PN-AAU-701 44852

SUBREGIONAL ISSUES IN THE IMPLEMENTATION OF FARMING SYSTEMS RESEARCH AND EXTENSION METHODOLOGY - A CASE STUDY IN ZAMBIA[1]

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INTRODUCTION

Considerable attention has been given to the institutionalization of Farming Systems Research and Extension in Latin America (Arauz and Martinez, 1983; Brown, 1981) and Africa (Collinson, 1982; Kean, 1982), and a glance at the program for this symposium shows that reports are coming in from more and more countries every year. With FSR/E practitioners taking to the field in record numbers armed with FSR/E academic theory and renewed optimism in agricultural development, much can be learned by sharing experiences. The purpose of this paper is therefore to highlight several practical issues that have arisen in FSR/E implementation in the Central Province of Zambia, and to discuss the response of the multidisciplinary team to these problems.

BACKGROUND AND INSTITUTIONAL FRAMEWORK OF FSR/E IN ZAMBIA

In 1978, the government of Zambia, aware of a lack of relevance in research to the problems of the small farmers in the traditional agricultural sector, invited the CIMMYT Eastern African Economics Program to demonstrate procedures leading to an interdisciplinary approach to agricultural research. This demonstration of formal survey techniques involved economists from the University of Zambia and biological scientists from the Central Research Station, Mount Makulu and used the Serenje District in the Central Province for a pilot study. A demonstration of zoning techniques for the entire Central Province followed this exercise in 1979, and in 1980, Zambia formally adopted a two level hierarchy for agricultural research consisting at present of six Provincial Adaptive Research Planning Teams (ARPT) and sixteen Commodity and Specialist Research Teams (CSRT). In Zambia, FSR/E is now institutionalized in the form of provincial Adaptive Research Planning Teams. While FSR/E is under the direction of the host government, each provincial ARPT receives financial and technical assistance from a different foreign donor, and efforts are underway to expand the ARPT program into the remaining three provinces as additional foreign donor support is obtained.

The multidisciplinary USAID FSR/E team in the Central Province is composed of an Agronomist, Agricultural Economist, Research Extension Liaison Officer, and Zambian counterparts. While agronomic and economic

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[1]This paper is based on the work of the Adaptive Research Planning Team (ARPT) in the Central Province which is funded under USAID Contract 611-0201. The author wishes to acknowledge contributions from other team members, including C. Chabala, K. Chanda, R.G. Dedert, and A.G. Harms, and comments from S.A. Kean, ARPT National Coordinator.

disciplines form the core of each provincial ARPT, these are supported by a Rural Sociologist and a Nutritionist who function on a national level. The national FSR/E effort is coordinated by an ARPT Team Leader in Lusaka, who also maintains formal linkages with the Extension Branch and Planning Divisions within the Ministry of Agriculture and Water Development (MAWD). CIMMYT has influenced the form and Structure of FSR/E in Zambia from conception through regional implementation, and continues to provide training assistance such as the five-session training program for all ARPT staff in Zambia in 1983/84. Field exercises in conducting informal and formal surveys and in designing and interpreting on-farm experiments were completed in the Central Province as part of the CIMMYT Training Program.

FSR/E IN THE CENTRAL PROVINCE

The location of the Central Province in relation to the urban markets in Lusaka and the Copperbelt (Figure 1) have given it a comparative advantage for commercial agricultural production and in the last decade, commercialization in the small farm sector has accelerated. As a result, the Central Province ranks among the most agriculturally productive regions of the country in terms of the total volume of maize produced and marketed.[2] Although maize is the dominant starch staple and cash crop in Zambia, the Central Province also has the largest acreage of sunflower, groundnuts, sorghum, and millets. The province has a low rural population density of about 3 person/km^2, plateau characteristics with a consistent altitude of 1,000 m above sea level and a rainfall period from November to April, which has a long term average from 800 to 1,000 mm. Most of the area under cultivation has a uniform topography with sandy (Sandveldt) soils. The exceptions are two small pockets of heavier textured soils and low lying drainage areas (Dambos). Dambo areas are generally not cultivated because of their high water table, but are used for dry season grazing. The Central Province is traversed by a railway and highway system leading from Lusaka to the Copperbelt and Tanzania. The input supply and crop marketing infrastructure has undergone a transition since 1981 from the parastatal National Agricultural Marketing Board (NAMBOARD) to the Central Province Cooperative Marketing Union (CPCMU), which is currently responsible for the distribution and sale of inputs and the purchase of agricultural produce at government controlled prices.

MAWD distinguishes three farmer categories in Zambia based on the degree of agricultural commercialization. Approximately 39% of the farms in the Central Province fall into the "traditional" category, which implies a minimal involvement in the market economy either for selling produce or purchasing inputs. "Traditional" farms use very little hired labor and consequently have a small acreage under cultivation. On the other polar extreme of this hierarchical grouping are the capital

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[2]Central Statistics Office. 1981. National Commission for Development Planning: Economic Report. MAWD. Zambia.

intensive (highly mechanized) "large scale commercial" farmers. Between these extremes is a third group consisting of "emergent farmers", who cultivate 10-40 ha, rely on ox power supplemented by tractor hire, and use hired labor and purchased inputs. Although zoning activities have been based on this MAWD classification, ARPT has been given a mandate to work with both "traditional" and "emergent" farmers under the new banner of "small scale commercial farmers".

The 1979 zoning activities in the Central Province identified six Recommendation Domains for traditional farmers and one each for emergent and large scale commercial farmers. ARPT on-farm experiments were initiated during the 1981-82 cropping season in the domain with the largest concentration of traditional farmers. With the financial and technical backstopping of USAID, diagnostic studies and on-farm experiments expanded to include a second domain in 1982/83 and a third domain in 1983/84. These three domains contain 70% of the traditional farmers and a large percentage of the emergent farmers in the province. The on-farm experimentation grew from 2 experiments on 16 farms in 1981/82 to 12 experiments on 59 farms in 1983-84. Informal (exploratory) and formal (verification) surveys have been completed in all three domains, and an intensive labor use study is now in its second year in one domain. In-Service Extension Training activities, which include a monthly newsletter, field days, demonstrations, and short courses, encompass the entire province.

ISSUES ENCOUNTERED IN FSR/E IMPLEMENTATION

Aside from the "teething" problems involved in setting up a functional FSR/E administration on a regional level (i.e. bookkeeping, inventories, communication, transport, etc.), operational difficulties were encountered within each disciplinary component of the FSR/E team. While most of these procedural issues have been successfully resolved within the context of FSR/E in the Central Province, documenting them in this paper may be of benefit to those involved in turning FSR/E theory into practice elsewhere. For the purposes of this presentation, twelve procedural issues will be discussed under three general topics: Zoning and Stratification, Technology Development and Testing, and Communication and People Management.

A. Zoning and Stratification

1. Zoning in relation to the organization of the extension service

The demarcation of subregions is not unique to FSR/E, and the output of such an exercise is directly related to objectives and academic perspective of those involved. For example, Zambia has been divided into agroecological zones (Figure 2) by meterologists on the basis of length of the growing season, dry periods of 10 days with less than 30 mm rainfall within the growing period, water holding capacity of the soil, amount of radiation in the rainy season, and temperature regimes. The Maize Research Team subdivides the country into four major regions (Figure 3) on the basis of maize genetic potential. These zones are drawn from knowledge of crop performance in relation to rainfall, soil,

and other climatic (e.g. evapotranspiration) factors. Plant breeding activities focus on developing maize varieties for each of these zones. Although agronomic research places importance on agroecological factors, the administrative infrastructure for the extension service is not organized accordingly. This situation leads to operational difficulties for FSR/E on two levels.

With the administrative organization of the extension service in mind, FSR/E was institutionalized in Zambia on a national level according to the existing regional political structure. Whereas having an ARPT in each province guarantees that the FSR/E effort is decentralized and distributed evenly throughout the country, when six autonomous provincial units are superimposed over the broad agroecological zones. the danger of ARPTSs duplicating agronomic research becomes evident. Not only is a duplication of effort possible, but technical recommendations emanating from one ARPT may be applicable over a much larger area beyond the political confines of a province. FSR/E success under such circumstances requires a strong national coordination and viable communication links between provincial teams.

