sequences with two or three crops per year, management complexity is also increased by the need to sometimes make simultaneous decisions on management of each crop in the sequence. For example, in the cotton-wheat rotation of Pakistan, the potentially positive effect of introducing earlier cotton varieties on planting dates for wheat following cotton was largely cancelled by farmers' rapid increase in pesticide use for cotton which increased cotton yields and delayed the cotton harvest (Byerlee, Akhter and Hobbs, 1987). Likewise, crop rotation in more intensive cropping systems often plays a critical role in managing pest populations.

In addition, the technical environment in which these management decisions are made is unlikely to remain static. Increased yields and cropping intensity tend to deplete soil potassium and micro-nutrient reserves and lead to responses to application of these inputs. Application of phosphatic fertilizers has substantial carryover effects that eventually allow the application of lower maintenance doses. Control of broadleaf weeds in wheat reduces the competition for grassy weeds whose increasing population demands control measures. Increased supplies of tubewell water and higher cropping intensities complicate water and salinity control management in irrigated areas of South Asia. Unless farmers keep abreast of these changes in the technical environment, productivity may *decline* over time due to depletion of soil nutrients or pest build-up in intensive cropping systems.⁵

The second generation inputs often require more information and skills for successful adoption than the earlier introduction of new varieties and nitrogenous fertilizer (Kahlon, 1984). While the semi-dwarf varieties, especially for wheat, are well known for their adaptability over a wide range of environments, the use of more complex fertilizers and pesticides often interacts strongly with variation in soil type and with year-to-year variation in climate and pest incidence. Hence, individual farmers need to adapt the technology to their own requirements and frequently there are substantial returns to managing inputs for individual fields and seasonal conditions *within* a farm.

Technical skills required to use the new inputs efficiently are also much greater than for a simple varietal change. An extreme example is use of integrated pest management (IPM) in rice in Asia. While the practice has potentially high returns to farmers and to society, it

requires skills in identification of pest insects and beneficial insects, quantification of pest populations and damages, knowledge of threshold levels of pest damage, and skills in selecting the appropriate chemical, calculating the dosage and applying the product (Goodell, 1984). Management complexity is further increased by the wide variety of inputs available. For example, one survey of 150 rice farmers in the Philippines recorded 38 different insecticides being used by farmers, many of them similar products under different names (Litsinger *et al.*, 1980). Even the number of new wheat varieties available to farmers has tended to increase in order to provide different maturities to fit multiple cropping systems, and to reduce the risk of disease epidemics.

Hence, effective crop management in this post-green revolution era places heavy demands on the information and skills of farmers. In traditional agriculture, information is primarily generated internally by farmers. Although management in traditional agriculture is often complex, gradual changes in the resource base and the external environment, especially through population growth, allowed an evolution of farmer management to incorporate these changes based on farmers' knowledge of their environment accumulated over generations of farming. In the new science-based agriculture, however, the value of traditional knowledge rapidly depreciates as new inputs and cropping patterns are introduced.

In addition, the spread of semi-dwarf varieties was very rapid as new seeds and information passed from farmer to farmer, with minimal support from extension services after early adopters had taken up the technology. However, information flows from farmer to farmer for the second generation inputs are slower and less effective, since a much greater range and complexity of information and skills are needed.

In many post-green revolution areas, decision-making complexity in smallholder agriculture is now closer to the situation of farmers in industrialised countries (the levels of biochemical technologies are similar) than the image of traditional agriculture commonly held for farmers in developing countries. Just as farmers in industrialised countries have moved from a science-based to an information-based agriculture (Sonka, 1985), small farmers in the post-green revolution era are also entering this 'information age'. However, unlike farmers in industrialised countries who have had a relatively long period to adjust to a science-based agriculture, the increased demands on knowledge, technical skills, and managerial capacity of post-green revolution farmers, most of whom used practically no purchased

inputs two decades ago, has been collapsed into a very short period of less than two decades.

Information, Education and Economic Efficiency

The green revolution in the 1960s and 1970s spawned a large number of studies of the adoption of the new varieties and fertilizer and their equity implications (for reviews, see Lipton and Longhurst, 1985; Herdt and Capule, 1983; Ruttan and Binswanger, 1978). Until recently, however, there were few studies on the development of farmers' knowledge and managerial skills and the *efficiency* with which the new technology was used once adopted.

There is increasing evidence that farmers' technical knowledge is inadequate to use post-green revolution technologies effectively. In the mid-1970s, Bernstein (1977) surveyed farmers' technical knowledge of 50 management practices judged by rice scientists to be 'critical for the farmer to achieve maximum input efficiency' (Bernstein, 1977, p.191). These included age for transplanting modern varieties, appropriate depth of standing water for herbicide use and appropriate insecticides for given insect pests. Out of a maximum score of 12, farmers averaged 5.7, suggesting substantial scope to increase farmers' technical knowledge. Recent surveys in Pakistan (Heisey *et al.*, 1987) show that most farmers, even after nearly two decades of experience with modern wheat varieties and fertilizers, were not able to compute nutrient doses, especially for phosphatic and compound fertilizers. They had inadequate knowledge of newer varieties and their characteristics, and most were unaware of the potential breakdown in rust resistance of wheat varieties. In northwest India, where more effective extension has been in place, farmers' knowledge appears to be much better, but away from these areas, farmers' information scores for modern inputs are generally poor (Feder, Slade and Sundaram, 1986; Srivastava, 1976). Deficiencies in farmers' technical knowledge generally increase with increasing complexity of the practice (Mayani and Kumar, 1980). In particular, information on plant protection is generally poor.

Deficiencies in technical knowledge are reflected in relatively low technical efficiency in many areas of Asia. Production function studies from post-green revolution settings in Asia show that on average, farmers could increase output by 20-50%, given existing resource use.⁶ The major factors explaining differences in efficiency between farmers were variables measuring farmers' information and skills such as

education age, experience, contacts with extension agents, and technical knowledge. More detailed evidence on technical efficiency at the farm level is provided by multi-disciplinary studies that combine the insights of agronomists and economists and integrate on-farm survey and experimental data. In research on irrigated wheat in Pakistan (Byerlee *et al.*, 1986) and rice in the Philippines (Herd and Mandac, 1981), a complex of factors (such as soil type, availability of irrigation water, pest incidence, plant density, crop rotation, planting date, and nutrient balance) are shown to explain variation in yields between farmers. In addition, both studies estimated that the average yield gap between what would be profitable and feasible given existing technology and farmers' current yields was 30-40% in each case and much of this gain can be achieved within existing expenditure levels by a better mix and timing and method of application of inputs. Deficiencies in technical knowledge and skills of farmers were identified in both cases as important factors determining productivity levels.

In both of the above case studies the productivity gap was expressed through a yield gap between farmers' actual yields and economically feasible yields. In several post-green revolution areas (eg. parts of the Indian Punjab, northwest Mexico, central Luzon of the Philippines) farmers' yields are now close to the potential (eg. Kahlon, 1984; Byerlee and Longmire, 1986). Here better information may substitute for high input use in the form of more efficient use of fertilizer in multiple cropping patterns or in integrated pest management to reduce pesticide use. For example, Kenmore (1986) estimates that 50% of insecticide applications in rice in southeast Asia are unnecessary, while a similar situation holds for fertilizers and pesticides in wheat in northwest Mexico.

It is also now widely recognised that formal schooling helps develop the technical and managerial skills needed for a science-based agriculture (Schultz, 1975; Welch, 1978). Education may increase farmers' ability to acquire and evaluate information, and enhance technical skills (eg. in computing dosages) as well as improve farmers' ability to adapt to changes in the environment. Farm-level studies show consistent and high returns to education in modernising agriculture, especially in Asia (Jamison and Lau, 1982). There is thus strong evidence of the importance of education in farmer efficiency in post-green revolution settings.

In sum, the evidence from farm-level studies points toward substantial opportunities to increase productivity through

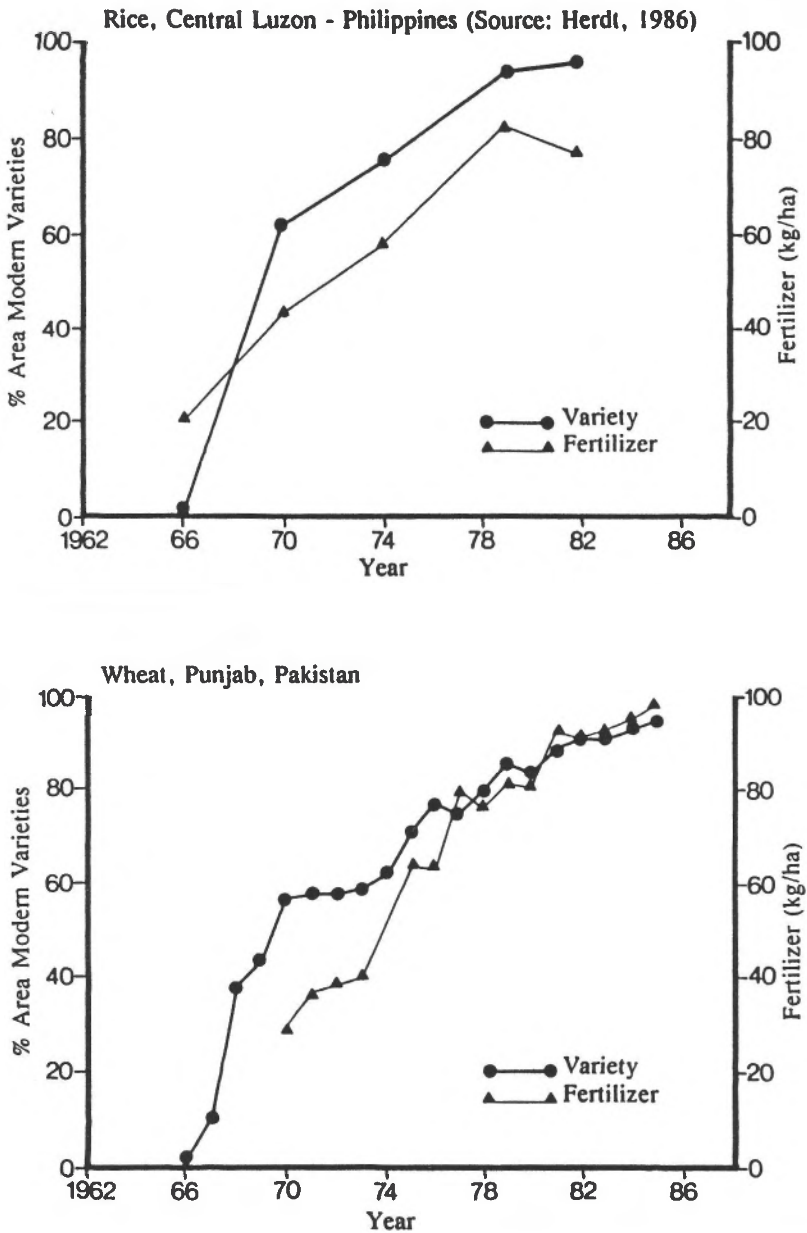


Figure 1. Changes in area under modern varieties and fertilizer applied to wheat in Pakistan's Punjab and rice in Central Luzon, Philippines.

improvements in economic efficiency, given existing technology and resource levels. Inadequate technical knowledge, as well as lags in adjustment in a dynamic environment related to deficiencies in human capital, limits farmers' ability to exploit these opportunities to improve economic efficiency.

The Formal Information System

The constraints on improving productivity analysed above reflect inadequacies in rural institutions — agricultural research, extension and education — that participate in the development and dissemination of information and skills to farmers. This set of institutions can be termed the formal information system.

Agricultural research can generally be divided between applied research to generate new technology and adaptive research to provide improved technical information for farmer decision making. Yet according to a recent World Bank review, adaptive research is generally 'the weakest, most neglected and most confused aspect of national research systems' (World Bank, 1985). This is in contrast to the relative strength of applied research, particularly plant breeding research where most countries now have reasonably well-established plant research programmes for major food staples capable of sustaining a continuing flow of improved varieties.

The weakness of adaptive research efforts reflects the common approach of conducting a series of well controlled experiments (usually on the experiment station) and then to issue technical information in the form of recommended 'packages' of practices for large heterogeneous groups of farmers. Typically, each discipline — agronomy, soil fertility, weed science, entomology, water management, etc. — develops recommendations for practices related to that discipline and these are then 'packaged' without considering interactions either between technological components or between commodities in the farming system. Social scientists who might contribute to the identification of farmer problems and relevant solutions have typically not been included in this research process.

These problems reflect less the quantity of adaptive research (although expenditures on applied research have probably expanded more rapidly than expenditures on adaptive research) than the quality of research. For example, thousands of fertilizer experiments are conducted annually yet fertilizer recommendations in many countries still lack relevance to farmers' circumstances (Eklund, 1983).

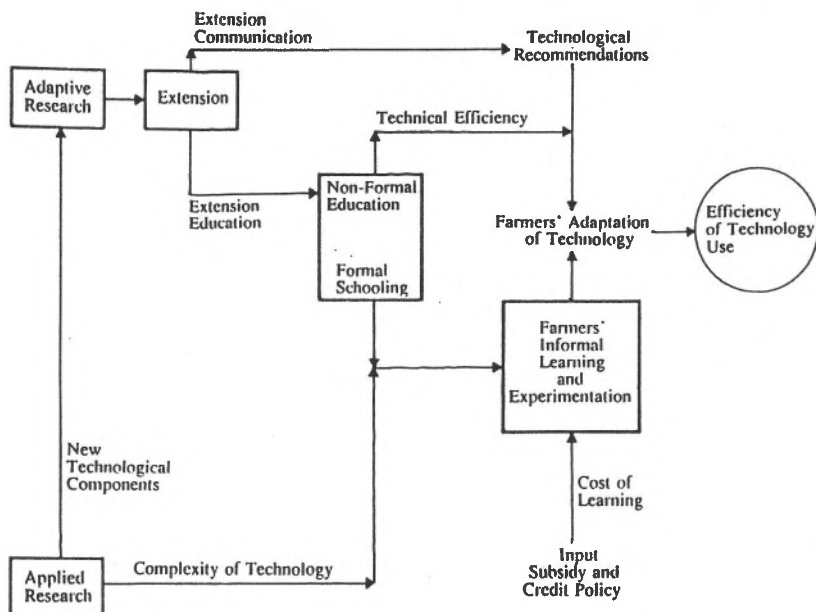


Figure 2. Components of farmers' information and skill system.

The poor quality of technical information provided by adaptive research is often compounded by weaknesses in the quantity and quality of extension advice. Extension has often been assigned a secondary role in the post-green revolution era. The rapid spread of the new seeds and fertilizer from farmer to farmer with only minimal input by extension seemed to bear out the image of the small farmer as poor-but-efficient and to downplay the role of extension.

The research system has also encouraged extension methods based on a 'recipe' approach to crop production whereby farmers are exhorted to use a rigid technical package which assumes that fixed technical coefficients apply to all farmers, fields and seasons. Typically this formula has also stressed information on types and quantities of inputs aimed at increasing yields through use of higher levels of inputs. Opportunities to increase efficiency *within existing resource levels* have largely been neglected. Emphasis on communicating recipes has also been at the expense of broader extension education to improve farmers' understanding of new technology and enhance farmers' technical skills.

However, extension agents often lack the basic skills needed by farmers for effective management of modern inputs. Training courses run by IRRI (Matheson, 1984) and CIMMYT (in Pakistan) have both observed that most extension entrants to these courses are not able to calculate dosages correctly for even basic inputs such as fertilizers, nor are they knowledgeable of the appropriate pesticide for a given pest.

These weaknesses in the extension system account for the rather variable findings on the returns to extension in developing country agriculture (Perraton *et al.*, 1983; Huffman, 1978; and Lockheed *et al.*, 1980). Without an effective 'formal' information system represented by adaptive research and extension, a large part of the burden of technology adaptation has fallen on farmers' own informal learning-by-doing. Not uncommonly, farmers are ahead of the research and extension system in technology adaptation (Biggs and Clay, 1981). However, this 'informal' system is inadequate to keep pace with the complexity and dynamics of post-green revolution agriculture.

Recent Innovations in Adaptive Research and Extension

The emergence of a continuing stream of new technology and the opportunities to improve productivity through increasing the technical information and skills of farmers has led to institutional reforms in adaptive research and extension. A major innovation in recent years has been the farming systems approach to adaptive research that emphasises a strong farmer focus and problem-solving orientation to research (Simmonds, 1986; Byerlee, *et al.*, 1982). Adaptive research programmes based on farming systems perspectives are being tested or have been adopted in most countries and promise to increase both the quality and quantity of technical information for farmers.

Returns to adaptive research conducted with a farming systems perspective are potentially high (Martinez and Sain, 1983). Returns are expected to be especially high in the irrigated post-green revolution areas, where a substantial amount of technology is available to be 'adopted' and 'adapted'. Moreover, the relative uniformity of irrigated areas ensures that information generated will be relevant to a large number of farmers. To meet the complexity of crop management decisions, adaptive research programmes increasingly provide recommendations conditional on specific field characteristics (eg. land type, crop rotation) and seasonal pest and weather conditions. However, even adaptive research programmes based on a farming systems perspective do not have well developed mechanisms by which the main client of the research, the small farmer, can formally or

informally pressure research institutions to address their problems.

The most important recent innovation in extension systems is the T and V system. Early experiences with the T and V system indicate mixed successes. Feder, Lau and Slade (1985) estimated a 6-7% increase in wheat productivity in Haryana State of India due to improved technical efficiency attributed to introduction of the T and V system. Preliminary data from some other states of India (Shingi *et al.*, 1982; Benor, Baxter and Harrison, 1984) as well as from Nepal (Jamison and Moock, 1984) support these findings. However, other observers in India (Moore, 1984; Howell, 1984) note that extension advice is still not relevant to many farmers and quantitative targets for farmer contacts are emphasised over the quality of information disseminated. Elsewhere, the results are less encouraging. Khan *et al.* (1984) found no effect of the T and V system in Pakistan's Punjab on either productivity or knowledge of farmers. The lack of a strong adaptive research programme may partly explain the failure of the T and V system in Pakistan.⁷ Overall, the experience with T and V extension may be too short to draw definite conclusions.

A major weakness of the T and V approach is its emphasis on communicating messages or recommendations to farmers. A major challenge of the extension in post-green revolution agriculture is the need for farmers to have a better understanding of new technology and improved technical and managerial skills. In post-green revolution areas these principles and skills include diagnostic skills on factors reducing yields, technical knowledge of chemical inputs such as residual effects or downside risks from untimely application, as well as specific technical skills such as calibration of knapsack sprayers or computation of nutrient doses for compound fertilizers.

The shift in extension emphasis from a communication role to more of an educational role requires continual upgrading of the quality of extension staff.⁸ One successful example, has been training in the complex principles of integrated pest management for rice in several countries in southeast Asia (Kenmore, 1986). It is significant that a large part of this programme was devoted to field-oriented training of both extension agents and farmers in broad principles of pest management as well as specific skills in pest identification, subjective scoring of pest densities and pesticide use.

Rural Schooling

Beyond adaptive research and extension systems, the other major source of increasing knowledge and skills for a scientific agriculture is

rural schooling. Expenditures on rural education have been one of the fastest growing sectors in the developing world and primary school enrolments have increased steadily. Studies of economic returns to education also generally show attractive pay-offs to investments in basic education generally (Colclough, 1982) and agriculture, specifically (Jamison and Lau, 1982). To the extent that these national figures reflect expenditures and returns in rural areas where the majority of the population resides, it would be easy to conclude that institutional changes are already underway in the educational sector to meet the growing need to increase the general educational level of farmers. However, these data are misleading for two reasons. First, there are still large numbers of farmers in post-green revolution areas, especially in South Asia, who lack basic numeracy and literacy skills. Adult literacy rates in rural areas of Pakistan, Bangladesh and Nepal average 25% or less and in northwest India are less than 50%. Even if most of the children of these farmers attend school and complete a basic education it will require at least another generation to achieve a minimally educated population of farmers. Added to this is the problem that drop-out rates even for primary schooling, are often close to 50% in rural areas. Second, there is now growing concern that the quality rather than the quantity of education may be a major limitation (Behrman and Birdsall, 1983; Heyneman, 1983). Educational quality is difficult to measure and even more difficult to relate to agricultural productivity. Evidence on returns to higher levels of education (presumably a proxy for quality, at least for basic numeracy and literacy skills) is scanty and conflicting for agricultural settings. Increasing complexity of crop management in post-green revolution agriculture is expected to lead to increased returns to quality and level of education. For example Heyneman (1983) has expressed educational requirements for different levels of agricultural technology that suggest a minimum of lower secondary school education for much of irrigated Asia.

