

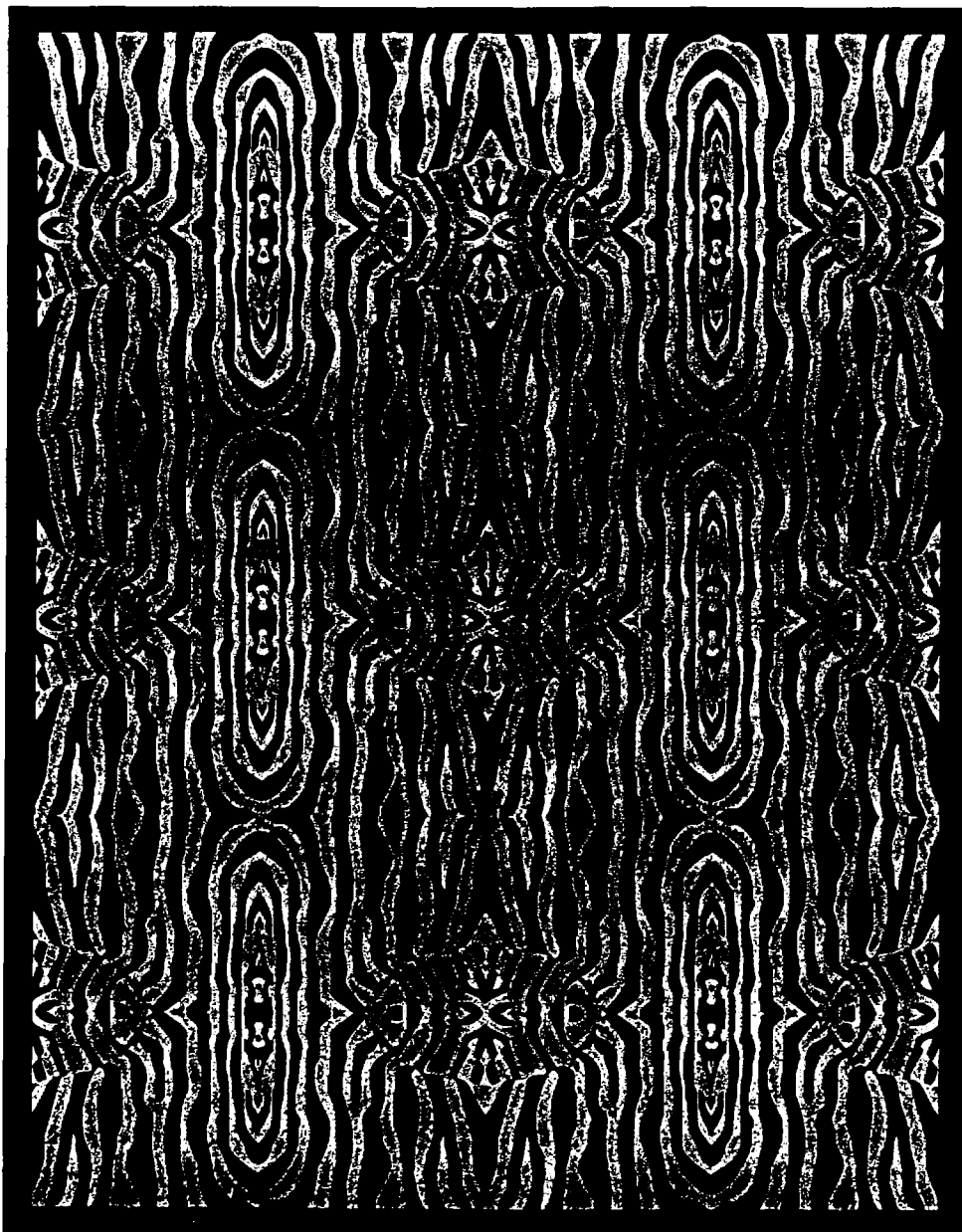
WTP-226



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Evaluation of T&V-Based Extension in Burkina Faso

Vishva Bindlish, Robert Evenson, and Mathurin Gbetibouo



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The World Bank
Washington, D.C.

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First printing November 1993

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ISSN: 0253-7494

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Library of Congress Cataloging-in-Publication Data

Bindlish, Vishva.

Evaluation of T&V-based extension in Burkina Faso / Vishva Bindlish, Robert Evenson, and Mathurin Gbetibouo.

p. cm. — (World Bank technical paper. Africa Technical Department series)

Includes bibliographical references.