On a regional level the issue of zoning has different implications. For example, in spite of the fact that the Central Province contains only one major soil type and generally falls within one of the Maize Research Team's genetic regions, the CIMMYT-coordinated zoning activity identified six separate recommendation domains for traditional farmers (Figure 4) and a separate domain for emergent farmers (Figure 5) according to socioeconomic characteristics of the farming systems (Collinson, 1979). At the same time, the extension service in the province is organized and funded according to the four main administrative units (districts) shown in Figure 6. The complication arises from the fact that each district, in which ARPT is working, has parts of three recommendation domains for traditional farmers. While this problem is not insurmountable, it does present problems in the transfer of technology.

Since extension training programs must be organized within the communication structure of the Extension Branch of MAWD, which moves through national, provincial, district, block, and camp levels, ARPT recommendation domains have not provided a logical framework on which to base the initial activities of the ARPT Research Extension Liaison Officer (RELO). In order to sensitize extension workers to a farming systems perspective that would allow them to distinguish between different farming practices and tailor technical recommendations according to the resource base and risk aversion levels of particular strata of the ARPT target group, extension training must start at the top of the extension organization and move down to the lowest echelon extension worker in the field. Not only does this approach have a multiplier effect, it also assures institutional support when training programs reach the field level. Consequently, ARPT training programs, newsletter distribution, and annual field days have been organized at first on a provincial and district basis. It has taken two years to work down to the camp level in the Central Province. Training programs are now being planned for camp staff to help them differentiate farmer groups and stress the need to understand the circumstances of each individual farm unit before giving advice. In this way the camp level extension

staff will be in a better position to handle flexible technical recommendations on crop husbandry practices for each ARPT recommendation domain.

2. The Dynamic Nature of Farming Systems

A comparison of the zoning criteria for three recommendation domains in the Central Province with findings from subsequent ARPT surveys is presented in Table 1. Many of the characteristics of the three farming systems were confirmed in latter studies, which reinforces the value of cost effective Rapid Rural Appraisal techniques (Chambers, 1980) that have been formalized into the fabric of FSR/E methodology (Tripp, 1982; Collinson, 1979). Of the differences that are apparent in this comparison, the most notable reflect the rapid commercialization of agriculture in the farming systems. The heavy demand for maize in urban areas in conjunction with the availability of hybrid seed, fertilizer, and credit at the local level have provided the catalyst for a shift from traditional starch staple crops to commercial maize. Without a land constraint, due to the low population density, the commercialization of agriculture was primarily limited by labor constraints. Since maize has lower labor demands for weeding and harvesting than finger millet and sorghum, and since it is compatible with local taste preferences when made into staple starch food (Nshima), in the last five years maize has begun to replace traditional starch crops of lower labor productivity. At the same time, labor constraints have caused an increase in labor hiring and in the use of animal and tractor power for preparing seedbeds. Commercialization has led to an expansion of acreage for other cash crops such as cotton and sunflower.

While it is not surprising to find that farming systems in the Central Province are not static, the speed with which they are changing presents a special challenge to FSR/E. Annual informal surveys with extension field staff and farmers in each domain have been necessary to keep abreast of changes in the farming systems. Research strategies must now have the foresight to be aimed at trends rather than simply developing rigid characterizations of a system based on an outdated survey.

The growing commercialization of the ARPT target group has been dealt severe blows recently by a series of abnormally dry years and rapid economic changes. Although the ratio of fertilizer price to maize market price (Table 2) has remained relatively stable since ARPT began operations in the Central Province, the price of fertilizer has increased 132%. This price increase places added pressure on the limited capital resources of small scale commercial farmers. Recent surveys have shown reduced rates of fertilizer application, a shift away from formula fertilizers toward fertilizers of higher nitrogen content, an increased tendency to use hybrid maize seed obtained from previous crops, and an emphasis on cash crops that require fewer purchased inputs (e.g. sunflowers). With continuing devaluation of the local currency, abnormal rainfall, and government policy changes, current management levels are likely to evolve further in spite of government price subsidies. FSR/E requires mechanisms for monitoring these changes and transmitting flexible technical recommendations that allow freedom for management

decisions based on variations in climate, prices, and resource base. The crucial step is the training of extension workers to monitor changes in farming practices and to deliver relevant messages.

3. Stratification of the Target Group Within Recommendation Domains

It is obvious that the ARPT target group of small scale commercial farmers represents a spectrum of producers with different resources and different capacities to take risks. It is therefore necessary to further stratify the target group within the boundaries of previously zoned farming systems in order to more appropriately tailor extension messages (Shaner, 1983). Given the fact that hand hoe cultivators exist alongside farmers with access to draft power within each farming system, power source was one of the first parameters used in stratifying farmer types in the Central Province. Table 3 gives an example of the characteristics of substrata in one recommendation domain using this parameter. Separate technical recommendations can then be developed for each type of farmer within the confines of the more general characteristics of the farming system (i.e. cropping pattern, labor use calendar, etc.). For example, in the case of hand hoe cultivators, efforts are underway to improve the LIMA recommendations, which were an earlier attempt of the MAWD Research Branch to scale existing crop recommendations down to unit areas of land consistent with hand hoe cultivation. Whereas LIMA recommendations concentrate on assuring uniform plant population densities and rates of fertilizer application, ARPT seeks to expand the concept to include incorporating lime into a crop rotation, which involves maize and groundnuts or soybean, in such a way as to sustain the agricultural productivity of a given field over time. Other agronomic research strategies include labor-saving technologies (e.g. 0-tillage, herbicides, etc.), improving the returns to cash and labor during the peak labor period, and moving labor demand out of the critical November-January period (e.g. winter plowing, late season cash crops, etc.). Up-coming studies of female and male headed houses, according to the criteria used in management decisions, resource base, and sources of technical information, will determine the need for additional stratification by gender.

B. Technology Development and Testing

1. Research Strategies for Short-term and Long-term Outputs

The ultimate success of ARPT in the Central Province will depend to a large extent on the establishment of strong research-extension and ARPT-CRST linkages during the first years of project implementation. Moreover, the FSR/E effort must develop credibility with both farmers and extension personnel from the beginning. Therefore, a research strategy has been developed to capitalize on the "spin off" information, which is generated in the course of annual on-farm research, geared to improving crop husbandry practices. Focusing on a refinement of current farmer practices, in the short run, assures close interaction with the respective CSRTs, while generating information to improve the effectiveness of extension recommendations. Although this short-term strategy is unlikely to result in large yield increases, it has stimulated farmer and extension interest in ARPT on-farm research,

because useful information is visible each year. During the 1983/84 cropping cycle, 66% of ARPT on-farm experiments in the Central Province were devoted to this short-term strategy. The remainder of the research trials were directed toward long-term ("pipeline") interventions, which have a greater potential for improving productivity, but which require more thorough investigation to assure their feasibility. These technical alternatives must be "introduced" into the farming systems, involve more radical changes in farmer practices, and require changes in the institutional infrastructure for input delivery and credit. Examples of 1983/84 experiments pertaining to this long-term strategy include 0-tillage for maize, early maturing maize varieties for late planting, the introduction of commercial grain sorghum as a late season cash crop, and the use of lime in crop rotations to sustain production levels.

2. Extension Involvement at the Testing Stage

After three years of on-farm research in the Central Province, it is felt that ARPT has outgrown the initial CIMMYT methodological structure of exploratory, levels, and verification stages and is entering a pioneering phase of extension managed and farmer managed testing. Recognizing a void in the methodological sequence (Figure 7), from research managed/research implemented (RM/FI), ARPT initiated 36 extension demonstrations in 1983/84 under the category of research managed/extension implemented (RM/EI), which is an expansion of the Testing Stage of FSR/E (Norman, 1983). Last season's demonstrations compared yields from small plots planted with F_1 (fresh) and hybrid maize seed and F_2 (older generation) hybrid seed retained from previous harvests. This was in response to survey findings showing that a large percentage of small scale commercial farmers in the Central Province were not using F_1 seed. ARPT provided the seed, fertilizers, and planting instructions during an extension training workshop designed to teach extension workers how to effectively utilize demonstration plots. Extension workers selected farmers, supervised planting, conducted local field days, recorded yields at harvest, and sent the information back to ARPT at the end of the season. More of these demonstrations will be conducted next season in different areas, and new demonstrations will be undertaken to compare soybeans grown with and without lime to demonstrate the current credit package for soybeans which requires lime. The use of RM/EI demonstrations increases the active involvement of extension workers in FSR/E and guarantees that extension ideas are incorporated into FSR/E testing and evaluation. However, it is important that RM/EI testing be visible to farmers in the same areas where RM/RI trials have been conducted so farmers can appreciate the methodological stages of technology generation. It is also preferable that the RM/EI testing be derived from on-farm trials so there is some assurance of what outcome to expect.