The Policy Implications

The critical importance of farmer information and skills in maintaining productivity increases in the post-green revolution period has far-reaching implications for the design of agricultural development strategies:

- a) Within the formal information system of the public sector, there

needs to be a balanced investment in adaptive research, extension and education to exploit the complementary and substitution relationships between these different types of investments.

- b) The role of the private sector (input suppliers or specialised information markets) in complementing and eventually substituting for public sector information services has to be addressed.
- c) Improving farmer information and skills must be balanced against other technical and economic policies that can substitute for the formal information and skill systems either through reducing the cost of farmers' own informal learning and experimentation, or through applied research efforts to develop less management-intensive technologies.

Integrating Research, Extension and Rural Schooling

Farmers in post-green revolution agriculture require a farm information and skill system that (a) generates and communicates useful technical information on a continuing basis, (b) develops farmers' understanding of new technologies, (c) develops farmers' technical and managerial skills, and (d) provides basic literacy, numeracy and cognitive skills.

A policy question is the relative priority that needs to be given to each institution and function at different stages of development, and in particular in the post-green revolution era. Much depends on the extent to which the various elements are regarded as substitutes or complements.

Given the management intensity of many second generation technologies, adaptive research and extension are expected to be highly complementary. Increasing amounts of information generated by adaptive research programmes will be wasted or will diffuse too slowly (and possibly become outdated) without a strong extension input. Likewise, extension programmes will have little impact if they do not have useful and relevant information to extend. To exploit their complementarity, adaptive research and extension must be closely linked. One of the major problems in most countries is the lack of effective linkages between research and extension (eg. World Bank, 1985; Howell, 1982a). Often they are institutionally separated, with extension in the Ministry of Agriculture and research in a parastatal organisation. Differences in incentives and prestige also undermine working relationships. Many research systems, believing that there is a

wide 'technological gap' that is not being effectively addressed by existing extension systems, have established their own technology transfer and extension activities, such as the 'Lab-to-land' programme in India and 'crop maximization' programmes in Pakistan (Mohammed, 1984).

It is a feature of both the farming systems perspective in adaptive research and the T and V extension system that they emphasise close research-extension linkages, especially in verification of technology at the farm level. Researchers are also expected to play a leading role in upgrading the knowledge and skills of extension workers through training programmes. Despite this emphasis, poor linkages between research and extension remain a major weakness of most farm information systems. This weakness is most apparent in feeding back information from farmers via extension to research. A client-oriented extension system with farmers able to influence extension performance (eg. through farmer associations) and extension able to influence research priorities is probably one of the most effective models for farmers to exert pressure on research (eg. Lionberger and Chang, 1970 for Taiwan).

Whether extension and formal schooling are complements or substitutes is also a critical policy question. The relationship between them is likely to be quite complex. To the extent that extension emphasises its communication function, farmers receiving the information may use it more effectively if schooling helps them to understand the rationale behind the recommendation. Where extension emphasises its educational role, it could also partly substitute for formal schooling. However, in either its communication or educational role, the *cost* of extension should be significantly reduced by competencies in literacy, numeracy and cognitive skills imparted through schooling. Hence, extension could be substituted for education in the early stages of development, but diminishing returns will soon be reached unless there are advances in basic education. In a dynamic agriculture where extension advice is subject to rapid depreciation, the viable skills will be those of 'learning to learn' imparted by formal schooling (Welch, 1978). Thus better educated farmers can exploit a wider range of information sources. At the extreme, the role of extension may decrease for highly educated farmers who have access to a wide range of alternative sources of information.

Where educational levels are very low, especially in south Asia, there is a danger that even if recent institutional innovations in

research and extension are successful, the low level of education of most farmers will be a binding constraint on rapid increases in productivity in the medium term. Formal schooling is a long-term investment that will only affect the productivity of the next generation of farmers. In post-green revolution areas, dramatic changes in managerial requirements have taken place within one generation of farmers, as shown by the wide array of purchased inputs already adopted or in the process of adoption. The question then arises about the role of adult education programmes as a means for effecting short run improvements in general educational levels. Some limited evidence exists that adult literacy classes have positive effects on agricultural productivity (Fuller, 1983; Jamison and Lau, 1982) but as yet too little is known about the specific products of formal schooling that increase agricultural productivity, and the extent that these outputs can be transmitted through adult education programmes.

The Private Sector

In industrialised countries the private sector plays a major role in the generation and transfer of better technical information to farmers through its own adaptive research programmes, advertising, promotion and demonstration programmes; dissemination of information through input suppliers and by providing specialised information services (eg. magazines, consultants, soil testing services etc.). In post-green revolution areas, the private sector has often been slow to adopt these roles, despite the rapidly increasing use of purchased inputs and the associated demand for better information. The most obvious opportunity for the private sector is the dissemination of information in association with input sales, especially chemical inputs. Some studies do note the importance of input dealers as a source of information (eg. Rogers and Meynen, 1975; Pontius, 1983) but they are often regarded by farmers as a secondary source of information (Heisey *et al.*, 1987; Feder and Slade, 1985; Litsinger *et al.*, 1980). A number of factors explain this anomaly. In the early stages of the green revolution, the public sector often played a major role in the delivery of inputs to farmers, often through the extension service. With demand for inputs established and the need to move extension back to the basic task of information dissemination, the private sector has assumed a larger role in input dissemination. Hence, the private sector is often a relatively recent entrant in input distribution at the farm level, and needs to develop its own capacity

and knowledge in the local use of the inputs. This is especially the case for input dealers in direct contact with farmers who are after local shopkeepers whose main business is consumer goods.

Private firms must also establish credibility as a source of reliable information. Private sector promotion of inappropriate chemicals and pressure (and even bribing) of public agencies to distribute a particular product through official credit programmes are not uncommon.⁹ Even deliberate misinformation is reported, such as the distribution of a fungicide as a 'growth enhancer' (Kenmore, 1986). There is also a natural tendency for chemical companies to recommend above optimum doses and to prefer prophylactic treatments to treatments conditional on the specific farmer, field and seasonal circumstances (Zadoks, 1985; Kenmore, 1986).¹⁰

Despite these problems, the role of the private sector in distributing information in association with inputs is likely to increase, especially as specialised input dealers assume a greater role. Hence, efforts to train local inputs dealers in use of modern inputs offers an opportunity to improve information flows to farmers. For example, in Bangladesh, the government has arranged training programmes for fertilizer distributors, while chemical companies are participating in training of pesticide dealers (C. Pray, personal communication).

'Substitution' Policies

While it is inevitable that increasing complexity and commercialisation of agriculture will place greater demands on farmers' information and skills, there may be ways to partly alleviate these demands. For example, applied research and particularly plant breeding research is often aimed at the limited managerial capacity of small farmers: plant breeding programmes for small farmers generally give much higher weight to pest resistance in varietal selection than similar programmes aimed at commercial agriculture. This is partly to reduce expenditures on pesticides but it also substitutes for extension resources and managerial capacity of small farmers.¹¹

Adaptability of varieties is another trait which can partly substitute for extension and managerial capacity of small farmers. A broadly adapted variety that does well over a range of conditions reduced the complexity to extension and to farmers of recommending a number of individual varieties for specific conditions. For example, farmers often plant wheat in irrigated areas over a range of planting dates depending on the crop rotations in specific fields. Wheat breeders have

traditionally developed separate varieties for normal and late planting. However, recognising the managerial complexity of this strategy breeders now screen for single varieties that do well over a range of planting dates. Similar principles can be applied to chemical inputs. Pesticides which have a broader spectrum of application to several pests, and are relatively insensitive to time of application and dosage, are easier for farmers with limited information to apply.

Another alternative to complement the formal information system is to reduce the cost of farmers' own learning-by-doing through subsidised input prices and credit programmes. Subsidies on chemical inputs have been a widespread policy response. For example, fertilizer subsidies in Pakistan are strongly biased towards phosphatic fertilizers in the belief (which is open to challenge) that this is the limiting nutrient for most crops and regions. While these subsidies can help reduce subjective risk and speed early adoption, they are difficult to reduce and often account for a high proportion of total government expenditures for the agricultural sector. Hence, the high cost of these subsidies must also be evaluated against investments in adaptive research and extension to provide better information to farmers.

In addition to subsidies, governments frequently try to force the use of a technological package through 'tied credit'. In these programmes, farmers are required to use the recommended package as a condition for loans from official credit banks, usually at low or negative real interest rates. This system if enforced, allows little opportunity for farmers to adapt technology to their own circumstances and frequently leads to inefficient input use due to the inappropriateness of the recommended package to individual farmers. More importantly, by fixing the technological coefficients, farmers are discouraged from developing their own knowledge of the technology through informal experimentation on different levels and combinations of inputs under their own conditions (Scobie and Franklin, 1977).

Conclusion

The changes initiated by the green revolution have revolutionised the technology of rice and wheat production in much of Asia and had a profound effect on the managerial complexity of small farmer agriculture. A major premise of this paper is that in many of these post-green revolution areas, knowledge and skills of farmers have become critically limiting factors in maintaining increases in productivity. Investments to increase the quantity of technical

information and develop the technical and managerial skills of farmers have not kept pace with investments in developing new technology. More importantly, institutional changes in research, extension and rural schooling needed to improve the *quality* of information and skill development have limited the opportunity to exploit the potential of the new technology, resulting in substantial inefficiencies in post-green revolution agriculture.

The endurance of Schultz's 'poor but efficient' hypothesis in development thought, aid agencies and national policy makers has slowed the shift in priorities toward investment in information generation and transfer and skill development for farmers. Indeed, the pendulum seems to have swung from the image of small farmers as ignorant and tradition bound to a situation where they are looked to as an example of rational decision making and a store of knowledge from which scientists should learn. The challenge is to combine the knowledge and insights of farmers of their environment with the information and skills generated by research, extension and formal schooling that are needed for effective management of a science-based agricultural technology.

The increased emphasis on farmer-oriented adaptive research (the farming systems perspective) and extension and education reform in the 1980s represents the beginnings of a process to alter the balance. Appropriate institutional arrangements to accommodate these changes are still evolving. Moreover, investment in adaptive research, extension and rural education is still inadequate in many areas and unless these imbalances are corrected there is a danger of further increasing inequalities in the agricultural sector between small and large farmers due to differential access to knowledge and skills.

Notes

1. This paper draws largely upon a much expanded account, *Maintaining the Momentum in Post-Green Revolution Agriculture: A Micro-level Perspective from Asia*, published as International Development Paper No. 10, Dept of Agricultural Economics, Michigan State University, 1987.
2. Economic efficiency in this paper refers to both technical efficiency — the productivity of farmers' existing input mix — and allocative efficiency — the combination of inputs that leads to profit maximization.
3. Semi-dwarf wheat varieties released in the 1960s generally yielded 30-50% more than earlier taller varieties under irrigated conditions with moderate doses of fertilizer. Releases since then have increased yield

potential by an average of 1% per year or a total of about 20%. Most of this increase was due to the crossing of spring by winter wheats. Similarly, Dalrymple (1986) notes that no new rice variety has out-yielded the potential in favourable environments of the variety IR8 released nearly twenty years ago, although major progress has been made in incorporating pest resistance, stress tolerance, quality characteristics and earliness (probably at the expenses of gains in yield potential). Recent advances in bio-technology are not expected to change yield potential for cereals before the turn of the century.

4. Crop losses due to pests are often proportional to yield levels (Zadoks, 1985) and pest control measures which were uneconomic at low yield levels become economic at higher yield levels.
5. See Winkelmann (1987) for a discussion of sustainability in intensive production systems.
6. See Byerlee, 1987.
7. In Pakistan, separate adaptive research programmes were introduced with the T and V system and these programmes have yet to produce useful recommendations for farmers. In addition, there appear to be significant lapses in extension management. In the survey by Khan *et al.* (1984) only half of farmers designated by extension as 'contact' farmers were aware that they were in fact contact farmers with special obligations to disseminate extension messages to other farmers.
8. This change in roles also implies changes in extension methods. Mass media which may be appropriate for communicating messages are probably less effective for teaching principles and skills than informal and formal training programmes for individual farmers and groups of farmers.
9. Claims of adulteration of chemicals are widespread by farmers in many countries, and tests of inputs often confirm these claims (eg. Goodell, 1984).
10. For example, farmers in the central plateau of Mexico have evolved an effective dosage of 2-4,D herbicide for wheat and barley which is less than one-half the dose recommended by the manufacturer.
11. For example, both CIMMYT and IRRI devote a large share of their crop improvement programmes to genetic resistance to insects and diseases.

2

Agricultural Extension and the Development of Technical Messages in Zimbabwe*

Ben Cousins

In Zimbabwe there have been many changes in the orientation and practice of both agricultural research and extension since the country attained its independence in 1980. For a variety of reasons, including the provision of better extension services, the peasant farming sector has begun to produce a much larger marketed surplus than ever before. For example by 1984/85 peasant farmers accounted for 36% of the marketed maize crop, as compared to 9.7% in 1981/82 (Moyo, 1986). But, despite successes, much of the current stock of knowledge and technology appears to be irrelevant to many small-scale farmers. As a consequence there are now attempts to make research more pertinent to small-scale farmers, to improve research-extension linkages, and to develop a range of effective extension strategies to service Zimbabwe's diverse agricultural sector. The idea that extension staff should themselves take responsibility for the development and design of appropriate technical messages has also begun to be explored. Recent initiatives in this direction will be described in this paper.

Before these initiatives are discussed however, it is necessary to describe the structure of extension and research that has developed in Zimbabwe, indicate some of the operational problems that limit the effectiveness of the system as a whole, and explain the thinking behind ideas of a 'Farming Systems Extension' approach.

Agricultural Extension in Zimbabwe

The government agency responsible for agricultural extension in

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Zimbabwe is the Department of Agricultural Technical and Extension Services (Agritex). Its stated purpose is to provide the country's diversified agricultural sector with services which 'stimulate the adoption of proven agricultural practices leading to increased, sustained and profitable production' (Agritex, 1985).

Agritex was formed in 1981 through an amalgamation of two previously separate government departments known as CONEX and DEVAG respectively. The Department of Conservation and Extension (CONEX) had provided extension and technical services to 6000 large-scale commercial farmers (virtually all white) and 9000 smaller commercial growers (all black, and situated on freehold land in what were known before independence as the African Purchase Areas). The Department of Agricultural Development (DEVAG) fell under the Ministry of Internal Affairs, and not the Ministry of Agriculture as in the case of CONEX. It was responsible for extension in the Tribal Trust Lands, now known as the Communal Areas, where the bulk of the peasant farmers were engaged largely in subsistence agriculture.

These departments had a reputation for being among the finest extension services in Africa, and they were backed up by an innovative agricultural research infrastructure. But resources were not spread equitably between CONEX and DEVAG, and commercial farmers benefitted much more from this kind of government support. Research was dominated by the needs of commercial farmers which had become some of the most productive in the world by the 1970s. Peasant farmers, on the other hand, displayed the same kind of declining productivity that was causing such concern elsewhere on the continent.

After independence it was government policy to form a unified extension department consistent with objectives of redressing agricultural inequalities. In Agritex new responsibilities were taken on (resettlement land use planning, servicing of resettlement areas, conservation in Communal Areas, afforestation extension), and new priorities were set. The emphasis was henceforth on assisting rural development programmes in the Communal Areas, and servicing the resettlement schemes being set up on land purchased from large scale commercial farmers (Agritex, 1982).

In Agritex's structure, there are three main levels of authority: Head Office, the Province, and the Region. A functional division between administrative or field, and technical staff occurs at both Head Office and Province, with technical service branches (crops,

livestock, irrigation etc.) providing support to the field division by means of a small but well-trained cadre of subject matter specialists.

In administrative terms, there are 8 Provinces and 44 Regions in the country, the latter corresponding roughly to the major administrative unit of the District. Within the regions, Agricultural Extension Officers (AEOs), who are diploma or degree holders, have until recently been responsible for 'areas'. Within these Extension Supervisors (ESs) have supervised the day-to-day work of Extension Workers (EWs).

Within the Ministry of Agriculture the Department of Research and Specialist Services (DR & SS) undertakes agricultural research at a number of stations in different parts of the country. Within Agritex, links with DR & SS are largely the responsibility of subject matter specialists in the technical branches. Their main task in supporting the field services is in obtaining and disseminating research and information in their respective disciplines, and they also provide in-service training to field staff.

Because of high EW:farmer ratios in the Communal Areas, the major extension strategy employed by Agritex has been to assist the development of farmer groups, and then to provide advice and training through this channel. Building on older traditions of co-operative work parties, these farmer groups have become central to many development initiatives in the Communal Areas. Credit, savings, marketing and supply functions are increasingly undertaken by these groups, and a certain amount of labour, draught and equipment sharing has also taken place. (see Bratton, 1986 for a more detailed account). Groups elect 'leaders' who are sent for regular training sessions run by extension staff, and these leaders are in turn required to train group members on their return.

Operational Difficulties

Despite these advances in organisation and impact, many problems soon began to surface in Agritex. The amalgamation itself caused 'unprecedented turbulence' (Agritex, 1982), with many experienced staff leaving and large numbers of young and relatively inexperienced staff having to take their place. The high priority given to servicing the peasant and resettlement sectors created many new demands, and major adjustments had to be made.

This process of adjustment was initiated partly in response to a World Bank/IFAD-financed National Agricultural Research and

Extension Project, which commenced in 1983. A World Bank Mission the previous year had identified several problems in what was seen as an unwieldy, multi-levelled management structure, unable to provide extension agents with the technical advisory support they needed. The Mission also saw ineffective work programming and deficiencies in the training programmes. The urgent need for technical messages appropriate to Communal Area farmers, particularly that large proportion of the total who are concentrated in the drier, less fertile regions of Zimbabwe, was also given much emphasis.

Recommendations to overcome these problems included the reorganisation of technical branches to provide field staff with more effective support, the streamlining of the provincial structure to ensure the rapid transmission of technical messages to farmers, the programming of extension activities and staff meetings, and the development of new curricula for the in-service training programme.

The project involved a similar review and reorganisation with the Department of Research and Specialist Services, and again the need for a greater focus on the problem of small farmers was a high priority. An initiative of significance was the formation of a Farming Systems Research team, initially within the Agronomy Institute and subsequently as a fully-fledged and autonomous Unit.

The two most important areas of concern for the Extension Department were thus:

- i) organisation structure and management procedures; and
- ii) the development of appropriate technical recommendations for peasant farmers. These have remained central, and (as explained below) a strong inter-relationship between the two aspects has emerged over the past four years.

Between 1983 and 1985 no major changes were made to the structure of Agritex, although much debate took place on the role of the AEOs who tended more and more to be newly-trained college graduates. They were 'officers' in a position of authority with respect to the usually older and more experienced Supervisors and Extension Workers, but with little field experience. Their 'juniors' had often been resident in their areas for many years, and were familiar with the farmers and their problems, yet lacked both managerial authority and depth of technical knowledge. Tensions and communication problems began to emerge.

A pilot T and V project also received a great deal of interest in this period, confirming the diagnosis that a clearer definition of the roles of different levels of extension staff, on the one hand, and more

systematic management, on the other, were needed throughout the Department. A major curriculum development effort was launched, aimed at improving the relevance of in-service training, and first priority was given to a management training programme for senior staff at provincial and regional levels. The issue of appropriate technical advice was addressed in an innovative training course on the design of agricultural package programmes.