ISBN 0-8213-2631-7

1. Agricultural extension work—Burkina Faso—Evaluation.

I. Evenson, Robert E. (Robert Eugene), 1934– . II. Gbetibouo, Mathurin, 1949– . III. Title. IV. Title: Evaluation of T&V-based extension in Burkina Faso. V. Series.

S544.5.B92B56 1993

630'.71'5—dc20

93-37941
CIP

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ACKNOWLEDGMENTS

Mr. Ibrahim Nebie (Ougadougou Field Office of the World Bank's Sahelian Department) extended crucial support in the field without which this study could not have been completed. Ms. Ann Judd provided exceptional research assistance. Ms. Cheryl Powell, Mrs. Marjorie Adrien and Mrs. Christina Dhanaraj were responsible for processing this document. Mr. P.C. Mohan provided editorial assistance.

This study represents a collaborative effort between the Government of Burkina Faso, the World Bank and Yale University. In Burkina Faso, the Ministère de l'Agriculture et des Ressources Animales, the Direction des Etudes et de la Planification, the Direction de la Vulgarisation Agricole, and the Institut Géographique du Burkina, were especially closely involved. The cooperation provided by Messrs. Gaspar Badalo, Jean Bahili, Christophe Yameogo, Sibili Parkouda and Roger Kaboré, and other officials of these organizations, is acknowledged with gratitude. At the World Bank, the support provided by the Technical and Sahelian Departments of the Africa Region, and in particular by Messrs. Kevin Cleaver, Salah Darghouth and Jean Doyen, needs to be acknowledged. Yale University needs to be thanked for allowing Robert Evenson to work on this study. Mr. Christian Leduc provided valuable support in the field during the initial stages of the study.

The study has profited from the support and comments provided at various times by its steering committee under the chairmanship of Messrs. Michael Gillette and Stephen Denning, and including Messrs. Michel Petit, Pierre Landell-Mills, Kevin Cleaver, Jayasankar Shivakumar, John Peberdy, Graham Donaldson, Gershon Feder, Charles Antholt, Dennis Purcell, Michael Walshe (World Bank), Michael Fuchs-Carsch (USAID), Lance Jepson (USAID), Pierre Petre (Caisse Centrale de Coopération Economique), Randolph Barker (Cornell University), and Ms. Uma Lele (University of Florida).

Particular appreciation is expressed to Messrs. Gershon Feder, Dennis Purcell, Franz Schorosch, and Ibrahim Nebie, who reviewed this study. This study has benefited greatly from their comments. It has also benefited from the review process undergone by its companion-study, *Evaluation of the Performance of T&V Extension in Kenya*. Thus, thanks must be expressed to Messrs. Jock Anderson, Michael Collinson, Bob Lindner, Douglas Horton and James Oehmke, as well.

FOREWORD

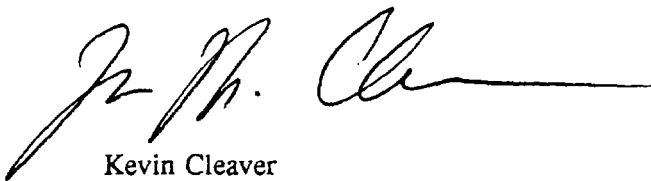
Analysis by the World Bank shows that African agriculture has grown an average of less than 2 percent a year over the last 25 years. Moreover, this analysis shows that if economic growth, food security, and poverty alleviation are ever to be attained, Africa's agricultural growth rate must double.

The World Bank's strategy for accelerating growth in this area assigns a high priority to extension. And within this strategy, extension's role goes beyond its usual function of disseminating improved technologies—it also helps farmers to organize so that they can manage services and conserve natural resources. As farmers become more efficient users of resources, they demand better research and other services; and it is through the extension system that this demand is communicated upwards. Thus, the World Bank is now supporting extension programs based on the training and visit (T&V) system in some 30 African countries.

Because of T&V extension's importance to the Bank's strategy, it is essential to evaluate its effectiveness. The World Bank has sponsored evaluations of the impact of two of the first T&V-based national extension programs which it supported in Africa—in Kenya and Burkina Faso. The results of both evaluations are promising and confirm that these programs have had a positive impact on agricultural production.