C. Communication and People Management

1. Agronomists in FSR/E

Zambia is unique among most Third World countries in that the population density is very low and land is not a limiting production factor in the small scale commercial farming systems. Nevertheless, the

research methods inherited from on-station experimentation place emphasis on treatment comparisons on the basis of "yields per unit land area". While recognizing that yields expressed in this fashion can be easily converted into productivity per unit scarce resource (labor or capital) by economists on FSR/E teams, this inflexibility on the part of agronomists makes it difficult to instill a farming systems perspective into national counterparts, who consistently discover non-significant statistical differences between treatments using the tools of their trade only to be shown by economists that there were in fact tremendous treatment differences. The issue is using the right yard stick to measure the differences.

A good example of this occurred in the 0-tillage experiment last season. The statistical analysis confirmed that there were no significant differences in the yields of herbicide treated plots and those prepared with conventional tillage methods. However, the economic analysis showed that the variable costs of the herbicide treatments were less than those of land preparation with oxen due to a saving of labor for weeding and the elimination of the need to hire oxen. Therefore, the net benefits were significantly higher for the herbicide treatments and the marginal rate of return on capital invested was 14 times greater than the cost of the capital. Additional benefits were accrued when this information was extrapolated onto older, weedier fields, where an even greater labor saving can be anticipated.

At risk is the feeling among national agronomists that they are locked into an infexible discipline (i.e. that only economists are in a position to interpret farming systems implications) and the danger that they would subconsciously stress on-farm work with high yielding varieties and fertilizers (land saving technology) in the face of a need for labor saving technology (e.g. herbicides). Vain attempts by ARPT in the Central Province were made to conduct an analysis of variance for different experiments using yield per unit labor invested (Hudgens, 1984). Unfortunately, the small plots used in the RM/RI trials were inadequate for generating labor information for treatment application, and the available benchmark labor use data from other studies did not consider labor for filling backpack sprayers, mixing chemicals, and applying herbicides. The exercise became one of speculation similar to "pre-screening technology" and again we were back in the discipline of economics.

2. Linkage with Commodity Research Teams

Adaptive Research Planning Teams should, as the name implies, "adapt" existing technologies to technical problems identified in specific farming systems. However, in many cases the technologies are not appropriate for ARPT target group farmers (e.g. ripping hardpans that develop in Sandveldt soils using tractor power), varietal development has not progressed to the point of going into on-farm tests (e.g. bean varieties), or the CSRT's recognize a problem area, but are powerless to address it because of limitations in manpower and funding. Whereas ARPT has influenced the nature of CSRT work such as in screening maize and sunflower varieties with and without fertilizer in CSRT national variety

trials, ARPT is on its own in other areas where there is no CSRT backstopping (e.g. ox drawn tillage implements).

In light of the absence of technologies to "adapt", ARPT in the Central Province was faced with three options: a) generate our own technical solutions in farmers' fields, which is far from an ideal research environment from the standpoint of controlling non-experimental variables; b) skip the problem for the moment and wait for CSRTs to generate the necessary technologies; c) import technologies from other countries. Although CIMMYT has provided some useful regional networking in relation to international conferences, it is difficult and politically insensitive to circumvent the system and import ox plows directly from Botswana, ox planters from India, rippers from Zimbabwe, or varieties directly from CIAT or ICRISAT through personal contacts. Consequently, ARPT has been forced to generate some of its own information and skip priority problems for which there is no appropriate solution at the moment. This has led to fertilizer response curve studies for late planting, the screening of local sorghum, bean, and finger millet varieties, and trials to work out basic interactions between new maize varieties and fertilizer levels.

3. Policy Decisions

In the institutionalization of FSR/E in Zambia (Kean and Chibasa, 1982), the research-extension linkage centered on the creation of a position for a Research Extension Liaison Officer (RELO) on each provincial ARPT and the establishment of Provincial ARPT Steering Committee, composed of provincial and district extension officers, ARPT members, and the Officer-in-Charge of the regional research station. The main function of the committee was to select ARPT work areas (recommendation domains), approve annual research programs, and decide the appropriate time for releasing recommendations. In the Central Province the steering committee has been very successful in providing Extension Branch input into ARPT decision-making, but it has not ventured outside the MAWD to influence policy-making in marketing, input, and credit institutions. When this was raised at the last committee meeting, it was decided that group dynamics would prevent an expansion of the committee membership to include representatives of other agencies, but that they could be invited for special meetings to present research evidence arguing in favor of a policy change. Thus, the Provincial ARPT Steering Committee would remain the vehicle for influencing policy makers at the regional level and would assure that research reports (policy papers) were processed through the appropriate channels at the national level.

4. Supervision of On-Farm Trials

Overseeing widely distributed on-farm trials in the Central Province requires a great investment of manpower, time, transport, and expensive fuel. A solution was found in utilizing local extension workers on a full-time basis as ARPT Trials Assistants. One such extension worker, supplied with an ARPT motorbike, is now living and working in each recommendation domain. After some basic instruction, Trials Assistants, under the supervision of ARPT agronomists, are responsible for selecting

sites for on-farm experiments, timely planting and input application, and collecting and recording data. However, they are training extension workers without previous research experience, and as such they seldom understand or appreciate the need for replication, border areas, precision in measurements, and farmer involvement in the trials. Illness (e.g. malaria), motorbike accidents, voter registration, or deaths in the family can lead to long periods in which the ARPT trials are unattended.

ARPT Trial Books, prepared individually for each experiment, are usually followed according to written instructions, however observations on crop performance at critical growth stages and farmer comments on the treatments under study are generally sketchy and without meaningful detail. The ARPT motorbike and occasional per diem allowances, which are the only incentives offered the Trials Assistants, often cause envy and dissension among other extension personnel at the field level, and there is a tendency for Trials Assistants to feel separated from both extension and research.

Recognizing that the success of ARPT on-farm experimentation in the Central Province depends to a large degree on the performance of the Trials Assistants and that they play an important public relations role within the farming community in explaining the objectives and treatments in on-farm trials, ARPT has responded to these problems by expanding the annual briefing session into a training program, establishing a more regimented supervision schedule by ARPT agronomists, and organizing a rotation system whereby Trials Assistants return to extension duties after three years. The continuous rotation of Trials Assistants requires constant attention to training and supervision, but it reinforces the research-extension linkage at the local level by involving extension workers directly in ARPT on-farm research.

5. Size of the Workload for Trials Assistants

It is widely accepted by FSR agronomists that the best means of reducing experimental error and improving precision in treatment comparisons is by maximizing the number of replicates of each experiment, particularly when farms are used as replicates. However, this leads to a decision between a larger number of experiments in more leverage areas in a wider range of crops or fewer experiments which are more carefully managed. Experiences in the Central Province have shown that an overly ambitious research program can result in high experimental errors, lost sites, and fewer visits to each site by the ARPT agronomist. Although the nature and complexity of the experiments determine the research workload, grouping the trials into clusters so that the Trials Assistant can visit several trials in one area one day and another group of trials in another area the next day, increases the total number of experiments that can be attended by one person. In general, ARPT Trials Assistants in the Central Province have difficulty supervising more than 15 sites without help from local extension staff.

6. Approaches to In-Service Extension Training

In-service training programs for extension personnel have been conducted by the RELO at the district, provincial, and national levels.