In 1986 the issue of streamlining Agritex's structure came to a head, and a fundamental redefinition of positions at the sub-regional level took place. AEOs were to relinquish their line management responsibilities and become primarily technical support staff. They were now tasked with the training of teams of extension workers in their areas, land use planning in Communal Areas, the preparation of technical reports, and the provision of technical services 'on demand' from large-scale commercial farmers. This sub-regional allocation of responsibilities thus echoed the functional division higher up in the organisation. This change of role has proved difficult, with some resistance from AEOs, probably due to the loss of authority involved and also to insecurities about promotion prospects.

Other changes were brought by the merger of the two (formerly separate) Ministries of Agriculture and Lands, and Resettlement, and the resulting incorporation into Agritex of a large irrigation division. Coinciding with this change was the loss in late 1985 of three members of Agritex's national directorate. Inevitably much of the organisation's energies at national level went into accommodating all these changes and easing a new leadership into place.

New Opportunities: Farming Systems Extension

However, change brought opportunities as well as problems. In particular the work of the Farming Systems Research Unit in DR & SS was beginning to influence the thinking of members of both the field and technical divisions. The need for technical messages which address the reciprocal nature of crop-livestock interactions in peasant farming systems was becoming more evident. The Monitoring and Evaluation Unit within Agritex reported that farmer groups were beginning to demand more relevant technical advice from Extension Workers. New curricula emerging from Agritex's Training Branch increasingly stressed the importance of integrated approaches to various aspects of resource planning and management. And the long-recognised problem of how to make more effective use of subject matter

specialists was again becoming pressing. All in all, the time was ripe for a discussion of new approaches to extension and research links, particularly through the adaptation of farming systems research to Zimbabwe conditions.

Farming Systems Research (FSR) aimed to 'increase the productivity of farming systems by generating technologies for particular groups of farmers and by developing greater insight into which technologies fit, where and why' (Shaner *et al.*, 1982). It achieves this by identifying groups of farmers with similar resources as 'recommendation domains'; by focussing on whole farm systems and farm-households rather than on single crops or species of livestock; and it encourages farmer participation in problem identification, on-farm trials, and evaluation of results. These procedures attempt to close the gap between researchers and farmers. Extension staff have a potentially important role to play in this process, for example in assisting researchers to select target areas, select farmers for trials and tests and in supervising farmer-managed trials.

However, FSR — and research generally — is inevitably concentrated in relatively few areas, and the research process takes time to produce reliable technologies capable of widespread dissemination. In the meantime, pressure is exerted by farmers for extension to deliver appropriate technical messages. Usually the process is seen to be one of *adapting* research results and standard recommendations to the specific conditions found in particular localities, or faced by particular groups of farmers. Exceptionally, extension services are involved in generating recommendations without reference to formal research. For example, Froude (personal communication) reports that extension staff from Maranda in Masvingo Province have for some time been recommending that farmers plough twice in every second or third furrow to achieve the same effect as a ripper tyne. This idea was developed at the extension/farmer interface, without reference to either researchers or subject matter specialists within the Extension Department, and until very recently it had gone unremarked by all save local staff.

In Zimbabwe generally, however, the issue is which *level* of staff within the extension service should take major responsibility for the task of adapting recommendations and designing appropriate technical messages. Should Head Office specialists design messages for whole agro-ecological regions? And should extension agents play any significant role? Certainly extension agents feel the need to be active. In Wedza, for example, both extension workers and farmer

extension promoters (FEPs) 'want to make agricultural advice suit local conditions and farmer needs', and EWs would like more responsibility for the 'tailoring of advice to suit local needs' (Truscott, 1985).

While the question of which level of staff has the technical competence to undertake this kind of work is relevant, it has tended to dominate the debate to the neglect of the issue of the degree of generality of recommendations. Hildebrand (1981) has pointed out that in commercial agriculture the high degree of mechanisation and the strong capital base tend to 'homogenise' production technologies, in what is otherwise a complex and highly variable situation. This is not the case for peasant agriculture, which has a much higher need for 'location-specific' technologies because of variations in soils, climate, vegetation, population density, cattle ownership etc.

Extension staff in Agritex are currently developing recommendation packages which attempt to match improved practices and inputs to the resources, constraints and opportunities of a specified target group of farmers. The criteria used in this matching process include ecological, economic and technical feasibility, beneficial results, minimum risk, and conservation of resources.

A number of points of convergence with the farming systems approach to research are evident. There is some similarity between the idea of a 'target group' and that of a 'recommendation domain'. The identification of resource constraints within which the farmers have to operate is integral to both. Recommendations are consciously integrated as a 'system' of production and not promoted in isolation. These are all undoubted strengths, and improvements on past extension practice.

But some limitations also need to be noted. The major problem with the current interpretation of 'packages' is the concentration on single enterprises (maize, or groundnuts, or cattle, or vegetables). Secondly, the procedure tends to assume that package designers have an intimate and detailed knowledge of the characteristics of the target group of farmers. A detailed knowledge of the specific resource constraints, problems and opportunities of different groups of farmers in different communities may or may not develop through day to day activities of extension staff, but it cannot be relied upon to do so. It should be remembered that extension personnel, be they certificate, diploma or degree holders, have all received training with a strong focus on single enterprises, and that whole system perspectives as an integral part of agricultural education are still in their infancy. (Bawden *et al.*, 1984)

It is evident in Zimbabwe, as elsewhere, that extension agents can only enhance their capacity for developing technical messages if the intuitive, unstructured knowledge (of the kind most extension staff have) can be complemented by more systematic attempts to characterise target groups. Part of the answer obviously lies in enhancing communication and co-ordination between researchers and extension staff. But this is unlikely to be the whole answer because of the inevitable time lag between the initiation of research and the recommendation of reliable technologies, and the fact that widely varying agro-ecological and socio-economic conditions exist within a single country. Adaptation by extension staff, to one degree or another, is *always* going to be needed. What methods, then, should be used when undertaking such adaptation?

The strength of an extension service lies in its close and regular contact with organised groups of farmers, and the potential that then exists for an awareness and understanding of local farming systems, their constraints and opportunities. However, the conceptual tools to diagnose these in a fully systematic manner are often lacking in extension staff. These tools are best provided by a farming systems approach which allows for a better understanding of small-farmer and farm-household dynamics, and provides an operational method for adapting generalised recommendations to the particular needs of specific groups of farmers, and developing locally appropriate technologies together with the farmers themselves.

There are four main elements of what could be called a 'Farming Systems Extension' approach to the development of appropriate technical messages; and the methodology should be well within the capabilities of Agricultural Extension Officers, Regional Officers and subject matter specialists. Each element needs a brief elaboration.

Diagnostic Surveys

Extension staff have long been expected to compile information on the farming population in their areas, and an important phase of extension programme planning is 'fact collection'. Thus they are not new to the idea of conducting surveys of one kind or another. But data has tended to be used mainly for the purpose of establishing extension 'benchmarks' and only secondarily for diagnosing problems and opportunities within a farming system.

A 'Farming System' orientation would, in contrast, stress the diagnostic purposes of fact collection and analysis, and emphasise the interactions between subsystems and components. Here there would

be much to learn from 'rapid rural appraisal' (Chambers, 1985), the 'sondeo' methods developed by Hildebrand (1979), and other formal or informal survey methods now being widely used by FSR researchers. (Shaner *et al.*, 1982)

Recommendation Domains

Farmers within a single geographical area do not all possess the same resources and do not face identical problems. Significant differences between large and small families, male- and female-headed households, cattle owners and non-owners, and so on, have emerged from a number of studies (CSO, 1984; Shumba, 1984; Truscott and Pambirei, 1983).

Thus recommendations may need to be adapted to distinct types of farm households within one and the same area, and a diagnostic survey should allow the clear identification for such types (domains). A successful maize fertilizer package in Wedza has moved some way towards this kind of recognition by incorporating a 'ladder' of recommendations for different levels of fertilizer use (Bratton and Truscott, 1985).

On-Farm Trials

On-farm trials are now being widely conducted by the Department of Research and Specialist Services, with the co-operation of Agritex field staff. This demonstrates that the capacity for such an activity already exists to some extent within the extension service, and could be further developed. It is worth noting here that Agricultural Extension Officers, in their new role of providing technical and training support services, are all expected to supervise at least two on-farm trials a year.

Experience with on-farm trials to date has yielded uneven results and field staff will need the assistance of researchers and specialists in the design implementation and evaluation of such trials. Training may also be necessary. Experience indicates that there would be few problems in soliciting the co-operation of farmers (Truscott, 1985).

Adaptation of Recommendations

An agricultural season is a period of intense learning for many farmers, as they try out new techniques, experiment with new inputs, and invest resources in new kinds of enterprise. It is also an opportunity for extension agents to learn, and to develop a better understanding about what works and what does not under changing conditions. Adaptation can be best understood as a learning process which consists of cutting

and trimming a general pattern to match a particular set of circumstances. In the context of agricultural recommendations, the particular circumstances are a farming system, and adaptation activities must keep this framework clearly in mind.

Recent Initiatives

A 'farming systems extension' approach along the lines suggested here was first proposed in an earlier version of this paper, and was discussed within Agritex in early 1986 (Cousins, 1986). Since then a number of initiatives have been taken which may result in a further development of the notion.

Firstly, the modified organisation structure has been more fully accepted by AEOs and senior staff, and a concerted effort is being made by many to provide more relevant technical support to field staff. It had been noted in the earlier paper that the revised position charter (job description) for AEOs described their role as providing extension support 'according to ... in depth knowledge of agricultural production in the areas and local adaptation of recommendation'. It was suggested that this implied a capacity for whole system diagnoses and solutions, and that designating AEOs as 'systems agriculturalists' would imply a specific expertise essential for effective extension, and help to ameliorate the insecurities attendant upon the change from a 'line' to a 'staff' position.

This perspective informed the institution of bimonthly technical workshops for AEOs in Midlands Province in May 1986. The basic idea is adapted from the T and V system, and aims to improve interactions between AEOs and subject matter specialists, and to build more effective linkages between Agritex and researchers, as well as to develop the systems expertise of officers. It is reported that a wide range of technical subjects has been covered, and new opportunities and potential solutions to problems have sometimes emerged. Discussion of research trials has formed an integral part of the workshops, and highlighted 'the need to use a systems approach to tackling problems in the Communal Areas' (Chitenje, 1987).

Secondly, the role of subject matter specialists is being reassessed at both provincial and national level. The possibility of working as multidisciplinary teams with an explicitly farming systems orientation is beginning to be explored, as in the technical workshops in Midlands Province. Some specialists are attending the Farming Systems Research Training Workshops held twice a year by CIMMYT in

conjunction with the University of Zimbabwe.

Thirdly, the formal linkages between Agritex and DR & SS are being reviewed in the light of the need for a systems approach. Current proposals include the formation of technical committees at national, provincial and regional levels, on which would sit representatives of both Agritex and DR & SS. The National Committee would provide policy guidelines, and the provincial level would be concerned with the planning and evaluation of research programmes and extension activities. The regional committee would implement research programmes and undertake staff training. At this level the AEOs would actively participate in the on-farm research work being carried out (Vaughan-Evans, 1987).

Finally, an introductory training course on a systems approach to agricultural extension has been included in the in-service training programme for all new Agritex officers. The new curricula which have been developed over the past four years all attempt to develop 'the extension agent as an autonomous learner and problem solver/system improver'.

Conclusion

Agricultural extension is recognised as having contributed significantly to recent successes in peasant production in Zimbabwe. Adopting a Farming Systems Extension approach could enhance its capacity for effective servicing of this crucial sector, and the components of an operational methodology are close at hand. The first few steps to develop such a methodology have been taken, and given the openness to change of both policy makers and field staff, and their continuing commitment to maintaining the highest technical standards, there is reason to be optimistic about the future development of agricultural extension in Zimbabwe.

The Impact of T and V Extension in Somalia*

Nick Chapman

This paper traces the development of the National Extension Service (NES) in Somalia during the execution of the first large multi-donor project in the country concerned with upgrading the extension services through the T and V approach. It also examines the version of T and V extension developed by the project as a response to local circumstances and needs. Before this, however, an account of extension activities prior to the project is necessary.

The first agricultural advisory service to farmers in Somalia was initiated at Bonka Research Station in 1954 under a joint Italian/Somali Government scheme. This was followed in the 1960s by the establishment of three extension centres at Lower Juba, Janale and Hargesa. They were mainly concerned with the promotion of cash crops, particularly citrus and banana, and therefore had little involvement with the largely subsistence smallholder sector.

Throughout the 1970s, the emphasis in the government's agricultural development effort was on expanding the irrigation infrastructure. Four-fifths of planned investments in agriculture were devoted to this component (World Bank, 1981). Extension activities *per se* received limited attention, with the Ministry of Agriculture (MoA) staff effectively forming a body of local rural administrators with limited technical training. The main method of farmer contact was through village meetings and talks to farmers, under a programme known as 'Agraria Propaganda'. Attempts were made to introduce

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animal traction and promote the use of inputs including improved seed and fertilizer. However older extension agents recall this programme as being largely a publicity exercise with little field involvement or practical instruction.

The Agricultural Sector Review (ASR) of the World Bank (1981), summarised the reasons for the lack of extension effectiveness in the country:

- few agents or demonstrations at the farm level
- insufficient training
- inadequate planning and supervision
- little information from the Agricultural Research Institute
- non-availability of inputs and credit
- lack of staff motivation

From this background of modest extension activity, the first phase of the Agricultural Extension and Farm Management Training Project (AFMET) was brought into effect in August, 1980. The terms of the multi-donor loan agreement were for funding for an initial five year period (estimated at \$35m), with an additional two years of reduced operational funding.

The central purpose of the project, as defined in the project Staff Appraisal Report (SAR)(World Bank, 1979), is to strengthen the extension service through (i) a programme of pre-service and in-service training and (ii) the implementation of a more methodical farmer visit system. Implicitly, the method of extension proposed in the SAR is the Training and Visit System and the SAR outline contains many of the standard principles of T and V as stated in a recent World Bank publication (Benor and Baxter, 1984).

A second phase of the project has now been approved (SAR, April 1987) and will run from 1988 to 1994. Co-funded by IDA and ADF, the new phase will cost a total of \$26.7 m. The aim of this second phase is to build on the initiatives in the first phase and to tackle weaknesses identified during the early stages of T and V development.

Resources of the National Extension Service during Phase I

Field activities began in the Gu season, January 1981, with 50 selected former MoA extension agents deployed in the three Regions of Lower Shebelli, Middle Shebelli and Bay. The actual number of agents deployed since then has fallen behind the SAR proposed figures. There were nominally 185 Field Extension Agents (FEAs) in the field

in 1985, against the planned figure for Year 5 of 250. However, in the second phase, the planned number of FEAs is only 216. With the gradual inclusion of more districts and refugee settlements than planned, the FEA to farm-family ratio has risen from 1:600 to 1:900.

In Phase II the target population will rise to cover all 158,000 households in the eight regions with agricultural potential in Somalia, compared with an earlier target population of 124,000 in the three regions of Phase I.

The provision of facilities for extension work has also fallen below the expectations of the original plan. By the end of Phase I, 150 of the 210 houses required for field staff had been built; and 109 motorbikes provided for field agents, District Supervisors and Subject Matter Specialists. However, 88 of these were of a type unsuited for use on rough roads, and are now in poor condition. Supervisory staff have however been effectively provided with transport since 1982, and shortage of fuel has often been a more important constraint to field activities.

As the experience and ability of the FEA increase, greater mobility will be required to enhance his effective coverage. In Phase II, 100 FEAs (46% of field staff) will be equipped with new motorbikes and it is intended to complete the housing of all field staff.

T and V Methods

With technical assistance from USAID in Phase I, pre-service and in-service training programmes have been designed and conducted for both field and supervisory staff. The training has been mainly in the form of short pre-service and in-service courses at the Extension Training Centres (ETCs). The courses last from one to four weeks, and cover topics such as management and planning (for Regional and District Extension Officers), instructional skills (Subject Matter Specialists and Regional Extension Officers) and pre-season and monthly training (FEAs). Some fifty-five such courses were held over the first project period. In addition, overseas training has been afforded to a total of 29 staff between 1982-84, with courses covering a wide range of agricultural and financial disciplines.

The Agricultural Secondary School (ASS) at Afgoi received support in the first two years of the project, but with the cessation of external funding, teaching stopped from early 1984. This and the requirement for the project to limit increasing staff and recurrent costs following the donors' mid-term review exercises in 1983, has meant that only 15 new

FEAs have been added to the field force in the two years from 1983 to 1985.

Finally, the last training component, the Media Unit, has been well established and a useful library of slide and video instructional material is now available. Regular radio broadcasts, extension bulletins and crop leaflets are also prepared. At present the Unit is substantially under-utilised, largely through lack of transport. As a result, an important element of the T and V system is presently under-exploited.

In Phase II, the emphasis will be on improvement of the Regional ETCs, and the establishment of a new ETC at Yontey to meet training requirements in the Juba Region. To replace the USAID support offered in Phase I, technical assistance will be provided for some 11 man-years to continue to assist in training.

The form of T and V adopted by extension management has been modified and developed through the life of the project. In the first three years, a standard form of T and V was attempted, with training and visits based on a fortnightly cycle. This was found unworkable for two main reasons: the lack of transport and fuel for the required fieldwork; and the lack of sufficiently detailed recommendations (and hence training packages) for the main crops.

The T and V system was subsequently rationalised on the basis of a monthly cycle of activities by the Gu season 1984, with training taking place for two days each month at the ETC, and the number of FEA groups to be visited reduced from two to one per day. These and other organisational aspects of the revised AFMET T and V system were set out in 1984-85 in a series of four Operational Guidelines' which comprehensively outlined the basic tenets of T and V and how they have been adapted for the project's purposes (AFMET, 1984b).

Research and Extension Messages

Throughout the first phase of the project's funding period, the extension programme concentrated on increasing production of the most important crops in the irrigated and non-irrigated smallholder farming environments. Maize and sesame are the major rotation in the Gu and Der seasons (long and short rains) in the irrigated areas with rice as a new crop introduced in the Middle Shebelli Region. Sorghum and occasionally a legume such as cowpea, mungbean and more recently groundnut are prevalent in the non-irrigated areas.

In the absence of support from a productive applied research body,

the recommendations for these traditional crops have consisted of a few simple but effective planting and cultivation measures and the promotion of insecticide. The main recommendations have been:

- proper seed selection with germination tests to ensure viability;
- use of improved seed varieties;
- planting in rows;
- regular plant spacing;
- early planting;
- weeding two, or if necessary three times;
- use of insecticide for stalk borer control.

In Phase II, besides improved cropping recommendations, following the research activities described below, it is intended to give greater attention to livestock, agro-forestry and animal traction.

An adequate formal linkage between the agricultural research institutes and the extension service under the MoA has yet to materialise in Somalia. A lack of coordination and a failure to identify common objectives have prevented a more productive relationship from developing between AFMET and the Agricultural Research Institute (ARI), the Country's chief research body. Thus, while formal research has been conducted at ARI stations for many years, little of the work has been fed into the extension programme or related to production problems identified by farmers through their extension agent.

While external links with research agencies have been weak, the internal development of adaptive research has, through USAID technical and financial support, become an important project component in AFMET. Beginning with verification trials in 1982, the use of Contact Farmer fields for testing the appropriateness of research findings has been undertaken each year. From varietal trials with sorghum, maize and cowpea, research activities have expanded into adaptive trials dealing with such aspects as plant population, irrigation management, rotations, weeding and stalk borer control (Boateng, 1985).