This paper presents the results of the Burkina Faso evaluation. The Burkina program in particular indicates that extension programs can contribute to short-run production rates in Africa. But the results also show that long-term contributions require new technologies and that there is an urgent need in Africa for developing agricultural research.

The World Bank plans to increase its efforts to develop agricultural research in Africa and especially to strengthen the links between research and extension. These two must work together to produce the results which are crucial to the long-term prospects for African agriculture.



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ABSTRACT

Based on a random sample of some 3,600 farmers drawn from all twelve regions, this study shows that the introduction of T&V has increased the adoption of improved practices in Burkina Faso. It shows that while all farmers have benefited, those belonging to T&V contact groups have benefited more with their crop yields being 25 to 30 percent higher. The rates-of-return computed by the study for marginal investments in expanding the present T&V-based system range from 86 percent to 187 percent. The study estimates that these investments can contribute as much as 2 percent a year to the agricultural production growth rate, although to maintain this contribution from extension over an extended period will require the generation of suitable new technologies by the research system. The study also shows that the average extension expenditure per farm family declined by almost 30 percent after the adoption of T&V as the national system, compared to the period preceding its introduction in Burkina Faso.

ABBREVIATIONS

ASVE	Activité de Suivi et de Visite des Exploitations
ATG	Activité de Travaux de Groupe
CRPA	Centre Régional de Promotion Agro-Pastorale
DEP	Direction des Etudes et de la Planification
DVA	Direction de la Vulgarisation Agricole
FEW	Frontline (i.e. field-level) Extension Worker
GDP	Gross Domestic Product
INERA	Institut d'Etudes et de Recherches Agricoles
JD	Journée de Démonstration
NGO	Non-Governmental Organization
OLS	Ordinary Least Squares
ORD	Organisme Régional de Développement
PAPEM	Point d'Appui de Prévulgarisation et d'Expérimentations Multilocales
3SLS	Three-Stage Least Squares
SMS	Subject Matter Specialist
SOFITEX	Société des Fibres et des Textiles
SPA	Service Provincial d'Agriculture
SPE	Service Provincial d'Elevage
SSA	Sub-Saharan Africa
SUR	Seemingly Unrelated Regression
T&V	Training and Visit Extension
VC	Visite Commentée
UEA	Unité d'Encadrement d'Agriculture
UEE	Unité d'Encadrement d'Elevage
ZEA	Zone d'Encadrement d'Agriculture
ZEE	Zone d'Encadrement d'Elevage

WEIGHTS AND MEASURES

1 metric ton (mt)	=	2,205	pounds
1 hectare (ha)	=	2.47	acres
1 kilometer (km)	=	0.62	mile
1 meter (m)	=	3.28	feet
1 millimeter (mm)	=	0.04	inch

1. INTRODUCTION

Rationale

The training and visit (T&V) system is designed to serve as the basis of a national extension service providing information to farm households on all activities engaged in by them.^{1/} It was first implemented by the World Bank in Turkey in the late 1960s. Then, starting in the early 1970s, it was introduced in India, Thailand and Indonesia, followed by other Asian countries. Among African countries, the first to witness its introduction was Kenya in 1982, followed by Cote D'Ivoire in 1984 and Burkina Faso in 1986. Now a linchpin of the agricultural services initiative that is central to the World Bank's current strategy for agricultural growth in Sub-Saharan Africa (SSA), T&V extension is being applied widely in some thirty countries in the region.

This, and the related investments being undertaken by national governments and the World Bank, make it important to have measures of the performance of T&V extension in SSA. There are, however, few recent evaluations of the performance of agricultural extension in SSA (see Birkhaeuser and others 1991, for a review of studies of the impact of agricultural extension). Indeed, in general, few evaluations exist of the impact of T&V extension on agricultural production. One such evaluation, also undertaken at the behest of the World Bank, utilized farm-level data from northern India (Feder and Slade 1986). It showed that there was a high probability of the rate-of-return on added investments in T&V extension (in the areas covered by the evaluation) being more than 15-20 percent. The rate-of-return on the actual past investments in T&V extension in these areas would have been more than 100 percent.