Given the existing structure of the Extension Branch, it was not possible to communicate within the boundaries of recommendation domains. A monthly ARPT Newsletter, entitled "For Your Information", was distributed throughout the province via District Agricultural Offices to camp staff. Follow-up studies showed that only about 50% of the camp staff were actually receiving the newsletter on a consistent basis. Other distribution approaches included mailing them to camp offices and attaching them to monthly paychecks. The newsletter is a vital source of information for the camp level extension worker, providing research updates, specialist articles, and dates of upcoming events (i.e. field days, agricultural shows, etc). Had the entire target audience received their copies, the cost of this activity would have been minimal in comparison to the number of beneficiaries (Table 4). However, in spite of the distribution problems, the newsletter offers great potential for disseminating ARPT recommendations in the future.

While field meetings (Field Days) for ARPT on-farm trials have not been the most cost effective extension training activity, they have been very popular with extension workers. ARPT provided the transport and lunch, with the tours starting and ending at the district Farm Training Centers. Separate Field Days were conducted for extension workers (in English) and farmers (in Icibemba). The location of long-term LIMA Improvement Demonstrations at the Farm Training Centers in each District provides a sense of continuity to the annual field meetings as the objectives and previous performance of the demonstrations are reviewed each year. In addition to serving as a focal point for dialogue between researchers, farmers, and extension workers, these demonstrations visibly tie ARPT to the extension training centers and to the functions they represent.

7. Communication with Farmers

The term "research" to an American connotates a series of specific activities and the use of analytical tools designed for the purpose of comparing treatments. However, there is no direct translation for the term in local Zambian languages aside from a general statement of "finding out". Since statistical tools are used to interpret experimental results in FSR/E, it is very easy to become confined within the boundaries of statistical terminology to express research findings to others (e.g. interactions, significant differences, etc.). Obviously, talking statistics to the general public, especially when several languages are involved, is not an effective form of communication. On the other hand, there is a danger in oversimplifying research results with terms like "best treatment" in an atmosphere of extensionists who are eager to hear recommendations and conclusive research findings.

The separate Farmer Field Days held annually in each district allow farmers to receive a general explanation from ARPT Zambians of ARPT trials and to ask questions. Farmers who are directly participating in ARPT research are in much closer contact with ARPT Trials Assistants and extension workers, and thus are in a better position to understand RM/RI experiments. The problem arises at the end of the season, when Farmer Group Meetings are called to explain ARPT research results and to outline a research program for the upcoming season based on these results. ARPT

recognizes the need to inform the farming community on the progress and evolution of research efforts for which they are the ultimate beneficiaries, but has had limited success in addressing them directly.

8. Cooperation with other Development Projects

Several foreign-financed development projects co-exist with ARPT in the Central Province. The two major projects involve Integrated Rural Development with an emphasis on improving the effectiveness of the Extension Branch. ARPT has established constructive relationships with each project by the customary exchange of reports, attendance at field meetings, and in one case, the sharing of data from labor use studies. However, the most notable mutual efforts were made in the area of pooling funds for the construction of housing facilities for trainees at the Kabwe Regional Research Station and a joint undertaking to monitor yields from farmer fields. In the latter, ARPT provided instructions and survey forms for measuring yield components in several crops, while another development agency provided spring balances and tape measures for taking the field measurements.

CONCLUSIONS

The FSR/E effort in the Central Province of Zambia within the institutionalized structure of provincial ARPTs is in its fourth year of operation. Considerable success has been achieved to date in revitalizing the extension service morale through involvement in FSR/E activities. Intermediate ARPT outputs have taken the form of more effective extension recommendations in the area of crop husbandry, training of extension workers and research counterparts, and improved communications between research and extension. ARPT field days and training programs are eagerly attended by extension staff and many of the training techniques used at the district and provincial levels have been employed by trainees in subsequent activities.

Several operational difficulties have been encountered and addressed in the course of FSR/E implementation in the province (Table 5). Efforts to group farmers into target populations for which the same technology will be relevant have emphasized natural, social, and economic factors that distinguish farming systems but little attention has been given to the structure of the extension branch for transferring technology. This has serious implications for extension training. The ultimate success of FSR/E in the Central Province depends on ARPT's ability to develop a farming systems perspective at the camp staff level of the extension service. Camp staff must be instructed to differentiate farmer groups, apply general recommendations, monitor farmer practices, and feedback relevant information to modify extension messages. However, before camp staff can be reached, upper echelon extension staff at the national, provincial, and district levels must be exposed to the value of a farming systems perspective.

Mechanisms must be established to monitor the dynamic nature of farming systems and to determine production trends. Research strategies must delineate short and long-term outputs to provide a framework for

monitoring progress in short-term foreign donor supported projects. The importance of extension involvement in the "testing stage" to screen promising technologies over a larger number of sites and to demonstrate the potential value of modifying a specific farming practice to a wider target audience, should not be underestimated. In short-term FSR/E projects there is often a tendency to rush through the "design stage" and give only token attention to extension testing, prefering instead to go straight into production scale farmer-testing. Experience in Zambia under abnormal rainfall conditions and with an extension service that lacks a sensitivity to a farming systems perspective would suggest a degree of caution in this approach.

Extension participation in FSR/E decision-making is fundamental to successful institutionalization at the regional as well as national levels. In Zambia, this has been implemented through the creation of Provincial ARPT Steering Committees, which consist of provincial and district extension representatives and are chaired by the highest ranking extension officer in each province. The incorporation of a full time Research Extension Liaison Officer on the ARPT staff in the Central Province has also facilitated communication between the two branches of the Ministry of Agriculture at the regional level and has provided a solid foundation for a combined effort in FSR/E. The ARPT in-service extension training activities, such as field days, subject matter training programs, and the monthly newsletter, have been well received and have helped construct a healthy research-extension linkage at the operational level.

In retrospect, the FSR/E team in the Central Province has been quite successful in addressing some of the problems it has encountered in its formative years. The research-extension linkage, development of short-term and long-term agronomic research strategies to overcome the specific production constraints of each farming system, and cooperative interactions with other regional development organizations are examples of success. On the other hand, the team is still struggling to cope with the issues of stratification of the target group within recommendation domains, multidisciplinary understanding within the ARPT provincial staff and between ARPT and commodity researchers, and monitoring rapidly changing farming systems. Rotations of short-term expatriate personnel as contracts expire and national counterpart staff as overseas training opportunities present themselves have exasperated attempts to maintain a unified FSR/E team spirit. New personalities also constantly appear in commodity research teams and within the extension branch hierarchy at provincial and district levels.

In the final anlaysis, FSR/E in the Central Province has matured significantly by learning from its own experience and by sharing experiences with other provincial ARPTs. Every FSR/E project in the world is faced with a unique series of problems and has a limited armory with which to do battle. However, the exchange of information on lessons learned through trial and error allows other FSR/E practitioners to feed off ideas and promising methodologies developed in other geographical areas. Networking is essential. It is hoped that this paper and the discussion it generates will provide insights that make FSR/E work elsewhere more effective.