A major objective of Phase II is to ensure greater coordination between the various research activities under the MoA, and to ensure that the results of research are fed into the extension system. This is being tackled at an institutional level by the creation of a Research Directorate to upgrade the ARI. The stated objectives are to 'foster closer linkages between the various research stations, project research units ... and between research and extension'. It is stressed that 'field trials of extension will continue to play a key role in testing research

station findings in different locations' (SAR, Phase III). Besides these institutional reforms, a key factor in the development of research will be the effectiveness of the technical assistance personnel (25 man-years) provided for under Phase II as a replacement for the USAID team in Phase I.

Extension Coverage

The decision as to whether to concentrate limited personnel in areas of high potential at the expense of other less promising areas is faced by many extension programmes. The Phase I SAR proposed that the extension force should initially be restricted to areas of greatest potential and within easy reach of the headquarters at Afgoi.

In the event, the Government felt it necessary to operate a service in all eight regions from the start of the project, but in recognition of the original plan, to concentrate field staff in the three most productive regions. In terms of the proportion of the rural population residing here, the eventual allocation of staff is not unreasonable, with 59% of the field force serving an estimated 51% of the farm population. Even within the three regions, the distribution of staff is allocated according to population and agricultural (particularly irrigation) potential, with Lower and Middle Shebelli Regions having 43% of all FEAs, 33% of the farming population and 63% of total irrigated maize production.

It is perhaps in the *quality* of coverage that real regional imbalance exists. With ETCs located only in Lower Shebelli, Middle Shebelli and Bay Regions, training and research activities have inevitably been concentrated there. With the execution of crop surveys on-farm and fertilizer trials, and farming system research in the three main regions, the extension staff there are required to perform a more varied set of activities than in the other regions, leading to a more rapid acquisition of skills and experience. The extension staff in the three regions are better equipped and supported (with more motorbikes, housing and frequent senior staff visits), and their effectiveness in conducting the T and V activities (and as a result their morale) is very likely to be higher than for staff in the other regions.

In Phase II, the project will operate on a wider basis and more resources will be available to all eight regions. Staff will still be concentrated in the three main regions of Bay, Lower and Middle Shebelli, but the new ETC in Juba Region will permit more effective coverage in that important and so far neglected area. An attempt will be made to increase the involvement of women through the greater use of female Contact Farmers, female FEAs and training staff.

Workload

As the size and experience of the field force have grown, so the number of extension activities has increased. From the setting up of farmers groups and a routine of visits, other elements of T and V have been introduced each year, including Contact Farmer demonstrations, group meetings, field days and on-farm trials. For the Gu season (long rains) of 1985, for example, a force of 170 agents established 4,965 demonstration plots (an average of 29 per agent), 10,900 fortnightly group meetings were recorded during the season, and some 30 District field days held. In addition, the FEAs have been involved in a number of data collection exercises in certain districts.

T and V duties:

- Establish and Visit 8 contact farmer groups
- Establish 48 demonstration plots
- Hold group meetings
- Hold field days
- Attend monthly training
- Meet with DEO
- Maintain daily diary and demo plot records

While additional resources are sometimes available (eg. FEAs conducting the FAO fertilizer trials are given motorbikes), it is evident that in some areas, particularly at harvest periods, the various tasks, if they were all performed properly, would be considerably beyond the FEA's scope. A conflict may therefore soon emerge between the increasing requirements of the extension, training and research programmes, and the number of staff available for the work. It may also be noted that this conflict could occur despite the absence of other traditionally contentious extension duties such as input supply, seed production or credit delivery.

T and V Impact

The information that is available from formal surveys (MEU) carried out between 1982-84 and informal assessments (REO and PMU reports, World Bank Mission aide-memoires, and the author's field visits), indicate that the level of adoption is relatively high in the three regions and for the two crops (maize and sorghum) where the NES has concentrated its efforts. In those three Regions (Lower and Middle Shebelli and Bay), according to the 1984 MEU survey (AFMET, 1984a) based on a stratified random sample of 243 respondents,

adoption rates for Contact and non-Contact Farmers for five of the key recommended practices are given in Table 1.

Table 1: Adoption Rates for a Sample of Contact and Non-Contact Farmers.

	<i>CFs</i>	<i>Non CFs</i>
	%	%
Row planting	72	35
Improved Seed	44	8
Fixed planting distance	64	15
Stalk borer control	48	15
Two+ weedings	68	61
Average	60	26

Yield Results

From annual crop-cut surveys conducted between 1983-86, a set of Gu season yield estimates were obtained for sole cropped maize (irrigated) and sorghum (rain-fed). Although a more detailed discussion of the survey findings and their implications for measuring extension impact has been published elsewhere, it is useful to include the results in outline here in order to provide an indication of the apparent impact of the NES under the modified T and V approach as described.

Table 2: Crop-Cutting Survey Yields 1983-85 (100 kgs/ha)

	<i>Maize</i>		<i>Sorghum</i>	
	<i>CF</i>	<i>NCF</i>	<i>CF</i>	<i>NCF</i>
1983	27.0	22.3	9.2	9.4
1984	29.0	22.3	9.3	5.7
1985	21.1	11.8	11.7	6.3
1986	22.4	13.8	6.2	3.8

While some caution should be exercised in interpreting these results, the overall trend is reasonably clear and shows that the sample of Contact Farmers is obtaining a significant production margin over neighbouring non-Contact Farmers, particularly under irrigated conditions.

Lessons

A number of general lessons may be drawn from the first phase of AFNET's development of T and V. A suitably modified T and V system has been established in Somalia with clear operational guidelines and management control. Field evidence suggests that FEA morale is high, and following the effective housing of FEAs in their villages and the regular visit programme, the FEA:farmer relationship appears positive. Difficulties have arisen in this multiple donor project, especially since funds have to be independently budgetted, drawn and accounted for. This should be alleviated to some extent in the second phase since the number of donors has fallen from four to two.

In the first phase the lack of involvement by outside research agencies weakened the development of the extension message. As one report observed (Hunting Technical Services, 1983), the recommendations were not specific enough to different areas and crop environments, nor did they effectively address many key problems in production. Internal research efforts have made some progress in this respect and have run trials, for example, on the effectiveness of most of the present recommendations, but they have neither the funds nor the staff to effectively replace the external agencies. As the project expands its geographical coverage in the years ahead, a more diversified set of technical recommendations will be required by farmers under the extension umbrella. Much closer liaison will have to occur between the ARI and AFMET, a process which it is hoped the proposed directorate in the MoA will achieve.

Within the extension arm itself, if the NES is to recover its required expansion rate and achieve the eventual goal of 400 FEAs, the Agricultural Secondary School needs to be re-activated, and the supply of graduates resumed provided that the training programme remains within the context of a national agricultural manpower development programme. Shortage of skilled personnel is a major constraint at higher levels too, and for those that have completed training overseas, there is the further problem of adjustment on their return to Somalia where conditions of service as an extension officer

provide a marked contrast to their former overseas life. The future policy will be to send senior staff on short professional courses or on attachment to comparable projects in other countries, so that the period of absence is reduced and the problems of readjustment minimised.

While the establishment of the T and V system of extension has been reasonably successful, incorporating many of the standard activities of the system such as field days, group meetings, and demonstrations on Contact Farmers' fields, the monitoring of these various activities is weak. The quality and impact of each field activity actually undertaken each season, for example, is mostly unrecorded, and as a result the true extent and impact of field operations is hard to judge. A simple monthly reporting system needs to be introduced which will allow simple physical targets to be set and then actual performance measured at the monthly training sessions. The effort and cost in collection and analysis will be justified by the benefits of better informed managers and donors.

The information that has been gathered on extension impact does suggest that there has been a marked regional disparity in extension impact. The three regions where there has been a concentrated effort have had a better supported and managed extension force than the other five. Research, training and crop survey activities have all focussed on these three Regions. The existing pattern of concentration is a result of a compromise between the government's concern to involve all farmers in the first phase of AFMET, and the donors' concern to achieve a measurable impact with limited resources in a restricted area.

The level of adoption is also a question of logistics. Lack of transport and fuel has undoubtedly restricted the coverage of the extension staff, particularly in a country with low population densities and few all-weather roads. After four years of extension activity, therefore, the overall adoption rates of around 60% for Contact Farmers and 25% for follower farmers in the three key Regions may be considered as reasonable, especially since some of the practices are to some extent dependent on input (seed and insecticide) availability. In Phase II, it is likely that the continued expansion of the extension force will take place without serious difficulties, given the experience available and the base achieved in Phase I. The real challenge in the next Phase will be to gear up the research capability of the MoA and create more effective links between the presently isolated research stations and the increasingly professional extension service.

Extension and Farming Systems Research in Zambia¹

Alistair Sutherland

Improving the small-scale farming sector in Africa presents a major challenge for national governments. Many countries are trying two relatively new strategies; one for research and the other for extension. Farming systems research (FSR) programmes are a strategy aimed to make the output of national agricultural research organisations more relevant to the needs of the small-scale farmer. The T and V model of extension is being introduced in order to further rationalise national extension services, and enable field Extension Workers (EWs) to reach a larger number of farmers on a more regular basis to pass on technical information and recommendations.

While the importance of good research extension linkages in Africa has been widely recognised (Moris, 1983), there has been comparatively little discussion about the inter-relationship, and indeed the compatibility, of FSR with T and V (CIMMYT, 1986). This paper begins to tackle this issue on the basis of a field level case study carried out in Chambuka Block in Zambia's Central Province. It is a revised and updated version of an ODI Discussion Paper (Sutherland, 1986). Reference is also made to developments in the Eastern Province of Zambia where implementation of T and V contrasts significantly with Central Province. Before discussing findings from Central Province, it is necessary to place the study in the national context of FSR and T and V.

FSR In Zambia.

The Adaptive Research Planning Team (ARPT) is Zambia's provincially based FSR programme. In each province, a multidisciplinary team of scientists conducts diagnostic survey work

before carrying out a programme of on-farm experimentation and testing. ARPT's aim is to strengthen and complement the work of other technical scientists in the Ministry of Agriculture's Research Branch by analysing each of Zambia's many farming systems and pinpointing key points for technical intervention. Specifically, this involves directing the national research effort further towards the problems facing Zambia's 500,000 small farm households, who were neglected because of the commercial sector focus of previous agricultural research (Kean and Chibasa, 1981). ARPT achieves this in two main ways. Firstly, it facilitates the flow of information relating to production problems from the small farmer up to the national teams of specialist scientists (such as crop breeders, plant pathologists and soil chemists) who are organised into commodity teams (Kean *et al.*, 1985). Secondly, in order to immediately address production problems and bottlenecks identified during survey work, ARPT tests, and if necessary, adapts new technologies developed at research stations on farmers' fields. After a new technology has proved successful in a pilot area, ARPT presents this as a technical recommendation to the newly formed provincial research committee which has a strong extension representation. If the committee accepts the recommendations, the provincial extension service takes on the responsibility extending it throughout the area where the technology is relevant.

From its inception in 1981, ARPT has envisaged a close working relationship with the Extension Branch (GRZ, 1982). At the field level, ARPT scientists, EWs and small-scale farmers come into direct contact. Field extension staff are involved in survey work and in each province a small number of field staff are seconded to work fulltime with ARPT to supervise on-farm trials. Interaction at the professional level is also emphasised, and since 1984 it has been policy to attach a 'research extension liaison officer' (RELO) to each provincial team (GRZ, 1982). The RELO's tasks include: keeping provincial and district level extension specialists and managers abreast with developments in adaptive on-farm research in the province; assist extension specialists with the formulation and revision of technical recommendations appropriate for the different farming systems within each province; and assist with training extension staff in a farming systems perspective.

The Training And Visit System In Zambia

In Zambia, extension is part of the national government organisation.

Like the Research Branch, the Extension Branch is part of the Department of Agriculture within the Ministry of Agriculture and Water Development. T and V, as an extension strategy, was adopted by Zambia's Department of Agriculture in 1978 as a policy decision without donor project support (GRZ, 1983). As a first step towards implementation, clear levels of administration were agreed on. At the field level, EWs were organised on the basis of 'agricultural camps'. Each camp contained an average of about 800 farm families. Four to six camps made up the larger unit of an 'agricultural block', which fell under the control of a block supervisor (BS). About four to six blocks fell under the existing 'District Agricultural Officer' (DAO). Several districts make up a Province which is under the charge of the 'Provincial Agricultural Officer' (PAO). At both district and provincial level the DAO and PAO are supported by a team of 'Subject Matter Specialists' (SMS), who provide specialist advice to field EWs and farmers through the extension hierarchy.

This hierarchy is manned by staff with differing levels of education. At field level, agricultural certificate holders supported by smaller numbers of untrained 'commodity demonstrators' predominate. Blocks are usually supervised by senior certificate or diploma holders, while Districts are often manned by diploma holders and increasingly by degree holders. Degree holders prevail at the provincial and national headquarters.

The main idea is that T and V provides the field EW 'with a detailed work programme' (GRZ, 1983). At the camp level, each camp is supposed to be divided into six sections, each with a small number of contact farmers (CFs). A regular schedule of twice monthly visits is required during the first three days of each week, with Thursdays and Fridays being reserved for other matters such as writing reports, credit and input issues, and attending training courses.

It is important to note that the system described above has been introduced at different rates in different provinces, and with varying degrees of modification. While all provinces have reorganised staff into camps and blocks, and also strengthened specialist staff at the District level, the regular programme of visiting based on CFs, supported by close supervision, regular supplies and technical information, has been introduced with different degrees of intensity and enthusiasm. This paper does not aim to describe all of the variation, nor the various historical and logistical reasons for this uneven implementation of T and V. However the government clearly recognised that in practice it is difficult, and not necessarily desirable,

to employ a blanket approach to implementing T and V. In a more recent major policy document prepared in conjunction with the World Bank, it notes that in provinces extension services and methods will have to be adjusted to local needs and capabilities in terms of resources and manpower (GRZ, 1984).

T and V and FSR In Central Province

Little in the way of field extension training took place until 1981, when LINTCO, a parastatal concerned with cotton production and marketing, began extension training in the province. Certain field EWs were seconded to LINTCO who provided them with motorcycles and allowances as incentives for carrying out cotton extension activities in addition to their existing duties. LINTCO also encouraged the use of T and V to promote cotton extension, and provided a more rigorous programme of visiting, reporting and supervision than had previously been possible. However, because only a few areas in the province had initially been targetted for cotton development, with some more included later, the effect of LINTCO on T and V was unevenly spread. ARPT began on-farm research in Central Province in 1981, but did not move into Chamuka Block, until 1983. Before this work had been concentrated in two other target areas in the north of the province where traditional farming systems dominated.

The study area, Chamuka Block, is one of nine within Kabwe Rural District, and in 1983 comprised four agricultural camps. The Block is situated close to the provincial headquarters, most camps being less than an hours drive from Kabwe. Chamuka Block is fairly representative of the more agriculturally developed blocks in the district. The main cash crops — maize, cotton, sunflower, vegetables and groundnuts — are typical of both the district and province. Sources of farm power are also typical of the district: oxen is the most important followed by tractor power (Sutherland, 1986).

For the purpose of FSR, farmers were classified into three main target groups: traditional (50%), small-scale commercial (40%) and medium-scale commercial (10%). Subsistence farmers concentrate on maize cultivation, aiming to grow enough for consumption and occasional sale. Small-scale commercial farmers aim to produce a surplus of maize for sale consistently and also grow supplementary cash crops such as sunflower, cotton and vegetables. Medium-scale commercial farmers grow large areas of maize (10ha or more) and in addition most grow a wider range of supplementary cash crops than

small-scale commercial farmers. FSR activities have been targetted largely at the poorer farmers; those with two or less pairs of oxen.

The different categories of farmer have access to a similar range of improved crop technologies — fertiliser, hybrid seed, ox drawn implements, tractor ploughing and cotton and soya bean technical packages — and differ mainly in the extent to which these are used. Medium-scale commercial farmers rely more on mechanised methods of planting, weeding and threshing, and use tractors more extensively than the other groups. They are also more likely to own tractors and motor vehicles and to use harrows and inter-row cultivators. Small-scale commercial farmers differ from traditional farmers in that they are more likely to rely on credit packages, purchase new hybrid seed and fertilizer, and use labour-saving methods of planting and weeding.

A feature of Chamuka common to other agriculturally developed blocks in Central Province is that the farming community comprises two distinct social groups; 'locals' and 'settlers' (GRZ, 1973). The 'locals' regard themselves as the 'owners of the land' and the village headmen, who are responsible for allocating land in the area, are drawn almost exclusively from this group. Locals account for all of the traditional farmers and a proportion of the small-scale commercial farmers. The 'settlers' are a mix of language groups from other provinces who were attracted to the area by the combination of a relative abundance of land, better rainfall, and a reasonably developed transport and marketing infrastructure. Many of the small-scale commercial and all of the medium-scale commercial farmers in the block are settlers.

Findings from Chamuka, 1983/84

T and V at the Camp Level

The theory of T and V in Chamuka contrasted with the practice. According to the BS, T and V in the block consisted of an organised programme of visits to contact farmers on pre-arranged days of the week, as laid down by the official handbook (GRZ, 1983). The groundwork for T and V in the block was started in late 1979, at a three day workshop attended by the BS and the senior EW in all four camps. The BS, supported by the DAO, assisted camp EWs in the selection of CFs and in scheduling a visiting programme. In most camps one or two CFs were selected in the first season, and the number was increased to 4 or 5 in the second season. In these two seasons the Lima crop

recommendations formed the basis of group meetings focusing on demonstrations on the fields of CFs.

After a further seminar on T and V in 1982 organised by LINTCO, cotton packages took priority in three of the camps. LINTCO incorporated the ideas from T and V as part of their drive to recruit more cotton growers, providing their seconded EWs with a timetable for visiting CFs, a diary for EWs to record the proceedings of meetings held at the CFs field, and a notebook in which the farmer was to record the details of how he managed the crop.

It was observed that the use of CFs was unevenly developed across the block. In one Camp, EWs and most local farmers interviewed had a reasonable understanding of the system, but transport and other problems (discussed below) hampered regular visits, particularly to CFs staying more than 5km from the camp. In other camps, both the EWs and the local farmers had a limited understanding of the CF system, and EWs tended to use a modified version adapted to their individual styles of extension work, low staff levels, and local circumstances. For example, lack of transport prevented visits to three CFs staying further than walking distance from the camp, and the senior EW tended to use nearby drinking places as points of contact instead.

The use of CFs in Chamuka block also needs to be examined in relation to the experience of local EWs in operating this aspect of the T and V system. All four camp EWs who attended the T and V training courses (in 1979 and 1982) discussed their experiences of T and V. In spite of differences between the camps in terms of manpower levels, transport, staff experience, motivation, and training levels, a similar pattern emerged.

In all four camps, T and V was introduced in conjunction with the crop recommendations through demonstrations on CFs fields. The attendance of meetings was reported as good. The same exercise was repeated in the following season of 1980-81. This time EWs reported more difficulty in persuading CFs to host demonstrations on their fields, and in cases where they succeeded, attendance by other farmers was reported as poor in comparison to the previous year. EWs said that most farmers 'became bored' with the messages after the second season, and gave this as the main reason that they stopped attending meetings. As a result the EWs said they became discouraged, as did the CFs, and that this was a reason why the system of regular visits to CFs had fallen into disuse in most cases.

The above situation illustrates the important precondition for any

successful extension system, including T and V, that the technical message should be appropriate for the targetted farmer. In Chamuka Block, the crop recommendations had some impact in population pockets where ox cultivation was inhibited by tsetse fly. However, the message was not well received by ox cultivators, EWs said, because these farmers 'feared labour'. Moreover, while most of the hand cultivators were enthusiastic, they lacked money to buy the fertilizer and hybrid seed required to follow the recommendations. An encouraging sign of adaptation and flexibility was that some farmers on better soils had tried out checkrow spacing using local maize and no fertilizer, reporting good results.