Thus, the World Bank's Technical Department for Africa has sponsored two evaluations of the performance of T&V extension in SSA, one for Burkina Faso and the other for Kenya (Bindlish and Evenson 1993). These two countries were chosen because they were among the first in SSA to adopt T&V. But also, their governments were willing to participate in the evaluations and provide financial and other support. In Burkina Faso, T&V was introduced on a pilot-basis in five CRPAs in 1986. It was then gradually expanded across Burkina Faso and adopted as the national extension system in 1989 when the entire country was brought under it.^{2/}

Objectives

To measure the impact of agricultural extension, the investments undertaken in it need to be related to changes in farm production. These investments -- which include staffing, management, training and vehicles -- result in the supply of extension to farmers. A general purpose of this extension is to educate farmers and make them into better farm managers. Its

^{1/} T&V is associated with Daniel Benor.

^{2/} The thirty provinces of Burkina Faso are organized into twelve CRPAs (Centres Régionaux de Promotion Agro-Pastorale, i.e. centres for agro-pastoral promotion). Organized along ecological lines, the CRPAs are the basic administrative units for crop and livestock development programs. It needs to be noted that T&V is purported to have been implemented previously in Burkina Faso (during 1978-85) in the Hauts-Bassins, Volta Noire and Bougouriba ORDs (Organismes Régionaux de Developpement) through an integrated rural development project financed by the International Development Association. An examination of the system which prevailed, however, suggests that it lacked such basic ingredients of T&V as subject matter specialists, regular training and fixed work programs. (The ORDs, of which there were eleven, were replaced by the twelve CRPAs in 1987).

more specific purpose, however, is to provide farmers information on improved agricultural practices. Consequently, the pace at which improved practices are adopted in the agricultural sector is expected to accelerate (assuming that some adoption of the available improved practices would have occurred even in the absence of extension). This acceleration is expected not only because of the response of the farmers informed directly by extension, but also because of other farmers who learn from them. The impact of such accelerated rates of adoption, as well as of overall improvements in farm management, would be reflected in changes in farm productivity which would occur earlier and more rapidly than otherwise.

T&V replaced another extension system in Burkina Faso. In line with the preceding discussion, that extension system would have also had an impact on farm production. Nevertheless, T&V was introduced in Burkina Faso because the earlier extension system was considered to be weak (World Bank 1988). Thus, a logical hypothesis to test would be that T&V has a greater impact on production than the extension system it replaced. The present study was, however, unable to test this hypothesis as relevant production data were not available for the period prior to the introduction of T&V.

Data on production and on farmers' participation in extension activities were collected for this study in 1990/91 (agricultural year) when T&V was operating as the national extension system. As would be expected, not all farmers were being served directly by the T&V-based CRPA extension. Therefore, a hypothesis more amenable to testing, in order to elicit the impact of T&V, is that farmers who participate directly in extension activities are likely to be more productive than other farmers (although the latter would indirectly derive some benefits from extension). Another hypothesis results from the likelihood of an accumulated effect of T&V. As T&V was phased across Burkina Faso over a four-year period (1986-89), the hypothesis can be tested that its impact (as measured on the basis of data for 1990/91) is greater in the CRPAs where it has operated longer. In this vein, this study has two objectives: one is to examine the Burkinabe experience with implementing T&V-based extension in terms of its various features (the key features and organization of T&V-based extension in Burkina Faso are discussed in Annex 1). The other objective is to test the aforementioned hypotheses concerning the impact of T&V on production.

Data Considerations

Implemented during the 1990/91 crop season, the sample surveys on which this study is based are representative of the whole of Burkina Faso as they covered all CRPAs and agro-climatic regions. The sample, which was random, consisted of 3,609 farm households for the surveys designed specifically for this study, and of 2,406 households for the production and area data used to measure the impact of T&V on production. The details concerning the sampling procedure, and survey design and implementation, are reported in Annex 2.

The implementation of the surveys was entrusted to the Direction des Etudes et de la Planification (the National Directorate for Studies and Planning, or DEP). By not involving the extension service, the possibility of bias was avoided. The questionnaires comprising the surveys were designed by the authors who subsequently participated in the training of the DEP enumerators and the testing of the questionnaires. Particular care was taken to ensure that the questions were consistent with local concepts and the nuances of local dialects. The production and area data for the 2,406 farm households used in the impact analysis were also provided by the DEP which, in its role as the national agency responsible for compiling agricultural statistics,

collects these data on a routine basis. Reported by 'parcel' for individual crops, a little over half of these data derived from crop-cutting techniques and the remainder from farmers' estimates.