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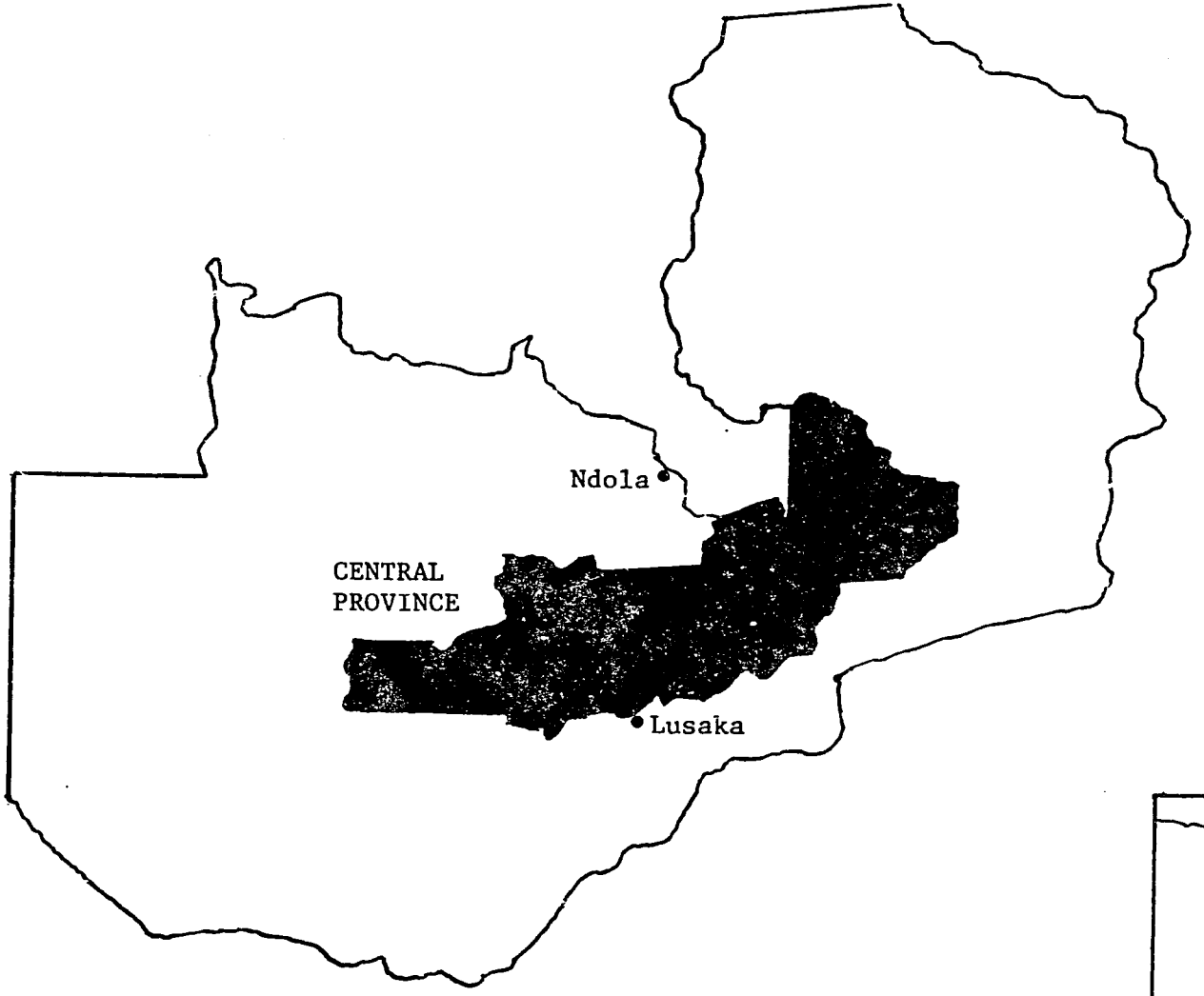


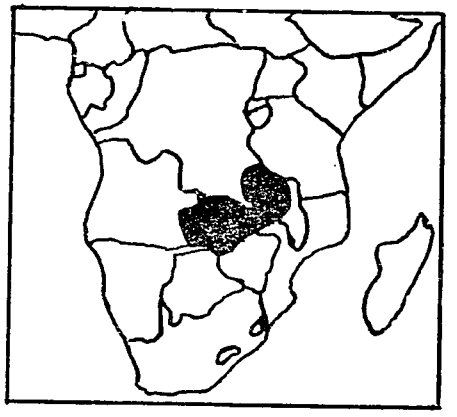


Figure 1. Location of the Central Province in Zambia.

Figure 2. Agroecological Zones in Zambia.
(Source: Meteorological Dept. 1984. MAWD)

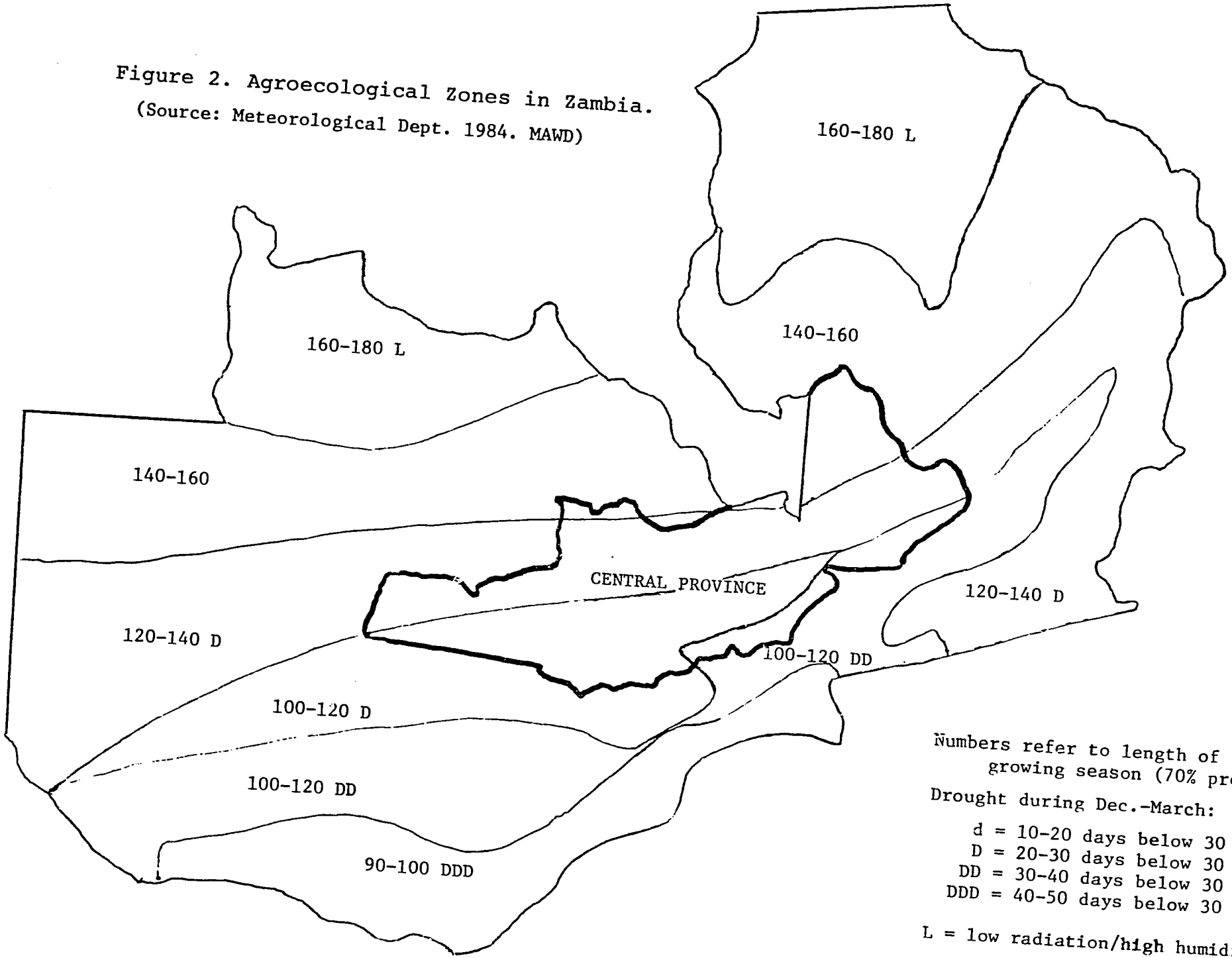
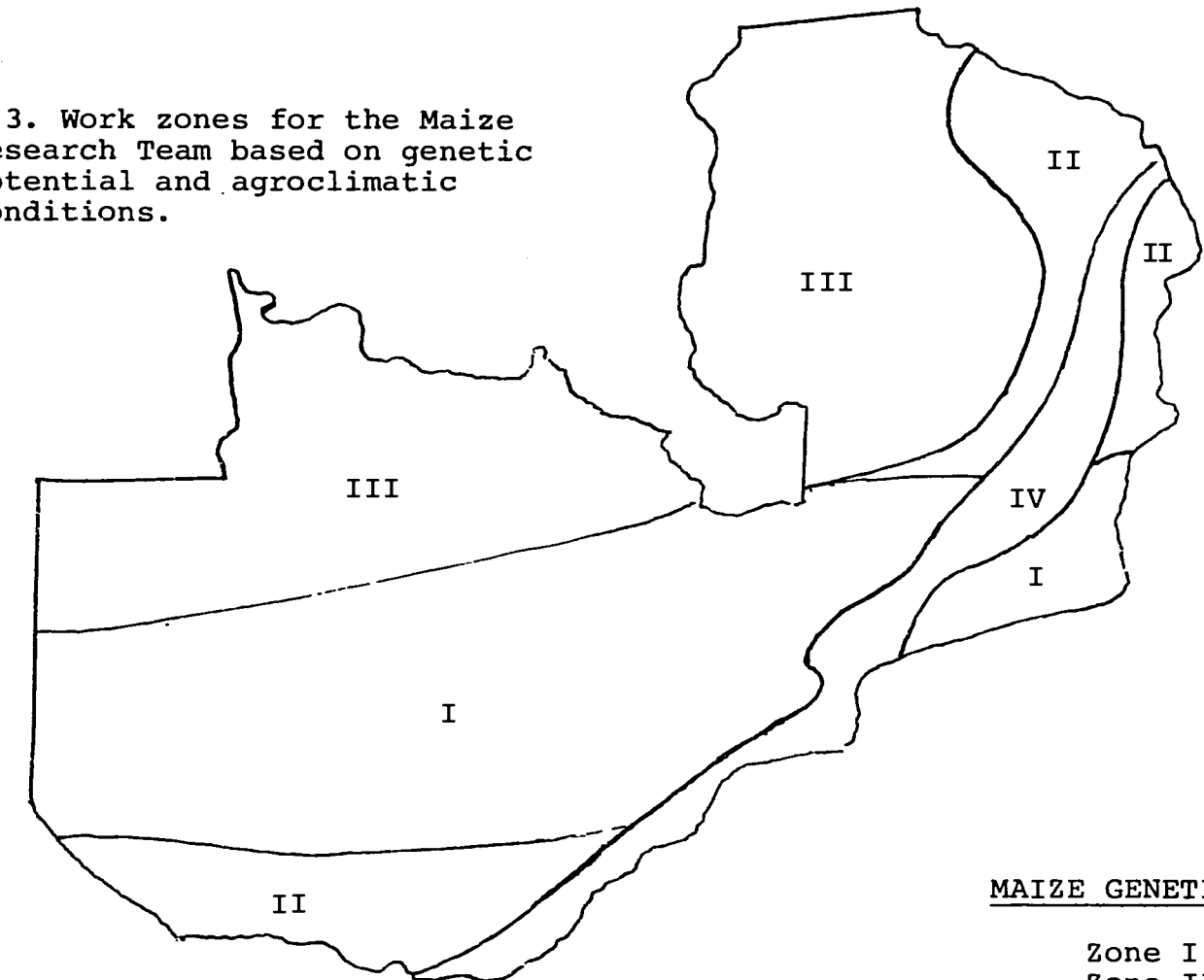