In order to try and anticipate some of the difficulties in operating T and V, it is informative to take a closer look at the CF selection process in the camp where the use of CFs had been pursued more rigorously. While the same CFs selected in 1979-80 had remained unchanged in the other three camps, this Camp had made some changes in order to try and improve attendance at meetings. Of the five CFs originally selected, three were still operating, but only one of these was regarded as really effective. The two CFs who were dropped were both local party officials with a poor record of farming: local farmers apparently respected these men in their political capacity, but not as 'model farmers'. The two ineffective CFs remaining were both older retired men who had a good relationship with EWs and were willing to try out new methods. However, they were not well integrated into the local community; both were church men who did not drink beer and thereby did not regularly meet neighbours at drinking places, and one had the further disability of blindness. Moreover, both men were selected by extension staff (in one case DAO) rather than by the local community. The fifth and most effective CF was a village headman who had experience as the chairman of a self-help group, and was successful in farming. A factor which had influenced the selection of CFs was the LINTCO T and V training programme. After the seminars in 1982 and 1983 two of the early CFs were replaced by two cotton growers. Thus five of the eight CFs in the 1983-84 season were cotton growers.

A further influence came in early 1984. In response to a request from managers of the EEC-sponsored maize development project operating in the block, the senior EW expanded the number of contact points from five to eight and increased the number of CFs from five to a potential list of 28. Of these 12 were selected by EWs, and the remaining 15 by local meetings of farmers. Analysis of the selection process showed that local farmers were less inclined than EWs to select

'modern' local leaders as CFs, and more inclined to choose either local headmen regarded as competent farmers, or active farmers without leadership positions. In view of the experience with using modern local leaders, this suggests that leaving CF selections up to the farmers is likely to be the more effective approach, and reduce the level of political influence on T and V noted as a problem by senior Zambian administrators (CIMMYT, 1984).

The poor operation of T and V through CFs as key intermediaries can be put in context further by looking at methods of delivering advice and the technical content of the messages.

Methods of Delivering Advice

While CFs were recognised and used in varying degrees in the four camps, and camps had been sub-divided geographically, a regular programme of visits to CFs as part of T and V was not operative at the time of the study. Rather, three main contexts for delivering advice on crops were observed by the researchers and reported by farmers; individual visits to farmers, group meetings and advice given at the camp office.

Visits to individual farmers were the most common form of contact between the EW and farmer in the block. Yet these visits rarely seemed to be problem specific. Of the 28 farmers in the sample receiving EW visits, 18 said they discussed general aspects of agriculture. The impression which farmers gave is that the EW called by to check on their progress; to inspect their crops, have a general discussion about how these were managed, and discuss any particular problems the farmer was facing. EWs had other reasons for visiting farmers. Half of the ten remaining visits were in connection with loan applications, three were to inform farmers that they would be interviewed by research officers, and two were 'private' calls.

Group meetings were convened at the homes or fields of contact farmers, or at 'contact points' such as the village headman's homesteads and local primary schools. They can be classified into two main types, group demonstrations and field days. At group demonstrations, the senior EW himself demonstrated a new technique — such as spacing or fertilization of maize or applying cotton insecticides — to a group of farmers. At a 'field day', a group of farmers was assembled to inspect and discuss standing crops. The audience is more likely to include local leaders (party representatives, headmen, school teachers), and were often conducted with some ceremony (speeches, the provision of food etc.).

Field days were still popular and in some of the camps EWs had been innovative. In the two most recent seasons, EWs have adapted the idea of a field day in order to show the results of 'good farming' more generally. Thus rather than using the occasion to validate the adoption of an officially recommended technology for the minority of hand cultivators, some EWs held field days at the plots of selected ox-cultivators who had been successful in growing a variety of crops.

Visits by farmers to the camp, while quite common, were found to be the least important of the three contexts for delivering advice on crops. While half of the farmers in the sample had visited the camp in the previous six months, only five of these went to seek advice on crops, the remaining twenty going to enquire about loan applications or to collect inputs.

The above findings suggest that in the absence of sufficient appropriate technical recommendations, informal individual contact combined with strategically organised group visits to successful farmers comprised manageable and reasonably effective methods of advice delivery. This further highlights the dependence of T and V on appropriate technical messages.

The Content of the Technical Message

The study asked the 50 farmers interviewed for details of EW advice primarily on maize, but also on sunflower and crop rotation. Findings showed that advice had been received, with 30 receiving advice on maize, 9 on sunflower and 24 remembering being advised on crop rotation. Most of the 30 farmers who received advice on growing maize were able to give a version of this advice covering; planting method, fertilizer application (rate, method and timing), and weeding (method and timing).

Three types of advised planting methods were identified for maize; behind the plough, mechanised planting, and hand planting using a rope. Twenty-four farmers reported being advised on methods of planting, and this advice was compared with their own practice. In ten cases farmers said that EWs had advised them to plant behind the plough, and in every case this corresponded with their practice. Only three of the ten farmers who reported being advised on the planting method using a rope, followed this advice. In four cases, farmers said they were advised to use mechanised planting methods and in three cases this corresponded with their practice.

The above pattern suggests that often extension workers delivered advice in a flexible way when visiting farmers and, after taking into

account farmer circumstances, supported the farmer practice rather than impose the official recommendation regardless.

This interpretation was supported during subsequent discussions with extension workers. After two or more seasons of experience extending the message for maize, all of the extension workers in the block recalled that this message was only well received by, and in their opinion appropriate for, hand cultivators. In every camp they had modified their advice when dealing with ox cultivators. Instead of planting with a rope, some EWs said they encouraged the practice followed by the more progressive settlers of planting in a furrow made after ploughing and then harrowing over to cover the seed. At the same time, some EWs also recognised that for many farmers planting behind the plough was the best option, especially for those who lacked harrows or who hired or shared oxen.

Similar variability in advice reported was found with other operations on maize. For example, farmers said that EW advice on the timing of basal dressing varied between 'at planting' (the official recommendation) and 'after emergence'. In this case, following the official recommendation corresponded with a higher level of extension contact, but this correspondence was not apparent with other operations. With rates of fertilizer application, weeding methods, timing of weeding, and timing of top dressing there was no noticeable relationship between the level of contact, and the farmers' version of the advice, supporting the theory of field EW flexibility in advice delivery.

When advice on planting and weeding methods was not followed the alternative method used made less demands on household resources, primarily labour, but also access to oxen and implements such as harrows and inter-row cultivators. The results of the survey, together with observations of and discussions with EWs, are encouraging from the viewpoint of EW sensitivity to differences in farmer circumstances, the message on maize husbandry often being adapted to farmer circumstances.

From the viewpoint of the compatibility of T and V with FSR, it is important to note that variability of the message is also related to the method or context of delivery. When T and V demonstrations were used, a blanket message was delivered to groups. When the system of visiting individual farmers was used, there was more scope for flexibility in the delivery of advice. Under such circumstances the experienced (but not necessarily highly qualified) EW was able to establish a more personal relationship with the farmer, and rather than

advise in a directive way, was able to engage in a dialogue, at times supporting practices not officially recommended.

Local Farmers as Consumers of Extension

The picture presented so far is that local EWs had a limited supply of useful technical information to pass on to farmers. Farmers were asked what they expected of the extension service. This question was included in view of the high proportion of time spent by EWs on non-technical tasks such as administering credit applications, credit inputs, and data collection for crop forecasting. Perhaps surprisingly, most farmers regarded EWs as technical advisers, and comparatively little reference was made to other practical problems (such as credit, or input availability). The kinds of technical information requested varied somewhat according to the scale of the farmers. The subsistence and small-scale commercial farmers questioned all requested advice on their principal cash crop, maize. Three common problems mentioned were weeds, insect damage, and methods of fertilizer application; and in that order of importance.

Medium-scale commercial farmers, and the more ambitious of the small-scale commercial farmers, expressed more sophisticated and diverse needs. All asked for advice on the preparation of dry season feeds for oxen, some wanted advice on crop rotation, and many wanted advice on the correct formula for mixing insecticides. This diversity of demands does raise questions about the ability of the T and V system as currently structured to handle a range of farmer types, each with a particular set of problems.

Technology Transfer Outside Extension

In one Camp, where EW coverage was lowest, particular attention in the study was focussed on the transfer of technology outside the extension service. Twenty three farmers (12 'locals' and 11 'settlers') were interviewed in depth. The idea was to find out how they learned about the use of 'new technologies': fertilizers, hybrid maize, sunflower cultivation, and improved (labour saving) methods of management.

At the start, it was assumed that the new technologies had been bought into the block by the more progressive Tonga and Zimbabwean settler farmers. However, the study findings did not fully support this idea. The 'early adopters' came both from settlers and locals; fertilizers and hybrid maize were used by about a third of the local farmers in the sample before 1973, the same proportion as the settler

farmers. Also, there was no difference between the two groups in the time of adoption of sunflower as a cash crop. In the case of early adoption of hybrid maize and fertilizer, the primary agents of technology transfer were reported to be EWs representatives of the credit and input supply organisations operating in the early 1970s.

Thus the early adopters who were settlers talked about what they learned from EWs in Southern Province and other parts of Central Province before moving into the block, while the locals talked about the previous EW and Depot Manager in the camp who had been operating in the early 1970s. Around three quarters of farmers — 'later adopters' — in the sample adopted hybrid maize and fertilizer (between 1973 and 1978) and sunflower (between 1979 and 1983) without the direction of their EW. In most cases they said they learnt these technologies from 'friends'. None mentioned the current EW as their instructor, but two did mention attendance of a farmer training course (organised through the local EW), while another three said they had experience of hybrid maize from working on nearby commercial farms.

The study of technology transfer also revealed that local farmers make their own modifications to farm implements. In a good proportion of cases farmers had modified their ploughs and other ox-drawn tools. These adaptations had taken place without any prompting from EWs, being introduced mainly by the Tonga farmers moving up from the Southern Province which has a long tradition of ox cultivation.

The conclusion to be drawn from these findings is that the local extension service, in conjunction with input supply agencies, was instrumental in introducing new technologies, particularly new crops, to a small group of innovative farmers. However, the widespread adoption of these technologies has depended mainly on farmers who, after observing friends and neighbours successfully managing the new technology, then try it out for themselves. This conclusion is supported by the fact that the methods farmers use for managing a new crop, or applying a new technology, are very often different from the recommended methods. So, for example, when growing sunflower the majority of farmers do not follow the technical guidelines given to EWs, nor do they follow many of the official recommendations for hybrid maize. This suggests that it is the more innovative farmers who provide the lead within the local farming community. Once a new crop or other new technology is made available and demonstrated by local EWs, early adopters will take these technologies, experiment

informally with them, and come out with adaptive solutions which best suit their local circumstances. This modification then becomes the model adopted by other local farmers with similar circumstances. This process of informal 'research and development', while not necessarily replacing the functions of on-farm trials and extension advice, requires fuller recognition and understanding (Biggs, 1986).

The Research-Extension Link in Central Province

The study of extension at the field level in Chamuka Block has highlighted the inadequacies of the national agricultural research capacity to provide EWs with appropriate technical messages for small farmers. During the 1970s new technologies developed primarily for commercial farmers such as hybrid maize, chemical fertilizers, and sunflower had been supplied to small-scale farmers through the agricultural input and marketing agencies. But the research on these had been targetted largely at the needs of commercial farmers. The small scale farmers, such as those in Chamuka Block, had been largely left to make their own adaptations of the new technologies, often learning more from friends and neighbours than the extension service. The local extension staff had operated largely in isolation, some using initiative in situations where the official technical message they had was not well received by, or appropriate to, their client group.

The impact of a farming systems programme on extension effectiveness in the block is a difficult thing to predict in advance of research results and subsequent technology adoption. However, certain developments taking place during 1983/84 gave scope for optimism.

Central Province ARPT had already taken important steps towards closing the gap between research and extension. Field level EWs had been involved in its programme of on-farm trials, survey work and 'field days'. Training programmes organised by the RELO brought extension staff at the provincial, district and block levels in touch with on-farm research in the province. The monthly newsletter initiated by the RELO had brought field EWs in touch with developments in on-farm and commodity research. The establishment of a 'Provincial ARPT Committee' provided an occasion for extension involvement through provincial SMSs and DAOs for the in the formal discussion of on-farm research programmes and priorities within the province.

Interviews with district and provincial level extension staff revealed a good knowledge of on-going research in the province. They attributed this to the activities of ARPT, especially to the RELO.

Their contacts with specialist researchers were more limited. They had little idea about the kinds of research taking place at national research stations and complained that they received very little technical information from their headquarters or the Research Branch. Like camp staff, they reported their main source of information on research as the provincial newsletter.

A further recognised 'gap' is between the researcher and the farmer. On farm trials, field days, and survey work have closed this gap, not province-wide, but at least in the three blocks where ARPT currently conducts on-farm trials. In Chamuka Block, the 50 farmers interviewed were asked to describe the difference between a 'demonstration' and an 'experiment' and all except two failed to do this. Often EWs had problems in making this distinction. Rather, most farmers and some EWs saw both demonstrations and on-farm trials as 'new methods'. In part, this misconception was caused by the fact that 'demonstrations' often consisted of a comparison of cultural practices, and the RELO and others involved often wanted further confirmation of the viability of a new research recommendation. For the farmer's purpose such a perspective may be sufficient as he may reach conclusions independently of the researcher or EW. But it is not sufficient for the EW operating within the T and V framework who needs to know the difference between what is being tested (on-farm) and what he is supposed to be recommending farmers to do.

Awareness by both extension and farmers of on-farm research is a step in the right direction, but supplying them with more appropriate technical recommendations is the critical stride forward. It is instructive to look at further developments in Chamuka Block since the 1983/84 study.

Recent Changes In Chamuka

Since 1984 there have been some positive changes in Chamuka. For one thing extension services have been more equitably apportioned across the Block, and all camp EWs are now fully mobile as they have motorcycles with allowances for running these along with allowances for overnight stays (for which there was previously no money). This improved transport and allowances situation has been facilitated through the maize development project, which has had other influences on the extension system.

The uniformity of the extension system, initially varied through secondment of some field EWs to LINTCO, has been further

diversified through the maize development project. The project has drawn field EWs more directly into agricultural development, diverting them further from straight forward extension activities based around T and V concepts, also making linkages between field EWs and the on-farm research programme, including extension demonstrations of new technologies, more difficult. In each village six farmers were selected to receive oxen loans. The 'pilot farmers', who replaced the previous CFs, were encouraged to buy their own hybrid maize seed and fertilizer but with their husbandry activities being closely monitored by local EWs who offer advice where necessary. Competitive incentives were provided as pilot farmers with good yields were given ox implements at the end of the season free of charge as a reward, the idea being that instead of having official contact farmers, the other farmers in each village would learn from the example of the pilot farmers. This system is only operative in the project area, and continues alongside LINTCO extension activities. In other parts of the district and province the T and V system, as introduced in 1979 and modified through LINTCO secondments, remains the official extension system.

On-farm research in Chamuka has progressed since it began in 1983. After three years of on-farm trials, two new technologies, one on minimal tillage of maize using herbicides and the other on liming soybeans, have been tested on-farm and are now being demonstrated through local EWs. The RELO has taken a close interest in managing and monitoring these, partly because it is the first time the technologies have been demonstrated, and also because local EWs are so busy with the pilot farmers they have little time for demonstrations. These demonstrations have raised a further issue of linkages between extension and input supply institutions. While farmers are enthusiastic about herbicides, local supply of these remains a problem. Similarly, if lime was also to become popular local supply would be a problem.

Other on-farm trials carried out on maize and sunflower husbandry have confirmed the validity of farmer practice. Some results of on-farm trials have been disseminated to field EWs through the monthly newsletter. The maize project has had an impact on ARPT on-farm trials. Currently, two on-farm trials are taking place on the effectiveness of some of the new ox-drawn implements being introduced in relation to planting maize and soybeans.

Collaboration between ARPT and field EWs has not flourished however. While there was good collaboration during the initial survey work, there has been minimal involvement of EWs in the on-farm trial

programme. This may also be a reason why the EWs have shown little interest in the demonstrations arising from the on-farm trials, apart from the obvious reason of being busy with their new extension/development duties. A further factor limiting collaboration is that the field EWs resent the fact that they are not made responsible for trials, but are only asked to assist by the trials assistant who is junior in age and experience, but is thought to regard himself as superior in knowledge.

At the provincial level, the link established between ARPT scientists and the SMSs has not progressed very significantly since the 1984. In part this can be attributed to changes of manpower on both sides. However, the persistence of traditional attitudes and organisational factors are also at fault. Extension continues to 'look up' to its (supposedly more knowledgeable) order brother research to 'pass down' the latest recommendations, putting little pressure on research to come up with better recommendations and providing minimal criticism of existing ones. The research scientists, in conformity to professional standards and sensitive to the opinions of colleagues in commodity research teams, appreciate any extra time to carry out another seasons' experiments so as to come up with revised recommendations more confidently. Moreover, it is important for the RELO to have confidence in the on-farm trials before the results can be translated into technical recommendations. Experience has shown that lack of confidence in a trial can lead to the RELO using demonstrations as on-farm tests to refine recommendations, or even try out new technologies, rather than actually to demonstrate. Perhaps as importantly, due to the weakness of communications between different levels in the extension hierarchy, there has been limited pressure on the provincial ARPT and RELO to come up with a comprehensive revision of the recommendations. Thus while the monthly newsletter has provided a useful way of presenting research results, it has not yet facilitated the extra step of presenting clear recommendations for separate target groups in the province. This in turn related to the absence of a strong commitment and resource input to the T and V approach which might provide the demand for the delivery of standardised extension messages in a routine way to the maximum number of farmers, together with a more effective feedback mechanism on the appropriateness of technical messages. The absence of a single and unambiguous set of technical messages has provided EWs with considerable autonomy and flexibility. It has also created potential uncertainty among field EWs as to what the official

recommendations are. From the point of view of an effective T and V system, these are clearly undesirable developments.

Research Extension Links

The link between extension and research in Central Province has clearly improved considerably since the inception of ARPT and the appointment of a RELO. However, the position of a RELO did not, on its own, guarantee the fast delivery of revised technical recommendations to field EWs in the Province. The large gap still existing between the official recommendations and farmer practice calls for a comprehensive review of these recommendations. This can be done on the basis of knowledge from survey work, agronomic monitoring and several years of on-farm trials, and in consultation with commodity research scientists and extension staff. That this review was not forcefully demanded reflects the recognised weakness in the organisation of SMSs at provincial and district level (GRZ, 1984), and extension's tradition of looking up to research rather than interacting as equals.

The communication upwards of farmers' agronomic problems through the extension hierarchy remains a weak link, and so the information available to research has been limited mainly to areas covered by ARPT surveys and on-farm trials. To improve the flow requires more training and support for all levels of extension staff. Training should focus on methods for eliciting and researching farmers' problems and for writing reports on these. To enable EWs to perform this task, a related important support will consist of a regular supply of stationery and transport to enable district staff to visit camp areas. The most appropriate forum for discussing and prioritising farmers' problems recorded by field EWs would be the Provincial ARPT Committee.

At the camp level, EWs in ARPT target areas could be more fully involved in the planning and management of on-farm trials, especially if farmer reaction to trials was incorporated as a part of the T and V visiting schedule. EWs need instruction on the differences between on-farm trials, on-farm tests, and extension demonstrations.

Relation of T and V and FSR to Development Projects

A further point relates to the influence of the maize project on both T and V and FSR in Chamuka. The way EWs have been mobilised to supervise individual farm management, allocate prizes to good

performers, and effectively supervise the farmers' use of capital loans represents a paternalistic model of extension which is reminiscent of the colonial apprentice farmer schemes, or the commodity focussed 'CFDT' approach used for cotton growers in Senegal (CIMMYT, 1984). Such an approach denies the assumption current in both T and V and FSR of an economically rational farmer who will respond quickly to technical advice once it has been demonstrated to be sound. The underlying implication for T and V is that extension staff are making major changes in their pattern and content of work, not because they believe the changes to be implicitly better, but in response to the incentives of transport and allowances offered by the project. The argument in favour is that at least transport and allowances enable EWs to be mobile and more active in visiting farmers, which is preferable to their remaining in the camp with sinking morales.