Figure 3. Work zones for the Maize Research Team based on genetic potential and agroclimatic conditions.



(Source: Meterological Department. 1984. Suitability Map for Maize. MAWD. Mt. Makulu)

MAIZE GENETIC POTENTIAL ZONES

Zone I	High potential
Zone II	Marginal potential (Drought conditions)
Zone III	Marginal potential (Insolation limiting)
Zone IV	Low potential

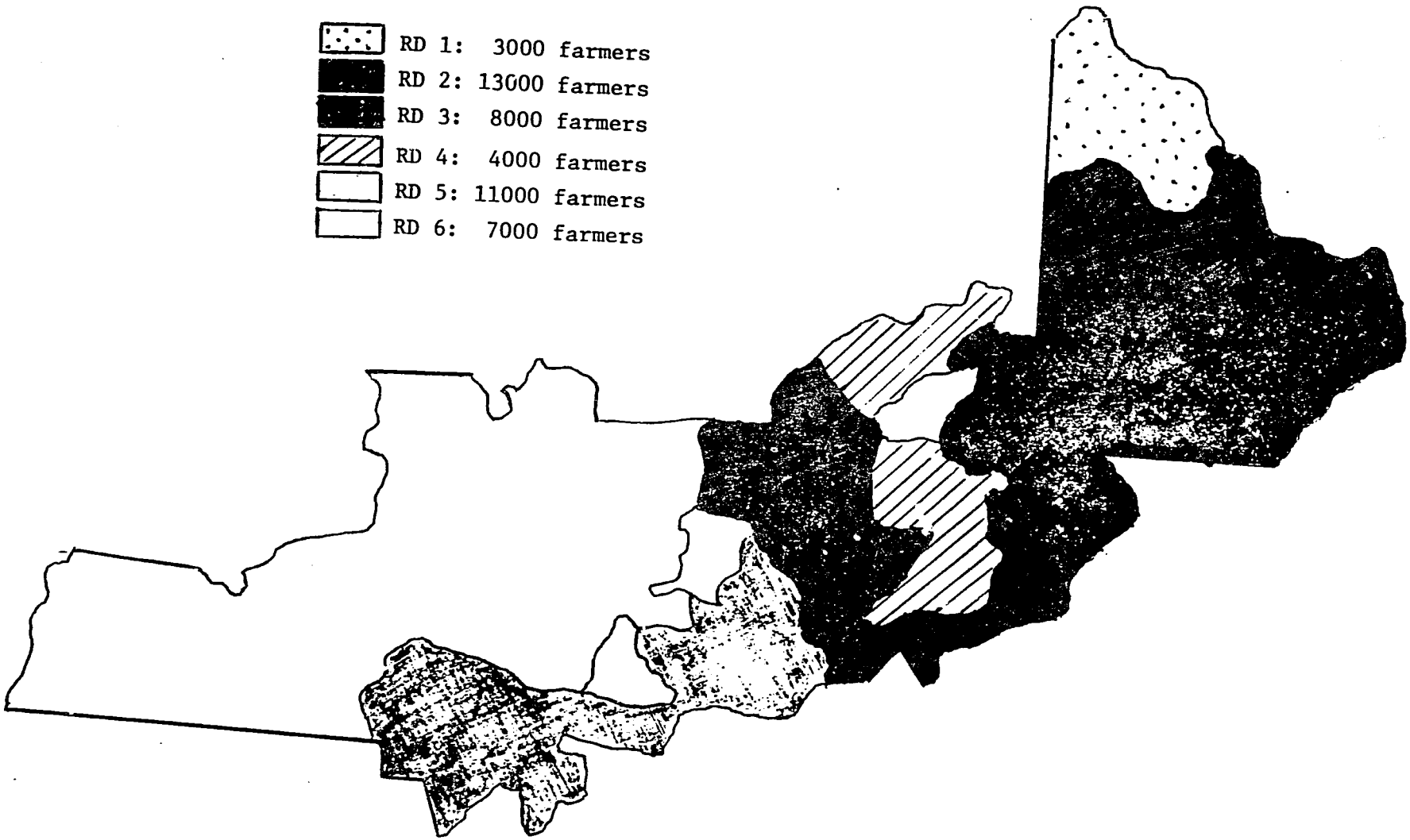


Figure 4. Recommendation Domains for Traditional Farmers in the Central Province.

(Source: Collinson,M.P. 1979. CIMMYT Eastern Africa Economics Program. Report No. 4)

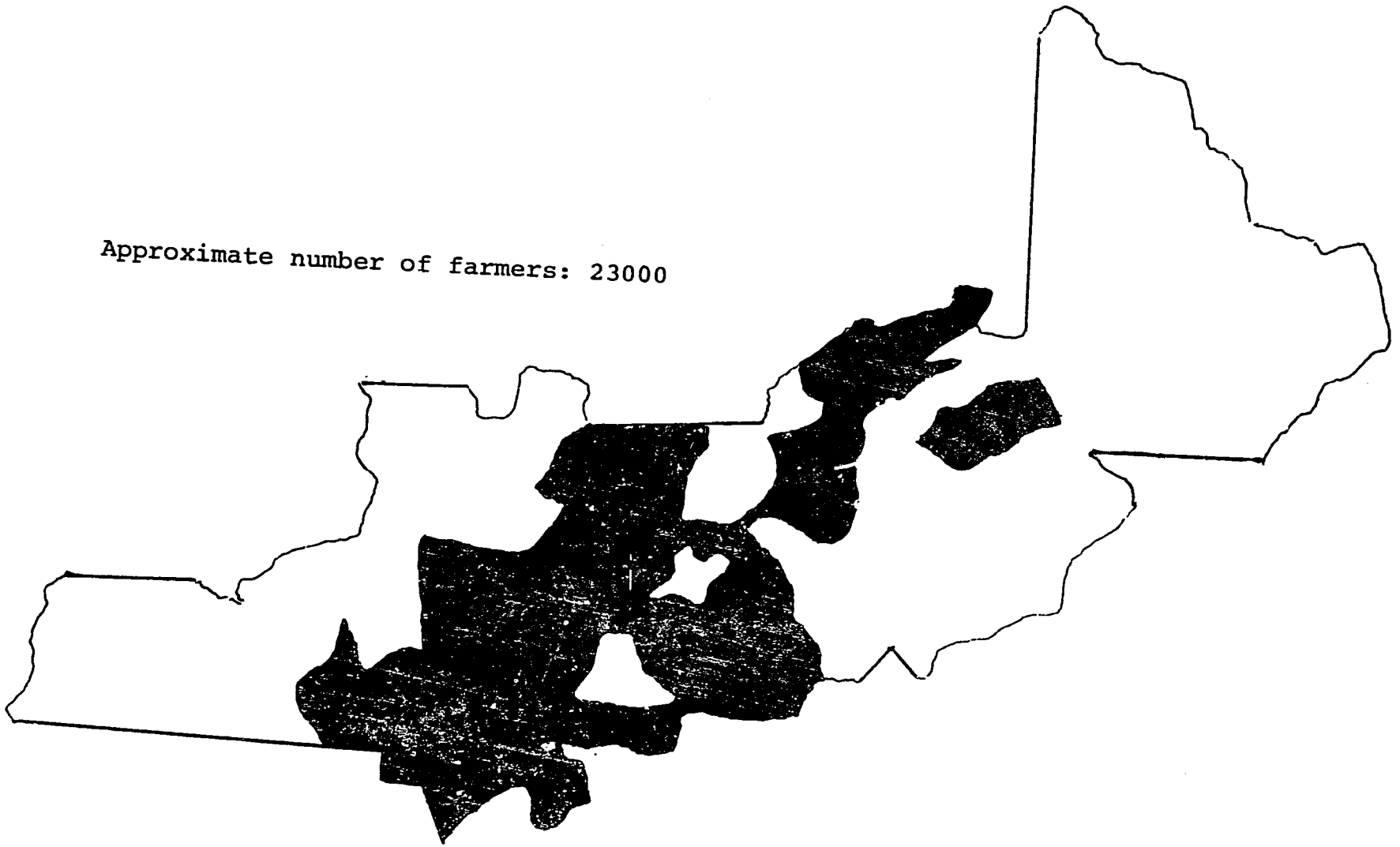


Figure 5. Recommendation Domain for Emergent Farmers in the Central Province.
(Source: Collinson, M.P. 1979. CIMMYT Eastern Africa Economics Program. Report No. 4)

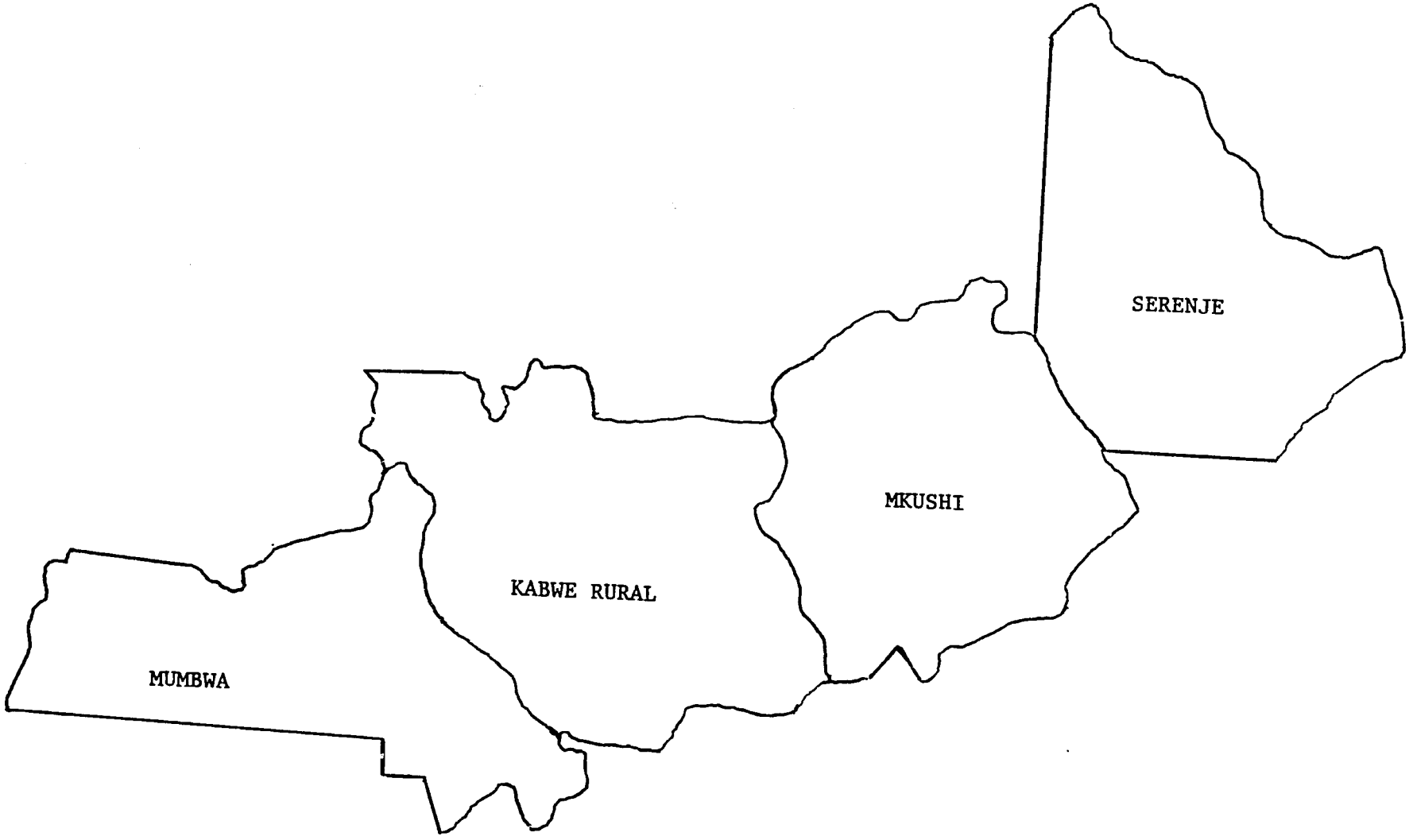


Figure 6. Political Districts in the Central Province, Zambia.

Figure 7. ARPT methodological steps (RM/RI to FM/FI) in the development and testing of appropriate technology.