In order to progress this case study further it is instructive to examine the situation in Eastern Province where developments in FSR and T and V have been somewhat different.

The Contrast In Eastern Province

Implementation of T and V in Eastern Province

In order to place Eastern Province in context, it should be noted that in comparison with Central Province, and indeed most other provinces in Zambia, Eastern Province has four characteristics which make it more attractive for implementing the T and V approach. It has comparative ecological uniformity with good soils and rainfall, making for broadly similar farming systems across the province. Secondly, it has a longer history of smallholder cash cropping along with extension services geared to small farmers. Thirdly, its population density is higher and settlement concentrated along the plateau, making most farming households easily accessible. Fourthly, because of the nature of its soils, rainfall and history of cash cropping much of the past agricultural in Zambia and neighbouring countries is relevant, and in conjunction with on-farm tests can be used to formulate technical recommendations for the province. This is possible because of similarities in soils, climate, and cash crops which are not common to many of Zambia's provinces.

In contrast with Central Province where minimal extra resources were invested, T and V in Eastern Province was introduced as the central part of a large donor-funded agricultural development project.

Expatriate experts arrived in 1982 to implement T and V and there was a major investment in vehicles, field officer allowances, and training operations.

Taking a district by district approach, T and V was operational province-wide by 1986. The scheduled visiting programme was tighter than originally planned (GRZ, 1983), with four instead of three days per week of scheduled visits, and a corresponding increase from six to eight sections per camp as detailed in the more recent official strategy (GRZ, 1984).

On a general level, it is worth noting that some of the obstacles to T and V encountered in Central Province were avoided in Eastern Province. Inadequate transport, fuel and allowances which hampered programmed visiting were avoided by the provision of these at considerable cost. These facilities, combined with experienced management and regular training/reporting meetings, have ensured a higher morale among all grades of staff, more effective supervision, and a more easily directed programme of work. However, in spite of these substantial extra inputs some common problems remained.

As in Central Province, selecting representative CFs and motivating those selected to attend meetings and extend their knowledge to neighbours, was reported as a problem. In the early selections virtually no women CFs were chosen. Inclusion of women as CFs had to be introduced as part of a policy directive. To some extent the problem of getting CFs to attend meetings regularly was overcome by providing them with the incentive of free demonstration inputs wherever possible. At the same time, there was a concern from extension management that administering too many demonstrations, like research trials, could overburden field EWs and divert them from the more straightforward task of delivering messages. On the other hand, some FSR and extension staff held the view that properly managed demonstrations, as part of a 'training and demonstration system' may be a more effective extension tool than the verbal and strictly routine delivery of messages (China, 1986).

As with Central Province, attention on collecting yield and other agronomic data from demonstration carries the risk that demonstrations may become a second order of on-farm trials, and field EWs (and farmers) may confuse the two. Indeed during interviews field EWs and some more senior extension staff tended to use the term 'trial' and 'demonstration' interchangeably. Ensuring that CFs extended their knowledge to neighbours remains a problem area, and begs the question as to whether the concept of the CF is appropriate in

the context of the kind of community structure prevailing in much of rural Zambia and indeed much of Africa (CIMMYT, 1984).

FSR and Extension Linkages in Eastern Province

FSR in Eastern Province also started in 1982 as a component of the same project. The project provided the technical assistance and operational funds for the establishment of the provincial ARPT. The managers in charge of implementing T and V saw the need for appropriate technical messages at an early stage of their programme. At the same time the expatriate farming systems agronomist in the provincial ARPT team was a very experienced field researcher who, perhaps more than his counterpart in Central Province, saw the production of appropriate technical recommendations in the shortest space of time as a prime objective. While there was no RELO in the province, one of the T and V managers saw the importance of this role and played it as far as time permitted, ensuring a Zambian RELO was recruited before he left the project in 1986. After two years of on-farm and complementary on-station research, combined with a review of relevant commodity research in Zambia and neighbouring countries, the ARPT agronomist took the initiative of revising the official recommendations. This revision initially met with some resistance from commodity researchers at national headquarters, but was quickly accepted at provincial level as vital for an effective T and V system. Indeed this initiative stimulated the Department of Agriculture to reconsider the procedures for formulating recommendations. Thus the more conservative attitudes and organisation which slowed the revision of the official recommendations in Central Province did not withstand the pioneering spirit of an individual combined with pressure from the agricultural development project for fast innovation in Eastern Province. Moreover, the absence of an official RELO in Eastern Province gave the FSR agronomist the mandate to revise the recommendations more independently, reducing possible delays arising from differences of professional opinion at the provincial level.

It is early days, and the T and V system has only been recently introduced throughout Eastern Province, but already there are encouraging signs for the potential for even closer research extension linkages. Transmission of new technical messages down the extension hierarchy to field EWs has been effectively accomplished through the distribution of a monthly extension bulletin combined with regular monthly meetings at district and block levels. These monthly meetings

also provide a valuable opportunity for field staff to report back on farmer's problems and the applicability of new technical recommendations. Already, an on-farm fertilizer trial has been devised in response to comments from EWs and farmers in some areas (where soils are sandy) to a new recommendation for the mixing of basal and top dressing fertilizers as a labour saving operation. However, it is recognised in the province that field EWs need more training in how to elicit and report problems relevant to agricultural research. At present they concentrate mainly on institutional problems (credit and input supply) and have difficulty in analysing farmer agronomic and socio-economic problems using a farming systems perspective.

In comparison to Central Province where on-farm trials have been managed solely by trial assistants seconded from extension, field EWs in Eastern Province have been widely used in running on-farm trials, particularly in the first three years. This has created a stronger link between FSR and extension at the field level. Some of the EWs who have been involved in running on-farm trials have expressed an interest in having more of these, noting that they can be fitted into their T and V schedule. While the extension management is sceptical about this, seeing trials as a potential disruption of programmed extension visits, the idea does provide ARPT with a quick and cost-effective way of covering a wider geographical area and getting farmer and extension feedback on new technical possibilities.

While the T and V programme has placed a high demand on the provincial ARPT for appropriate technical messages, and has been pleased with the service provided, there have been a few points of potential conflict. Firstly, the resistance by national level research scientists to the provincial revision of crop recommendations served to create some resentment on both sides, which was a potential obstacle to good communications within the Research Branch between ARPT and commodity teams. Secondly, the demands of a rigorous T and V schedule made it more difficult to involve field EWs in farming systems activities, particularly trials and survey work. Thirdly, while ARPT has subdivided the province into target groups based on differences in farming systems, the T and V system uses different divisions based on administrative units which often do not coincide with the ARPT subdivisions. Fourthly, and relatedly, the T and V system did not allow for different messages to be targeted to different categories of farmer at separate meetings; all messages were delivered during one meeting to a mixed group of farmers.

Happily, these potential conflicts have largely been resolved, signalling the prospects for a successful marriage between FSR and T and V in the province, and between FSR and commodity scientist in the Research Branch (Kean, 1985). After a working committee was set up at the central research station, the procedure for recommendation formulation and release was subsequently modified to give the provinces more authority. Provincial recommendations no longer come down from the central research station, but are formulated within the province and presented to the Provincial ARPT Committee for initial approval, before being passed up to a national committee for final ratification. The provincial committee provides an opportunity for SMSs, DAOs and specialist scientists operating in the province to pass comment. The T and V system has facilitated constructive comment from extension staff by providing them with fast feedback on the reactions of field EWs and farmers to previous recommendations. On the second issue of FSR activities competing for EWs time in the field, BSs have been assigned to assist with ARPT activities in order to relieve camp EWs in ARPT target areas of any clash of programme. Camp EWs will still be able to organise farmer visits to on-farm trials in their camps as part of their T and V programme and visit the trials themselves more regularly every other Friday as part of their training programme. However, initial investigations revealed some reluctance on the part of EWs who had been relieved of their on-farm trials to show CFs around trials which were no longer their responsibility. Regarding the issue of the discontinuity between ARPT target groups and extension subdivisions, the format and distribution of the monthly bulletin has been modified to take on more of a systems perspective. Now there is a separate bulletin for each of the different farming systems, and to get effective targetting of messages and bulletin distribution, camps have been classified in relation to the three main farming systems for more effective targetting of messages. This has not yet resolved potential confusion at the camp level when farmers operating different systems belong to the same contact group and receive the same messages at the fortnightly meetings. The extension management feels that arranging a separate visiting schedule for different target groups within a camp would create confusion among extension staff at this early stage of introducing T and V.

Finally, in common with Central Province, the organisation of input supplies was reported as an obstacle to the adoption of new technical recommendations. Lack of some of the appropriate fertilizers and hybrid maize seed in some areas put local EWs under pressure from

farmers to explain the situation. It is to the credit of the T and V system that it enabled the extension service, through the monthly bulleting and meetings, to respond quickly to the situation by modifying the recommendations in relation to the local availability of inputs.

Conclusions and Policy Implications

The Training and Visit System for Zambia

The benefits which T and V will bring to Zambia as a whole are still an unknown quantity. The experience of Central and Eastern Provinces supports the observations of senior extension administrators in Africa that a fully-operational T and V system requires a substantial financial and manpower input (CIMMYT, 1984). This input would come at a time when the government is trying to reduce costs and the size of the civil service. While agriculture is a priority for development, the government still has to assess the benefits of alternative lines of investment in the small scale farming sector. It is still not clear whether more investment in extension for example, would bring more benefits than investment in on-farm or commodity research, not forgetting provision of credit and input facilities. However, the study makes it clear that investment in extension (and by implication related agricultural development) is likely to be much more productive after a new and more relevant range of technical messages has come up from the provincial ARPT on-farm research activities; on-farm research should precede additional investment in extension activities.

A further conclusion is that, while the main strength of T and V is in its scheduled programming of field extension work, some flexibility will be required if T and V is to be further pursued across Zambia and indeed in most African countries (CIMMYT, 1984). For example, the number of section per camp and visiting days per fortnight, may need to be varied both seasonally and geographically. Such variation will be necessary because of low population densities and shortages of appropriate technical messages. Visiting could be more strategic for maximum impact during the cropping season, focusing on key operations. Slack months in the farm calendar could be used for extension training, especially in remote areas where transport logistics make monthly training problematic. Further flexibility may be required in the use of CFs as experience from Kenya has shown (CIMMYT, 1984), and the kinds of local community structures where CFs are likely to operate most effectively require further study.

Methods of Delivering Advice

While T and V demands a regular programme of visiting, it does not detail methods for delivering advice. The FSR approach stresses the need for appropriate technical messages for different categories of farmer, but also leaves the question of methods of delivery open. The findings of the study suggest that a T and V approach based on group demonstrations is likely to fail where, in the absence of conclusive adaptive research, relevant technical messages are not available. Successful demonstrations hinge critically on appropriate messages. If the message is not appropriate, or still in some doubt, demonstrations may be regarded as on-farm experiments or simply as demonstrations of novel but impractical ideas. Even when the message is technically sound, it was observed that farmers' own crops frequently looked superior to the demonstration plots, due to late arrival of inputs and/or poor management. Moreover, organising the distribution of instructions and inputs for demonstrations is often a major logistical task, placing an additional strain on extension administration.

Under such circumstances, alternative methods which make more use of local knowledge and resources should be developed. Possibilities include: field meetings at strategically selected local farmers, group discussions focussed on common problems, and individual informal visits to the innovative farmers in the camp area. It should also be recognised that dropping demonstration plots as a method will probably make the recruitment and motivation of CFs more difficult. In these circumstances it may make sense to follow the adaptation made by field EWs in Central Province and use T and V to ensure a systematic coverage of areas rather than individual CFs, using contact points, rather than CFs, to ensure a fuller coverage of the farmers in the camp. Such adjustments can be made within T and V which permits both a group and individual farmer focus (CIMMYT, 1984)

Where on-farm and commodity research programmes have provided appropriate technical messages for different groups of farmers a different approach can be used. Group meetings can be held and technical advice delivered to the group as a whole. In order to target the message more effectively, however, EWs will require training in a farming systems approach so that they can also visit farmers individually and provide advice which takes account of particular sets of circumstances, such as the competing demands for cash and labour of different crops.

Content of the Technical Message

The method of delivering advice has an important bearing on the content of the technical message. The use of demonstration plots allows less room for misunderstanding of new messages and also puts the onus on the field EW to present the message correctly in order to get good results. At the same time demonstrations often have the limitation of a single new message for a particular crop which may not be relevant to all or even the majority of farmers in the camp. Ideally, carefully targetted demonstrations can be combined with visits to farmers' fields to develop a more open ended and participatory forum for developing and discussing technical advice. Visits to individual farmers can be made firstly in order to discuss problems and give related advice, and if the advice produces good results a second meeting can be convened to witness and discuss the advice further.

The content of the technical message also needs to be considered in relation to the type of extension system dominant in a province. Where T and V is fully developed and supported by a regular (eg. monthly) bulletin then messages can be more specific and focussed, both in relation to key operations on particular crops, and for adjustments in recommendations necessary due to changing prices and input availability. Where a less developed system operates, with information going out to field workers less regularly, perhaps annually, the messages will need to be more general, stressing a possible range of 'best bet' agronomic practices, and more will be expected of EWs in terms of adapting messages to suit differences in farmers' circumstances and seasonal conditions.

The content of the technical message will also be affected by progress with on-farm research, and priorities attached to a complete update of technical recommendations. Where progress has been slow, and updating recommendations has low priority, the field EW will have a more varied and less uniform range of technical messages, many of which will be impractical for the local farmers. In the absence of nothing better, the EW will either continue with the same old unpopular messages, or modify existing recommendations by learning from local farmers and develop a locally adapted set of key messages. Or he may withdraw almost completely from giving advice except on new crops introduced with credit packages (such as the LINTCO packages).

The 'packaging' or 'framing' of recommendations for T and V finally needs to be considered in relation to familiarity with existing

proven recommendations. Where familiarity with recommendations corresponds with practice, the regular bulletins would more profitably leave out these messages and highlight those relating to new technologies and crops. A further way of focussing messages in monthly bulletins would be to avoid covering every crop and enterprise in the system and target the message on priority crops and priority operations (such as tillage or fertilizer application). This would fit well with the FSR approach which emphasises focus on priority areas of intervention in the farming system.

Farmers' views of Extension and FSR

Interviews with farmers in both provinces revealed that they did not clearly differentiate between the activities of EWs and those of FSR teams. Farmers saw both as teachers of official 'agriculture'. This perception partly arose because extension demonstrations, like on-farm trials, included comparative treatments and attempted to measure differences. Both extension and FSR should take note of the farmers' view, and review more critically the way they present their activities to farmers. One way of presenting farmers with a clearer idea of FSR activities would be to ensure visits to trials are included in the field EWs programme of farmer meetings.

Research Extension Links

The link between extension and research at the provincial level has been improved considerably through the establishment of provincial FSR teams. The position of RELO has further enhanced this link by making an individual officially responsible for ensuring that strong lines of communication are maintained. One danger in provinces where extension organisation is weak, and the RELO is an experienced extensionist, is that the RELO will be pulled into a range of extension activities which go beyond straight forward liaison and the review and formulation of technical messages, such as general training and managing demonstration programmes. Moreover, neither the existence of a provincial FSR team nor position of RELO automatically ensure that provincial recommendations will be quickly revised. Two other factors emerged from the study as important. Firstly, much depends on the demands made by the local extension service for revised recommendations, and its capacity to present itself as an organisation which can deliver these effectively. Second, the

priorities of the FSR agronomist for fast results (which are probably not publishable), together with his or her willingness to make judgements on limited research results and so risk incurring the criticism of the commodity scientists, particularly those involved in making the previous recommendations, are clearly important. The provincial ARPT research committee has proved to be a useful forum for formal communication between research and extension. While it presents the opportunity to consult extension on provincial research priorities, the committee is not the best forum for a detailed discussion of these. More detailed discussions can take place informally between professionals in extension and research, and where T and V has a monthly training programme, at extension training meetings.

While the flow of information from research to extension was good in both provinces, the communication upwards of farmers' agronomic problems through the extension hierarchy needed strengthening. The upward flow of information was, however, noticeably better in Eastern Province where the T and V system was operating effectively. Further improvements will depend largely on effective training of the EWs in a more participatory approach, and in an FSR approach which enables them to clearly differentiate between different kinds of problems: agronomic, climatic, economic, social and institutional. The RELO and other ARPT/FSR staff, clearly have a role to play in assisting with this training.

At the field level, research-extension linkages in Zambia as elsewhere have clearly been strengthened through FSR activities (Collinson, 1984). The secondment of field EWs to ARPT as trial assistants has served to expose a small number of extension staff to the farming systems approach. At the same time this arrangement has, like other secondments of extension staff, caused some resentment among regular field staff, and at times distanced local extension staff from the on-farm research programme. This distancing has happened most when a younger man has been brought into a camp as a trials assistant. Where a senior camp EW has been simply redesignated as a trials assistant, close working relations have been sustained. A further point is that effective linkage at the field level only takes place where there is an on-farm trial programme, and so a minority, perhaps 5-10% of camps in a province benefit directly. Where field EWs are more directly involved in on-farm trials, such as in Eastern Province, more camps can benefit. However, when trials are scattered too far apart effective supervision and monitoring, along with feedback of results to camp EWs becomes problematic.

The Compatibility of T and V and FSR

The aspect of compatibility between T and V and FSR has been covered indirectly in the conclusions above, and in discussion during the case studies of Central and Eastern Provinces. However, a few general and specific points are worth emphasising by way of a final conclusion.

From the general viewpoint both FSR and T and V have a compatible philosophical position in that both place the farmer (in preference to a commodity or a technical package) at the centre. Moreover like FSR, T and V targets its activities at the better use of farmers' existing resources rather than the provision of extra inputs along with advice (CIMMYT, 1984).

Specifically, the case of Eastern Province highlights two important ways a full-scale T and V programme can positively influence an FSR programme. Firstly, as has been found elsewhere, T and V places high demands on researchers to come up with relevant recommendations quickly, and encourages them with the guarantee that new recommendations will disseminate efficiently (CIMMYT, 1984). Secondly, once new recommendations have come out, T and V provides a fast and effective mechanism for feeding back farmer reactions to research and also extension SMSs. These two influences are complementary; the assurance of rapid feedback means there is less risk to coming up with recommendations on the basis of limited on-farm research. The potential for easy and fast revision of recommendations through the bulletin monthly is a further incentive for the quick formulation of technical recommendations.

A point of potential complication arises with the targeting of technical messages. Handling differences within the farming community by developing a flexible message to suit farmer circumstances may be less easy to manage through T and V than through the traditional method of individual contact, or even the new adaptation of 'pilot farmers' now operating in Chamuka Block. Again the experience of Eastern Province is encouraging. While the T and V system started by distributing the same range of messages to all camps, the recent development of a separate version of the bulletin for the different farming systems targeted in ARPT on-farm research has considerably improved the targeting of messages. Yet, the difficulties of targeting at the camp level have not been completely resolved. Within camps the visiting schedule, together with the selection of CFs, has not taken full account of the fact that different types of farmer will

require different technical messages. But this is not so much a constraint of the T and V system itself, as the way it has been implemented; with the accepted procedure of starting with the most easy arrangements to begin with and introducing more complexities as extension staff are further trianed and gain confidence in the system (CIMMYT, 1984).

One way that T and V has clearly improved the targeting of messages is by relying on a monthly bulletin of recommendations rather than a handbook covering the entire season. This has enabled better targeting both by ensuring that messages are delivered in a timely way in relation to the season, and by ensuring key messages relating to new technologies or modifications arising from input shortages or price changes receive emphasis.