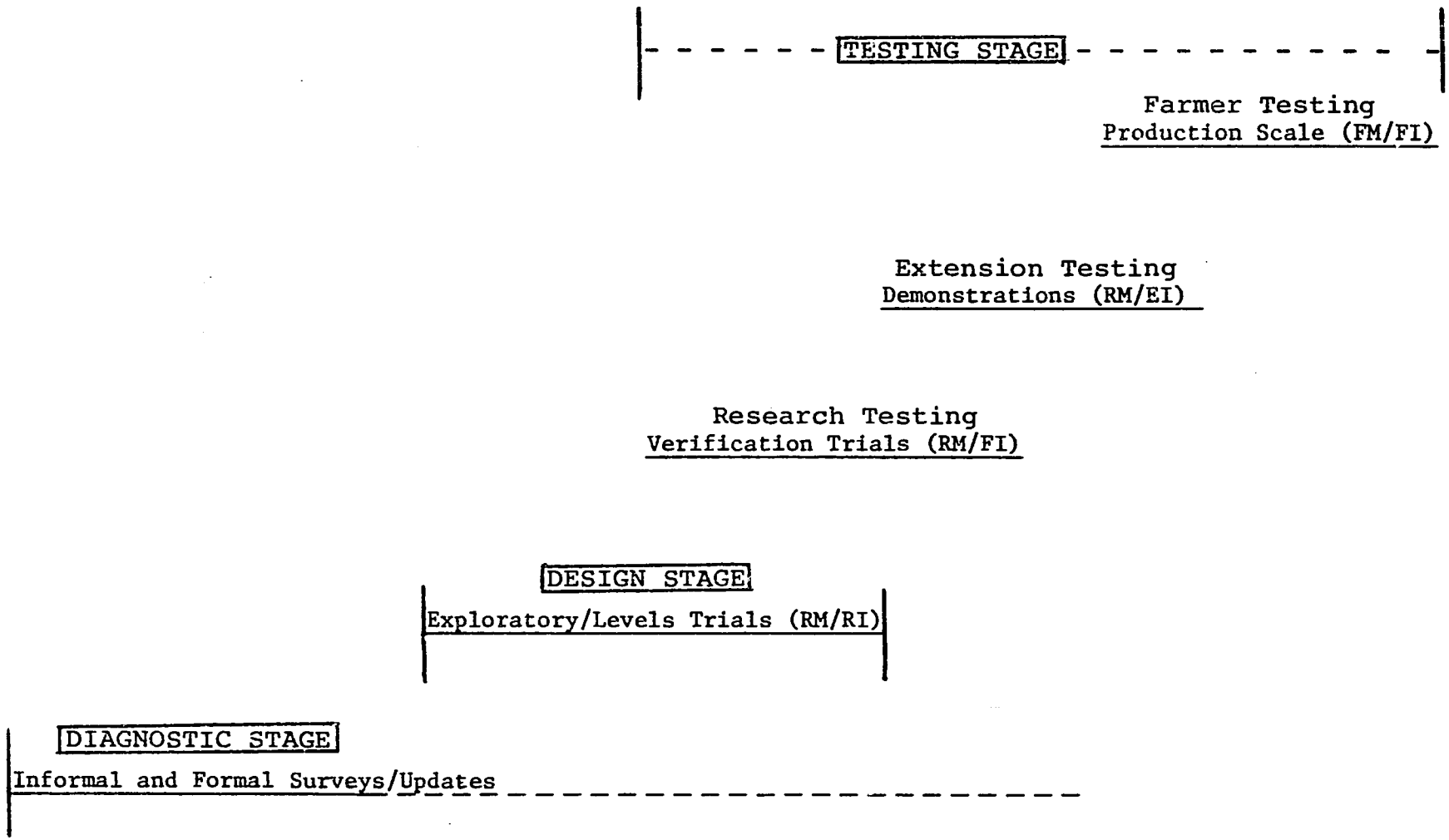


Table 1. Comparison of zoning criteria for three Recommendation Domains in the Central Province with findings from subsequent findings

Domain	Power Source	Starch Staple	Cash Source	Cash Crops	Purchased Inputs	Hired Labor
I. Zoning Criteria						
RD 2	Hoe/Ox hire (34%)	Finger Millet Maize Beans	Maize Beer	10% had Sunflower	91% Maize Seed & Fertilizer	40% hired labor
RD 3	Hoe	Sorghum Finger Millet	Beer;Off-farm labor Sorghum/ Chickens	10% had Cotton; 20% had Sunflower	10% Maize Seed & Fertilizer	None
RD 5	Ox/Ox-Tractor Hire	Maize	Maize Cotton/SF Cattle	20% had Cotton; 15% had S/F	100% Maize Seed & Fertilizer; Cotton pesticides	29% hired labor
II. Survey Findings						
RD 2	29% own oxen	Maize Cassava Millet	Maize Beer Beans	Sunflower	97% Maize Seed & Fertilizer	50% hired labor
RD 3	14% Hoe 44% Own Oxen 27% Hire Oxen 15% Hire Tractor	Maize Sorghum Millet	Maize Beer Sorghum	24% had Cotton 17% had Sunflower	81% Maize Seed 88% Maize Fertilizer	50% hired labor
RD 5	54% Owned Oxen 44% Ox & Tractor Hire	Maize	Maize Cotton Sunflower Cattle	79% had Sunflower; Cotton	89% Maize Fertilizer 93% Maize Seed	25% hired labor

Table 2. Price of fertilizer in relation to the market value of maize in Zambia.

Cropping Cycle	Fertilizer Price	Fertilizer Price Index	Market Value of Maize	Maize Price Index	Price Index Ratio Fert./Maize
	(Kwacha/Kg)		(Kwacha/Kg)		
1981/82	0.23	100	0.15	100	1.00
1982/83	0.30	129	0.20	136	0.95
1983/84	0.48	209	0.27	181	1.15
1984/85	0.54	232	0.31	210	1.10

Table 3. Farming System Characteristics by Power Source - TRD 3*
(Central Province)

Power Source	Average Cultivated Acreage	Average Maize Acreage	% Using F2 Hybrid Seed	% Maize Acreage Planted after 15 December	Amount Basal Fertilizer	Amount Top Dressing
	(has)	(has)	(%)	(%)	(Kg/ha)	(Kg/ha)
Hoe	1.58	0.94	11	27	110.3	120.1
Ox	3.42	1.75	34	22	109.0	112.7
Tractor	4.20	3.20	30	30	183.4	178.9

*Traditional Recommendation Domain No. 3

Table 4. RELO Extension Training Approaches in the Central Province.

Activity	Number Reached in 1983/84	Total Cost	Cost/Trainee	
		(Kwacha)	(Kwacha)	(U.S.$)
Newsletter	2000 (intended)	300.00	0.15	0.26
	1000 (actual		0.30	0.51
Training Courses				
a) National*	67	2910.00	43.43	25.54
b) Provincial**	30	2500.00	83.00	48.82
c) District**	160 (estimated)	4000.00	25.00	14.71
d) District + some camp	151	3730.00	24.70	14.53
Demonstrations#	175 (estimated)	500.00	2.85	1.68
District Field Days				
a) Extension workers	125			
b) Farmers	300	2145.88	4.42	2.60
c) Provincial extension staff (KRRS)##	60			
Total	2068	16085.88	7.78	4.58

*Communication and Teaching Skills Workshop
**Crop Husbandry Workshop
#One-half hectare LIMA Demonstrations at 4 Farm Training Centers and at the Kabwe Regional Research Station (KRRS).
##Includes extension workers and commercial farmers. The field visited both on-station and on-farm experiments

Table 5. Summary of Some of the Problems Encountered and the ARPT Response

Problem Encountered	Severity[1]	ARPT Response
Zoning without extension considerations	M	RELO must work within existing extension structure to teach FS perspective
Dynamic nature of farming systems	M	Annual monitoring; Establish production trends
Heterogeneity of target group within RDs	H	Stratify by power source, gender, degree of commercialization, credit use, etc.
Foreign donor need for measurable outputs	L	Develop short and long term research strategies
Extension involvement in testing stage	L	Extension managed demonstrations (RM/EI)
Weak CSRT technical backstopping	M	Prioritize leverage areas for each crop by information available and potential impact
Influencing policy makers	M	Via Provincial Steering Committee under control of Extension Branch
Accuracy of data collection	H	Trials Assistants training; Write Field Manual
Need for FS perspective in Extension Branch	H	In-service extension training at all levels
Communication with farmers	H	Farmer Field Days; Trials Assistant training;
Coordination with other develop projects	L	Involve in Field Days, share data, cooperate in demonstrations and surveys
Teaching extensionists to use flexible crop recommendations rather than specific receipes	H	Extension training at the camp level
Awareness of FSR/E developments elsewhere	M	Networking through FSSP, CIMMYT, USAID, KSU
Extension bias in Diagnostic Stage	L	Wider sampling; extension training
Coordination of FSR agronomists in different provinces within the same agroecological zone	M	Through CSRTs; Annual planning meetings

[1]Severity is a subjective ranking at three levels: High (H), Medium (M), and Low (L).