A further point of conflict relates to the involvement of EWs in on-farm research programmes. The T and V schedule places a heavy demand on EWs time, particularly at the time when on-farm trials are being prepared and planted. Secondment of EWs to the FSR programme is one way of avoiding this conflict, but it also weakens linkages and feedback at the field level. Another option is to make supervisory staff in extension responsible for on-farm trials, and has been recently done in Eastern Province. A combination of these options may be the best solution. A further solution would be to reduce or remove the demonstration programme in areas with on-farm verification trials, which would also act as demonstrations (CIMMYT, 1984). This would allow the EW to incorporate the trials rather than the demonstrations into his T and V schedule, and also reduce the confusion at the camp level between on-farm trials and demonstrations.

A further point on compatibility relates to the overall organisation of research and extension in a country. Because the links at the national level between the two have been historically weak in Zambia, it has been easy, and necessary, to form strong links at the provincial level. The centralised research system based on commodity teams has given the provincially based FSR teams more scope to participate in the formulation of research recommendations than if research had been regionally organised. In short, the fact that the organisation of the FSR programme has paralleled the provincial organisation of extension has greatly enhanced the potential for close links, and therefore more compatibility between T and V and FSR (CIMMYT, 1984).

A final point is that while FSR and T and V are broadly compatible,

with considerable potential for positive feedback in both directions, one does not critically depend on the other. It is conceivable that FSR could interface effectively with other styles and models of extension, and that T and V could operate effectively where on-farm research was conducted by commodity scientists, and there was not a separate FSR programme. Nevertheless, on the face of the evidence in this study, the small farmer stands to lose nothing and benefit considerably from a closely linked T and V and FSR programme operating at provincial level (or a comparable administrative subdivision).

Note

1. The research for this paper was carried out while the author was working in the Research Branch of the Zambian Department of Agriculture, as rural sociologist in the Adaptive Research Planning Team. Technical assistance for the post was provided by the Overseas Development Administration, U.K., initially through the ODI overseas research fellowship scheme and subsequently through the OSAS scheme. Four undergraduates from the University of Zambia assisted with the first two stages of the research; P. Shapi, E. Musaba, P. Chali and R Chulu. Extension staff at all levels from the Assistant Director of Extension down to the field staff, gave generously of their time and knowledge, as did the farmers interviewed and ARPT staff in the provinces. Valuable comments on the previous ODI discussion paper on which this chapter is based came from Guy Hunter and Michael Baxter. The author wishes to thank the above organisations and individuals for their assistance, but acknowledges sole responsibility for all views expressed and any remaining errors.

T and V Extension Impact in Northern India*

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The early literature on T and V extension (von Blanckenburg *et al.*, 1980; von Blanckenburg, 1982; Cernea, 1981; Cernea *et al.*, 1983; Howell, 1982a, 1982b; Jaiswal, 1983; Moore, 1984; Shingi *et al.*, 1982; Singh, 1983) has been mainly qualitative in nature and more often than not, a review of first experiences. This paper draws upon a rich data base provided by Monitoring and Evaluation reports on the implementation of T and V extension issued by several states in India and a study undertaken by two of the authors in conjunction with the Haryana Agricultural University at Hissar, India. This evidence suggests there are several issues worthy of further study and we have chosen three in this paper.

The first is the supply of and demand for extension services as measured by the frequency of VEW (Village Extension Worker) visits. Specific questions are: (a) is the supply of extension services close to its potential? is demand as high as supply? (b) is there a difference in the extension agents' interaction with farmers belonging to different farm-size categories? (c) is there a difference in the patterns of visits between the two major cropping seasons, namely, kharif (rainy season), and rabi (dry season)? (d) how does the pattern of interaction change as the new form of extension becomes more established?

Regarding the questions in (a), we presume that when the T and V system functions properly, there should be a high supply of extension services since the system allows *inter alia* for effective supervision.

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Technically, we define 'high supply' as being close to the designed frequency of agents' interaction with contact farmers. Demand, as measured by extension agent interaction with non-contact farmers, is bound to be lower than the observed level of interaction with contact farmers, since such farmers are less aware of the availability of extension services. Demand should, however, be higher in areas with T and V extension than in non-T and V areas. This is due to the fact that the cost to the farmer of information search and acquisition will be lower in an area of intensive extension coverage because agents are more numerous (Feder and Slade, 1984b). There may, however, be a demand-reducing effect because non-contact farmers under the T and V system are supposed to obtain information passed on from contact farmers and this could weaken their motivation to meet with the VEW.

In examining question (b), evidence suggests that extension agents are traditionally biased toward the more wealthy and influential farmers (see for example, Howell, 1982a). The factors and motivations generating such a bias in the supply of extension services could still be present under the reformed extension system. On the demand side, the economics of information-acquisition suggest that demand by smaller farmers will be less than that by larger farmers (Feder and Slade, 1984b).

Concerning (c) above, it is expected that the VEW will play a more significant role in the dry season (ie. rabi) if there are a significant number of farmers with access to irrigation. This is because agricultural research in countries like India has traditionally been directed towards improving technology for irrigated rather than rainfed crops. Hence, for irrigated crops there is a great quantum of proven technology available for delivery to farmers by the extension service. However, as we hypothesise below, the greater riskiness of rainfed agriculture could serve to increase the demand for accurate and proven information during the wet (kharif) season.

In relation to question (d), it is conceivable that as initial enthusiasm and institutional support diminish, various aspects of extension operations, such as visits to farmers, slacken. On the demand side, any favourable experience with extension advice and increased awareness of extension availability will tend to increase farmers' interaction with extension, while disappointment with recommended practices may result in diminished demand.

The second set of questions concerns the VEW as an information source in relation to other sources of information (eg. other farmers, radio, etc.) and the extent to which the VEW is a preferred source for

more expensive or complex agricultural practices. Specifically, we ask the following questions: (e) How important is the extension agent as a source of information in relation to other sources in areas covered by T and V extension? How does this compare with the role of an extension agent in a non-T and V extension system? (f) What is the nature of the interaction between extension agents and other sources of information? (g) Is the T and V agent more important than other (non-personal and non-specialised) sources of information?

Concerning (e), we expect the VEW, if the training and upgrading of staff skills called for under the T and V system are effective, to be the most important source of information, since he is a personalised and specialised means of information transmission to farmers while also being more readily available due to the schedule of frequent visits. We also hypothesise that the importance of the agent under the T and V system outweighs that of an extension agent in a non-T and V setting, because of superior training, more frequent availability and higher visibility.

In considering issue (f), our approach is exploratory. We attempt to examine other information sources as either complements to or substitutes for personalised extension. For example, Orivel (in Perraton *et al.*, 1983), quoting another study related to India, states that although radio was the medium most equitably distributed, its use had no impact on the introduction of agricultural innovations.

Finally, regarding question (g), the expected answer is positive, since the value of specific and accurate information should increase for riskier, more expensive, or complicated practices.

The three questions reviewed above are also explored further below. Our third set of questions related to farm productivity. Specifically: (h) Are yields higher for farmers who report the extension agent to be their main source of information? Does this hold for irrigated as well as non-irrigated farms?

If extension is delivering a flow of proven and acceptable technology then the adoption of that technology is likely to be greatest amongst those farmers who depend most heavily on extension for information. Hence there should be a discernible and positive effect on crop yields for such farmers. Following the arguments above, we also expect this effect to be greater in irrigated than in rainfed farms. Moreover, we hypothesise that this will hold even if the information provided by extension in rainfed and irrigated areas had equal expected value as the inherent riskiness of rainfed agriculture is greater than that of irrigated agriculture.

Supply and Demand for Extension Agent Visits

The interactions of the VEW with contact farmers can be viewed as a system determined 'supply' of extension services. 'Supply' is a relevant concept because the T and V system requires the VEW to regularly provide these services to contact farmers. Contact farmers, in turn, are expected to disseminate this information to non-contact farmers. Thus for non-contact farmers, the interactions between farmers and extension agents are likely to be 'demand' determined — ie. non-contact farmer meetings with the extension agent may reflect the farmer 'demanding' the information, since it is not a system imperative that the VEW regularly visit farmers other than contact farmers (see for example Cernea, 1981). The VEW is expected, however, to accommodate requests for information from all farmers. It is also expected that non-contact farmers will occasionally attend meetings between the VEW and contact farmers.

For the purpose of examining the broad differences in the quantum of visits by the extension agent to contact and non-contact farmers, data from monitoring and evaluation reports from seven states in India over a number of years have been used.

The critical indicator is the percentage of farmers who report not seeing extension agents. For contact farmers, this ranges from 1.2% to 34.7%, while for non-contact farmers, it ranges from 21.4% to 59.2%. Across all seven states the average percentage of 'no visits' reported by contact farmers is 15.4% (ie. about 85% of contact farmers were visited at least once in the reference month), while 34.5% of non-contact farmers reported no interaction with extension. The demand for T and V extension services as measured by non-contact farmers' interaction with extension agents thus appears significant. Considering that some share of 'no-visits' must be due to factors such as agent illness, vacant posts, contact farmer non-availability, etc. (factors that Feder and Slade, 1984a, refer to as 'normal friction'), the actual supply of T and V extension services seems adequate relative to the potential supply.

As expected, the demand for extension services (measured by agents' interaction with non-contact farmers) is significantly lower than the supply (measured by agent visits to contact farmers). But the actual supply available to non-contact farmers must be less than that which is available to contact farmers, thus there is not necessarily a significant level of unused capacity. Further, the demand for extension services in a T and V area is far higher than the demand in a non-T and

V area: data for a section of Muzaffarnagar district in Uttar Pradesh, which is not covered by the T and V system, show that between 89% and 97% of the farmers were not visited by (or did not seek out) the extension agent during the reference period (Feder and Slade 1984c).

This could be the result of either low demand or low supply. It is known however that the extension agent:farmer ratio is lower in non-T and V areas than in areas with T and V, and in the former areas agents have many duties other than extension. Hence it is possible that in areas without T and V extension the low supply of extension increases the cost to the farmer of acquiring information from extension and thereby reduces the cost of interaction between farmers and extension agents.

Data on visits and 'non-visits' by farm size show that there is remarkable similarity between large and small farms amongst both contact and non-contact farmers. Amongst contact farmers, 15.9% of the small farms and 14.5% of the large farms are not visited, a difference of only 1.4%. Similarly, for non-contact farmers, the difference is only 3.2%. While these differences are statistically significant, their size indicates that the bias in favour of large farmers is not great enough to warrant serious concern. Moreover, since non-contact farmers' interactions with extension agents are probably demand-driven, the difference between large and small farmers may merely indicate, as predicted by theory (Feder and Slade, 1984b), the tendency of larger farmers to invest more in information gathering.

We hypothesised that visit frequencies would be greater in the dry (rabi) season compared to the kharif. Data for both contact and non-contact farmers indicates that the incidence of no-visits during the rabi season is significantly lower than in the kharif, although the absolute difference is small. This result is consistent with an analysis conducted by Feder and Slade (1984c) which shows that knowledge diffusion rates tend to be higher for dry season crops than for rainy season crops. These findings support the hypothesis that the extension agent plays a greater role in the dry season although the cause may be more closely associated with the available technology and the riskiness of rainfed agriculture than the efficiency of the extension system. Another explanation may be that the rainy season reduces the mobility of extension agents.

We next examine the trend in extension visits as experience with the T and V system increases. The results form a mixed picture. The proportion of contact farmers not visited goes up significantly: amongst projects which are four or more years old, nearly one in five

contact farmers are not visited. This may, in part, be due to the VEW replacing those contact farmers who are deemed inadequate with other farmers without formally notifying the original contact farmers of the change. On the other hand, the proportion of non-contact farmers not visited declines equally significantly, from about 48% to 36%. This may be due to the fact that as projects mature, knowledge about the availability of regular extension visits spreads and more non-contact farmers take advantage of the service. As mentioned earlier, in the T and V extension system the VEW is expected to respond to all farmers who approach him with queries (Benor and Baxter, 1984). Remembering that contact farmers form only about 10% of the farming community, the most important finding is that the older the project, the greater the proportion of farmers visited.

Extension Agents in Relation to Other Sources of Information

It is reasonable to presume that farmers tend to prefer direct, specialised, personal and easily accessible sources of information, provided that they see such sources as being reliable and professional. Therefore, in areas with a large supply of professional extension agents we expect the role of extension as a means of information dissemination to increase.

We first examine how important the extension agent is as a source of information, in T and V and non-T and V areas. Data from the HAU/World Bank study was collected from geographically contiguous T and V and non-T and V areas in 1982. The main information sources were taken as extension personnel, demonstration days, other farmers, radio, sales personnel, research personnel, and 'other'. The data shows a dramatic difference between the two districts. In Karnal (a T and V district) 44% of the contact farmers and 13% of the non-contact farmers indicate that extension personnel are the main source of information. In Muzaffarnagar (a non-T and V district) only 2% of the farmers (all large farmers) are of the same opinion. For non-contact farmers in Karnal, and for all farmers in Muzaffarnagar, 'other farmers' are the most important source of information, followed by the radio. 'Other farmers' are an important source of information for contact farmers as well; slightly more so than radio. Sales personnel of firms marketing agricultural inputs also constitute a significant source of information for all farmers.

Since other farmers are the most frequently cited source of

agricultural information, and given the impracticability of reaching all farmers directly by extension, it is logical to base an information dissemination strategy on the principle of a two-step flow, whereby some farmers initially get continuous and frequent extension visits. Through the natural process of information diffusion, these farmers may subsequently be expected to transmit this information to other farmers.

These data also reveal the relative shares of different information sources. Ranking farmer categories by access to the T and V agent we see that the share of the VEW goes up from 2% to 44% with increasing access to T and V extension. It is then of interest to know which sources decline in importance. Among contact farmers, as the importance of the VEW increases the importance of 'other farmers' declines sharply. This is as expected since contact farmers are in a position to obtain information first-hand rather than through intermediaries. Among non-contact farmers, however, 'other farmers' continue to play a significant role, which is again as expected. This relationship between the VEWs and 'other farmers' as source of information is consistent with the two-step communication flow characterising the T and V system. The share of radio remains more or less constant, regardless of access to extension services.

The lowest ranked sources of information are 'sales personnel' and 'demonstration days'. The former seem to be an important source for farmers in non-T and V areas suggesting that they serve as a partial substitute for visits by extension agents. These five sources of information account for a little over 90% of the information needs of all classes of farmers.

To examine whether there may be differences related to farm-size, a similar analysis was conducted for large and small farmers separately. The results are almost exactly the same for both classes. There is a slightly higher preference among larger farmers for information from extension agents (irrespective of whether they were contact or non-contact farmers in T and V areas or farmers in non-T and V areas) but the differences are not statistically significant.

We also examined data on the T and V system drawn from seven states in India. These data are taken from the monitoring and evaluation reports produced by the State Governments and record the main sources of information, namely the 'VEW', 'other farmers', 'other sources', and 'no advice' for contact and non-contact farmers. We presume that the category 'no advice' means 'minimal advice' or the acquisition of information through observation or casual

conversation. The data shows that 80% of contact farmers and 54% of non-contact farmers claim extension agents to be their main source of information. Those who claim to take 'no advice', comprise about 9% of contact farmers and nearly 19% of non-contact farmers. 'Other farmers' are the main source of information for 20% of non-contact farmers, but less than 7% for contact farmers. These data support the finding that extension agents are the most important source of agricultural information in areas with T and V extension.

In contrast, data from a study in a non-T and V setting on the socio-economic constraints to rainfed agriculture in Thailand (Hutanawatr *et al.*, 1982) indicate that extension officers are the fourth ranked source of information — the most important being 'relatives and neighbours' (equivalent to our category of 'other farmers') followed by radio programmes and community leaders. The authors also report that '...more than half of the farmers sampled felt that extension officers could not help them solve any agricultural problems' (p25).

We next examine the question of whether extension agents become more important as information sources the more expensive or complicated a practice becomes, by calculating 'information source ratios' for two increasingly expensive categories of agricultural practices. 'Expensive' means the opportunity loss resulting from wrong application of the practice as well as the simple financial cost. The information source ratio is an indicator of the relative importance of two information sources: the VEW and 'other farmers' (ie. first-hand versus second-hand sources).

We found that in areas without T and V extension the VEW plays a very minor role in relation to both groups of practices — the ratios for less expensive practices and more expensive practices are 0.04 and 0.09 respectively. In areas with T and V extension the comparable ratios for non-contact farmers are 0.27 and 0.47, while those for contact farmers are much higher at 3.98 and 5.14. Reflecting the more favourable 'supply' conditions, the ratios become higher as access to extension increases.

There is also a distinct pattern with respect to farm size — the source ratios are consistently higher for larger farms. This may result from larger contact farmers having somewhat greater access to the VEW and larger non-contact farmers investing more in information acquisition. Moreover, the VEW is likely to be a more expensive source (in terms of time taken to locate and meet him) than 'other farmers'. In short, irrespective of farm size the data show that all classes of farmers prefer to receive advice about the more 'expensive'

practices from the VEW. Similar views are expressed by Howell (1984).

We also examined evidence contained in a detailed report on a study of T and V extension operations in the Indian State of Madhya Pradesh conducted by the National Council for Applied Economic Research (NCAER, 1983). Data in the report generally support the contention that VEWs play an important role as sources of knowledge about recommended practices for both contact and non-contact farmers. Further, the NCAER data suggest that the importance of the VEW rises as the riskiness or complexity of agricultural practices increases.

Information Sources and Farm Productivity

The process by which extension influences crop yields involves a wide range of intervening variables. The effect is indirect and not easily measured. However, if extension efforts are successful, this success must eventually result in an increase in output per unit and/or reduced costs per unit of product.

Since the contact point between the extension system and the farmer is the village extension worker, it is essential that the VEW, as a first-hand information source, be 'better' than other second-hand or non-personal sources of information. It would be hard to justify the expense of an intensive agricultural extension system under any other circumstances. A testable hypothesis is therefore implied, namely, that farmers whose main information source is the extension agent will have higher productivity than those who rely on other information sources, *ceteris paribus*. Of course, there may be some systematic relationship between farmers who are more inclined to utilise extension as a main source of information and other inherent attributes (eg. intelligence) which make them better farmers who obtain higher yields. Unfortunately, the data do not permit all other relevant attributes to be held constant and therefore our analysis is suggestive rather than definitive.

Drawing again on the State Monitoring and Evaluation reports in India, we used data on crop yields in the kharif and rabi seasons disaggregated by information source. For kharif, we use rice yields and for rabi, wheat, under both irrigated and unirrigated conditions.

State average yields were calculated by applying weights based on the sample sizes for irrigated and unirrigated farms and contact and non-contact farmers. The resulting overall average for each state was set equal to 100. Subsequently, each subset of yields was expressed as

an index number relative to the overall state average. This conversion permits rice and wheat yields to be compared (since they differ in absolute magnitudes) and heavily damps differences in agro-climatic and socio-economic factors between states. The net result of this conversion is a series of index numbers that is comparable across states, crops and cropping seasons.

Farmers whose main source of information is the VEW are found to have the highest yield index of 114.5. This was followed by those whose source is 'other farmers' and their yield index is close to the average. 'Other sources' (eg. radio, demonstration days, sales personnel, etc.) have a lower yield index of 95.77 and those farmers who receive 'no advice' 86.11. *Prima facie*, it would appear that those using the VEW as the main source of information have yields that differ substantially from all other sources, but the difference between 'other farmers' and 'other sources' is much less marked. All three, however, appear to be better compared to those farmers receiving 'no advice'.

Conclusions

The foregoing analysis of an extensive set of aggregate and farm-level data mostly pertaining to T and V extension operations in India permits several conclusions to be drawn. Approximately 85% of contact farmers are visited at least once a month, suggesting that 'supply' of extension services, taking normal 'friction' into account, is reasonable. Amongst non-contact farmers 65% have interacted with extension workers at least once during the reference period, suggesting that demand is substantial. The data also indicate that there is a statistically significant bias in favour of visits to large farmers; however, the absolute size of this bias is very small.

T and V agents appear to be more active and in higher demand in the dry as opposed to the rainfed cropping season; this is probably explainable by the fact that research has traditionally emphasised dry-season cropping technology and this has resulted in more reliable advice in the rabi season. Visits to contact farmers decrease with the age of the project, while they increase for non-contact farmers. With lengthening project life, there is a sizeable increase in the absolute number of farmers meeting with extension agents.

VEWs play a more important role in the dissemination of information in areas covered by T and V extension than they do in non-T and V settings; in both situations they are relatively more important to large farmers than to small. The VEW and radio are

probably complementary information sources. 'Other farmers' *qua* information sources appear to play a role consistent with a two-step communication flow. In a non-T and V setting they are the most important information source. In areas covered by T and V extension they are the major information source for non-contact farmers and a relatively minor one for contact farmers. These results hold for both large and small farmers.

VEWs become increasingly important information sources the more expensive or complicated an agricultural practice becomes; their role is somewhat greater in the case of large farmers. Yields in farms that rely on the VEW as the main source of information are higher than in farms that rely mainly on other sources of information. The other sources do not appear to differ greatly from one another, but any source of information appears to be better than receiving no advice.

6

Making Agricultural Extension Effective: Lessons of Recent Experience

John Howell

The likelihood of a long-term positive impact of the new and higher levels of public investment in agricultural extension depends upon the extent to which extension services can overcome the difficulties that have characterised past performance and which led to the period of neglect characteristic of most services throughout the 1970s. The most important of these difficulties are: (a) inadequate technical and economic research to complement the extension effort; (b) insufficient attention to the organisation of technical support services and input supplies; (c) disregard of the issue of financing the costs of extension and other farm support services; and (d) neglect of the factors of staff management and training in the provision of an effective field service. Before considering each of these in turn, it is worth reviewing the impact of ideas on the Training and Visit system and putting this initiative into perspective.

Training and Visit

The way that the Training and Visit system of extension has been promoted will ensure that controversies about its impact and implementation will remain. But these controversies are unlikely to be about extension *per se*: some are more likely to be about such matters as the appropriate role of the World Bank in attempting to reform Ministries of Agriculture; or the conditions of service of field staff previously employed by different public agencies. These are, however, extension issues proper which T and V has done much to illuminate: the appropriate functions of field staff and the selection of recipients among the most important.

On appropriate functions, there is general agreement that the extent of non-agricultural functions undertaken by extension staff has proved

to be a serious constraint on effectiveness in supporting agriculture. (I am thinking of public works supervision, assistance in electoral registration, public health campaigns, youth club management and so on). However, the non-extension agricultural functions of field staff are an area of more controversy.

Broadly, there are four categories of tasks which the field staff of a Ministry of Agriculture may be asked to perform:

- (i) data collection (eg. conducting eye estimates and crop cuttings, or managing rainfall gauges);
- (ii) supervising direct crop production (eg. government or licenced growers' seed farms, crop trials, school farms);
- (iii) assisting in the supply of inputs such as seed, fertilizer, pesticide, equipment, tractor-hire; and arranging loans for such inputs; and
- (iv) extension itself (supplying knowledge and advice).

The main issue is the relative weight to be given to (iii) input supply and (iv) extension. Most proponents of T and V argue that the tasks of input supply seriously undermine the extension effort. This is for two reasons. First, the time involved in input supply — and the priority given to it as a more measurable task than any others — prevents the extension agent from doing much extension proper. Second, the nature of the task inevitably leans the extension staff towards the more vocal and richer farmers who may be least in need of either input supply support or extension advice.

Opponents of this view claim that effective extension involving the recommendation of new practices, new varieties, new levels of input use etc must be closely harnessed to input availability. In many cases (eg. distribution of minikits, pesticide treatments on recommended varieties) extension work and input supply work are indistinguishable. For this reason, extension agents must be occasionally responsible for administering Ministry of Agriculture input supply programmes such as subsidised fertiliser promotion, and they must play a role in the programme of other agricultural agencies. This could involve for example, initialling loan applications for crop season lending or issuing permits for lifting certified seed where this is rationed.

In practice much of the heat has now gone out of this issue. This is because in reality (in India for example), T and V extension agents still play an important role in input supply whatever their formal roles are supposed to be. In Africa, furthermore, the inadequacy of both the private sector and publicly-owned agricultural service companies or boards, means that there is no practical alternative to some

involvement of extension staff in input supply work.

A second area of contention has been the selection of farmers for regular advice. From those who advocate and design T and V, the criteria for selection are as follows: farmers should be selected (as 'Contact Farmers' in most systems) from among those who have most to gain from (normally only incremental) technical improvements—in other words, the technically backward farmers who nonetheless have the potential for substantial yield increases. Furthermore, the selection should be representative of all categories of farmers within the above criteria of potential.

From the operational end of T and V, a rather different view emerges. This is that the selection of Contact Farmers should be based on criteria of a demonstration effect: only those willing to adopt improved practices and able to demonstrate, by example, the effects of adoption should be selected for special attention. This may mean that selected farmers have already a local reputation for higher investment in improved inputs and willingness to adopt newly released varieties.

It could be argued that this difference in approach has nothing to do with extension methodology: it simply reflects the pressure on field staff to demonstrate to their supervisory staff that recommendations are being followed and anticipated yield increases achieved. Hence, the field staff are drawn to supporting already successful farmers with a record of collaboration rather than the poorer non-collaborating group.

This dilemma points directly to the most frequent criticism of extension investment: that the establishment of T and V systems in particular countries or regions is unjustifiable on the grounds that there are simply insufficient reliable technical improvements to recommend to farmers. It is equally legitimate to criticise investment in T and V on the grounds that the available technical improvements are inappropriate to a majority of relatively disadvantaged farmers, as is the case in parts of India. But the general assumption of most T and V programmes is that the research system, to which extension is linked, *is* functioning and capable of producing technical recommendations and responding to difficulties confronting farmers of all categories.

Research and Extension

Extension work in practice has often suffered from the poor performance of research and, in particular, the inadequacy of

recommendations suitable to most farm conditions. Even in those countries where good research work has been done, there are problems of communicating research results. In Africa especially, research bulletins have become irregular or even stopped in some countries; crop-handbooks have not been updated; and an unacceptable number of field trials have been lost. In the latter case, this may be because of spending cuts arbitrarily imposed upon research station work or because of spending inflexibility which prevents, for example, the recruitment of casual labour for trials or restricts fuel availability to visit remote trials. In the southern regions of Tanzania, for example, I found that 75% of the established on-farm sorghum variety and fertilizer trials in the 1984/85 season had been lost because of the problem of transporting suitably-qualified agronomists to the sites.

These resource and organisation problems apart, the research challenge itself has often proved too formidable for existing research establishments. The attempts to develop new varieties and practices which out-perform those which already exist in peasant agriculture have come up against the complexity of farming in technically-backward and resource-scarce production systems. Occasionally, researchers and extensionists have found that recommendations involve a simple process of replacing one technology, such as a less disease-prone cotton variety in Malawi, with another and uptake is widespread. But more often, there are a range of characteristics other than, for example, yield performance and disease resistance which the peasant farmer has to take into account. It is this range of characteristics — including storage, labour requirements, timing of planting and cultural operations in relation to other crops, reliability of inputs and palatability — which make peasant agriculture such a challenge to research scientists. It has been the lack of understanding of such rural household systems which has diminished the performance of crop research and severely inhibited research involving the relationship between crops, animals, trees and land husbandry in those systems.

A more successful research effort is likely to require the use of extension staff in generating information on existing practices, and on how these should influence research design and recommendations. Yet the weakest link in extension organisation, in most African countries for example, is the generation of useful information on farm operations and the transfer of this information through the extension service to the research station. The regular meetings/training days

which are a feature of recent extension investment have the potential for rectifying this weakness, but the evidence on performance suggests that 'feed-back' remains inadequate.

In Zambia, for example, Sutherland reports much closer support from the research branch to extension services since the inception of an Adaptive Research Planning Team system with the Ministry of Agriculture and Water Development. But he also notes the continuing failure of the extension agents in systematically relaying information on farmers' agronomic problems. In a striking example from Zimbabwe, Cousins reports on a ploughing method developed with farmers by local extension staff outside the formal research system and thus only recently subject to replication trials elsewhere.

The CIMMYT-supported 'farming systems' work in both Zambia and Zimbabwe is helping to address the structural gap between research and extension. But professional attitudes are not easily altered. Research staff are not often interested in supporting extension where this involves additional and unfamiliar work; but as extension is currently organised, research staff rarely receive much benefit from closer collaboration with extension staff.

Within Training and Visit systems, there is normally a period for reporting problems in the training day, but in practice, this means a catalogue of agronomic difficulties with the performance of the improved varieties and practices discussed previously. In my own experience, there appears to be little discussion of the reasons for non-adoption, or the reasons why farmers have not followed extension advice. One way of strengthening this aspect of extension work is to encourage reporting on extension impact which puts a premium on diagnosing reasons for non-adoption, or perhaps adaptation, by farmers. Particularly where understanding of farm problems is poor, the value of extension reporting of this sort is for the design of research, although this presents real difficulties for aggregating and using the sort of necessarily anecdotal information that comes from extension meetings. (Howell, 1984)

Technical Support and Inputs

Where there is a generally poor record of research, the case for public investment in extension appears to be weak. The argument against extension investment is that effective extension must be 'demand led'. In other words, farmers must be looking for opportunities to plant new varieties or use new technologies; this readiness to adopt comes

primarily from looking at the experience of other farmers; and it is only when adoption has become fairly widespread that farmers begin to ask for advice from the field services of ministries of agriculture. By this interpretation it is farmers themselves who must take the risks before there is any interest in extension: extension itself will not encourage farmers to take risks. And therefore, the argument runs, until research stations have produced a stock of technologies which will attract farmers to innovation, there will not be a sufficient level of demand for technical advisory services to justify a major investment in extension.

But this argument — and its counter-argument — are somewhat academic. For example, it can be argued endlessly whether or not the introduction of hybrid maize varieties in Zimbabwe and Kenya was primarily led by an extension service confident in its recommendations or by farmer-to-farmer contact. Similarly it could be argued that the introduction of new small holder crops such as tea and cotton in eastern Africa in the 1940s and 1950s could be attributed largely to well-organised extension efforts and would not have taken place simply by farmers responding to market opportunities. Or the contrary could be argued.

The main issue that emerges from this discussion is that extension services are unlikely to be valued by farmers unless they are buttressed by a range of specialist advisory services and by government support for input supply services. In practice, extension services often lack such a supporting system. Within the extension service itself, professional support is weak. This is largely because, when ministries of agriculture expanded rapidly, many of the best agricultural staff were promoted into administrative positions or were transferred into specialised services such as horticulture or plant protection or into crop authorities. They became removed from direct field work and the general field services of ministries of agriculture became — and remain — relatively low status sections of ministries dominated by specialist services and planners.

For most countries, the biggest single organisational constraint in establishing effective extension systems is the difficulty of establishing such a support system. The particular difficulty is the staffing of 'district' level technical posts of 'Subject Matter Specialists'. It is simple enough to designate some underused diplomate in the district office as the agricultural engineering specialist. But developing a cadre of SMSs with the combination of research experiences (or familiarity with research work sufficient to refer problems and information to the appropriate place) and training ability is a longer-term exercise. Even

in a relatively well-endowed country such as Kenya, there are difficulties in recruiting specialists (in horticulture and crop protection, for example) to work at the district level and below (Government of Kenya, 1984).

The preparation and appraisal of extension projects does not always take into account the difficulties in building up this level — and because of the present low numbers of SMS posts especially in most African countries, it is an area of investment that tends to be neglected because of the high recurrent costs implication. In Africa, it is probably the greatest limiting factor to successful T and V forms of extension.

Financing Extension

There is a major question mark over the current generation of World Bank assisted extension projects. This concerns the high level of incremental costs for ministries of agriculture and the high level of long term recurrent cost financing of government extension services. African extension services are particularly threatened. In the earlier South Asia projects, the incremental costs were much lower because there was already in existence a large research and extension infrastructure with a well developed system of administrative support. Extension investment in South Asia was more to ensure a higher level of utilisation of existing staff and physical facilities rather than, as in Africa, the need to build up staff structures and facilities virtually from scratch.

If Africa is to follow the Asian lead, then this means priority to increasing substantially the level of staffing both at the field level and at the supervisory levels. It also means an increase in research expenditure both at the basic research station level down to the adaptive trials work. The establishment of research extension and trials work has a low capital cost to recurrent cost ratio and will necessarily mean that over the longer term, an increasing share of the cost contribution towards research and extension investment will fall upon governments rather than on donors.

The generation of funds from agriculture to finance extension and other services has been an issue in public finance from the period of colonial administration where crop cesses were earmarked for research and extension investment. There is also a record in most countries of user fees, particularly for 'private goods' such as animal treatments or tractor hire. While charges for 'public goods' such as

research or soil conservation cannot be usefully transferred to the ultimate users of services, there is clearly some potential scope for charging for specific extension services (such as soil testing) or for individual farm visits.

However, the experience of user charges on animal health and artificial insemination services shows the difficulty of assessing and collecting such charges in the traditional sector and, in any event, there remains the issue of how such charges (or Appropriations-in-Aid) can be effectively hypothecated for improving the management of services (rather than simply covering the costs of specific products). (Ramakrishnan)

Leaving such complexities to one side, it remains the case that at least a part of the activities currently termed 'extension' in some countries (such as pest control and seed inspection) could be considered for charging (or for charging at a full economic rate) and, as Nigeria's Kano State has shown, some input supply services can be transferred to more commercially-organised agencies of government than the extension service. The transfer of entire services to the private or co-operative sector is an obvious further possibility although in reality co-operatives undertaking extension-type work (quality control, loan administration, etc.) have required government subsidies to continue trading and in most countries the private sector option is restricted to a narrow range of services such as veterinary care or to specific high-value crop schemes.

The least promising possibility of all appears to be transferring a part of the salary costs of extension agents to farmers themselves. In Tanzania an experimental village-employed *bwana shamba* scheme has been unsuccessful despite the mechanism of village development committee collecting contributions. And quite apart from the practical difficulties of administering extension service charges in Africa, there would clearly be a contradiction in policy for those countries where smallholder production is already considered to be disadvantaged in terms of effective taxation on agriculture.

Given this somewhat pessimistic account of generating substantial new sources of revenue for extension, it is clear that most governments are faced with the need to invest scarce financial resources cautiously. The main approach has been to instigate expenditure on an area priority basis, rather than attempt programmes which are national in scope. Some governments (Kenya is an example) have used proven technical potential as the priority scale and have concentrated initially on the higher rainfall areas. The problem with this option is that areas

of low levels of agricultural productivity (where the opportunities for effective extension can be possibly highest) may be deprived of staff at the expense of areas of higher farmer demand for agricultural services generally. But other governments opting for priority in previously 'disadvantaged' areas (Tanzania and Ghana are 1970s examples) show, in the short run at least, a poor return on investment.

Managing Field Staff

The final issue which concerns extension investment is the apparent need to increase the productivity of staff, and the mechanism for this has been the introduction of a stronger management and staff training programme, normally termed 'training and visit'.

One of the main difficulties in employing any system of structured management is the sheer paucity of resources in some countries. In Tanzania, for example, much of the extension service was grounded in the early 1980s because of the lack of bicycle tyres in the country. In almost all African countries, several days at a time can be lost because meetings in headquarters have been cancelled but there has been no way of communicating this to remote field agents.

Even so obviously desirable a measure as regular technical meetings for extension agents is difficult to put into practice. Research staff and SMSs are thin on the ground and rarely very mobile; instructional material is difficult to prepare because of problems of production; overnight allowances have to be paid to extension agents travelling long distances; meals arranged and so on. In short, simply *arranging* meetings on a regular basis across the country involves a major administrative effort and cost.

But despite these obstacles to effective management, it is evident that new levels of extension investment must be accompanied by changes in organisation and supervision. This has been the thrust of recent World Bank support for the training and visit system. The main principles of the system are difficult to contest. However, the emphasis upon control is uncomfortably consistent with the prevailing bureaucratic and hierarchical style of most ministries and, rigidly applied, the system can stifle local extension initiative. Nonetheless, the new approach to extension management introduced in recent years has concentrated attention on three critical areas requiring improvement: the need to make extension staff specialists in production; the need for sustained field efforts; and the need for regular instruction.

A feature of the 1960s and 1970s was the spreading of the day-to-day work of the extension worker as the general purpose functionary of the ministry, involved in production schemes, data collection, grading of crops, etc. All of these pressures on the extension staff have meant that the long term job of developing a system of providing regular technical advice to farmers has been neglected. It is impractical to suggest that the role of ministries of agriculture should be redefined to concentrate wholly upon technical production matters; but the responsibilities of field staff clearly need to be consistent with those of the ministry itself. Arrangements whereby extension staff are at the beck and call of several ministries or regional authorities is a guarantee of ineffective extension.

In re-organising extension services, it must also be recognised that the calibre of field staff is generally poor and farmers lack confidence in the technical and diagnostic abilities of staff. There are few countries which can currently deploy a field staff with a universal standard of good secondary education plus two years diploma training or can afford to reach that level in the near future. In many countries, the use of meetings to upgrade technical knowledge is likely to be effective and relatively low-cost, but it does require a level of supervision by SMSs in the field which does not take place at present in many countries.

The structure of supervision appears to necessitate the establishment of a fixed schedule of visits to selected farmers undertaken by extension agents. For most poor countries, the individual farm visit remains the primary extension method of conveying information and obtaining information on farmer requirements. The use of mass media, local displays, demonstration farms, visits, and group meetings are auxiliary to face-to-face work with selected farmers. Because such work should normally take place over a growing season — at least — and as farmers need to have advance knowledge of visits, a repeatable work programme is desirable especially as this also facilitates supervision of staff and access to extension agents by farmers not selected for regular visits.

The further condition for effective management is the organisation of a field system involving a regular series of meetings held with groups of extension agents operating in similar agricultural environments and led by supervising officers and specialist staff. Under most existing T and V programmes, the (usually fortnightly) meetings are primarily devoted to instructions and explanations from SMSs and Extension Officers to extension agents on the series of practices that should be recommended for various crops over the forthcoming period. Despite

its limitations in diverse production environments, this is clearly an advance on 'unimproved' extension organisation whereby meetings are arranged for a particular ad hoc purpose or consist purely of administrative and salary matters. Like the narrowing of extension duties and the introduction of scheduled visiting, the regular holding of technical meetings is an essential condition for more effective extension work.

T and V again?

These points on the management of field staff provide some support for the emphasis on instigating a T and V approach to extension reform. However, they also suggest that there are some basic extension management principles which need to be established (or re-established) whatever particular term is used to describe a system of managing a dispersed field service with technical limitations. T and V has, at the very least, provided a framework for stimulating investment in extension and research within existing Ministries of Agriculture, and it has disclosed a wide measure of agreement on the deficiencies of existing extension systems. The questions raised by the experience of the T and V period are also timely and important. Costs and financing are the most immediate concern but the growing interest in the relationship between research and extension and between extension services and the supporting structure of specialist services are ultimately likely to determine whether current levels of interest in extension will be maintained.

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Occasional Paper 8 is a collection of papers focused on the role, management and performance of agricultural extension services using the Training and Visit system. The studies include an examination of the impact of the system in such countries as Zimbabwe, Somalia, Zambia and India. The book as a whole reflects the work of members of ODI's Agricultural Administration (Research and Extension) Network which emphasised extension management questions over the period 1982-87.

The Agricultural Administration Unit (AAU) was established at ODI in September 1975, with financial support from the Ministry of Overseas Development (now ODA).

The aim of the AAU has been to widen the state of knowledge and the flow of information about the administration of agriculture in developing countries. It does this through a programme of policy-oriented research into selected subject areas and the promotion and exchange of ideas and experience in four international 'Networks' of individuals directly involved in the implementation of agricultural development. The four networks are concerned with Agricultural Administration (Research and Extension), Irrigation Management, Pastoral Development, and Social Forestry. Members are drawn from a wide range of nationalities, professional backgrounds and disciplines.

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