Four questionnaires were administered to farmers. These questionnaires were of two types: one type was concerned with acquiring the farm-level information needed to supplement (in the impact analysis) the production and area data provided by the DEP. The second type focused on farmer participation in extension activities, and the experience with implementing T&V. The first type, consisting of two questionnaires, sought data on the socio-economic characteristics of farm households, including the number of individuals in each household, their ages, sex, education levels, and contributions to household income. Data were also obtained on the farm equipment owned (used as a proxy for capital in the estimated production functions), and on the conventional inputs applied, by each household during the 1990/91 crop season.

In the second type of questionnaire, farmers were asked whether they were aware of, or had tested or adopted, specific extension recommendations. They were also asked to specify the year in which they had first done so. While the information thus obtained was subject to some recall bias, it enabled the construction of a time-series that could be used to explore the relationships characterizing awareness, testing and adoption. This would not have been possible otherwise. Farmers were further asked to identify their main sources of information for improved practices (extension, other farmers, radio, etc.) and the constraints to adopting these practices.

Another focus of these questionnaires was on farmers' contact with extension, and the frequency of this contact. Farmers were also asked to rate extension recommendations and identify topics on which they wanted more extension help. Insofar as the extension service in Burkina Faso uses radio programs to complement its other activities, a set of questions dealt with these programs.

A short questionnaire was also administered to 783 of the 839 frontline/field extension workers (FEWs) in Burkina Faso. It sought information on their education and experience, as well as on their perceptions of the in-service training and extension messages. They were further asked to identify the constraints to their effective performance, and those to farmers' adoption of extension recommendations. Finally, this study required data on the financial and personnel resources committed to extension, and these were made available by the Direction de la Vulgarisation Agricole (the directorate of agricultural extension, or DVA).

2. ORGANIZATION OF STUDY

This study is organized into ten more chapters. These summarize supporting annexes which report the analysis undertaken for this study in detail. The next chapter considers the resource commitments to extension in Burkina Faso in terms of finances and personnel. The resources committed after the adoption of T&V as the national system are compared to both those committed before T&V was introduced in Burkina Faso, and those committed during its pilot phase. Chapter 4 reviews the characteristics of the sample farmers.

Chapter 5 focuses on farmers' participation in the extension activities associated with T&V in Burkina Faso. Farmers' awareness, testing and adoption of extension recommendations are examined in Chapter 6. Chapter 7 considers the constraints preventing farmers from adopting extension recommendations, and the topics on which they want more extension help. Chapter 8 discusses the sources identified by farmers for their information on improved practices.

The results of a statistical analysis of the factors determining farmers' awareness, testing and adoption of extension-recommended practices are summarized in Chapter 9. Chapter 10 reports the results of the analysis of the impact of T&V on farm production. Chapter 11, in turn, presents the ensuing economic analysis and rate-of-return estimates. Finally, the conclusion is rendered in Chapter 12.

3. RESOURCE COMMITMENTS TO EXTENSION

Financial Commitments

The expenditures on extension declined after the adoption of T&V as the national system, compared with the period preceding its introduction in Burkina Faso.^{3/} The total expenditure on extension nationally (in 1991 constant terms) declined from \$7 million in 1985/86 (the year immediately preceding the introduction of T&V in Burkina Faso) to an average of \$5.9 million a year during 1989/90 - 1990/91, i.e. by some 16 percent. This decline appears more striking when expressed on a per farm household basis because of the increase between these years in the estimated number of farm households. On a per farm household basis, the total expenditure on extension declined by 29 percent from 1985/86 (\$10.27) to 1990/91 (\$7.25).

Nevertheless, the total expenditures were highest during 1986/87 - 1988/89 (averaging \$7.3 million a year) when T&V was in its pilot phase. And, the subsequent decline in these expenditures during 1989/90 - 1990/91 (\$5.9 million a year) was more the result of investment expenditures than of recurrent expenditures; the average yearly investment expenditures declined by \$1.12 million or 65 percent, and the recurrent expenditures by 0.31 million or 6 percent. This suggests that most of the investments (in vehicles, buildings, etc.) entailed by T&V were undertaken during its pilot phase, leaving little to be undertaken after its adoption as the national system.

Recurrent expenditures accounted for the bulk of the total expenditures in all three periods (1985/86, 1986/87-1988/89, and 1989/90-1990/91). Moreover, their share increased in each successive period. They accounted for 75 percent of the total expenditures in 1985/86, 76 percent during 1986/87 - 1988/89, and as much as 90 percent between 1989/90 - 1990/91 because of the decline in investment expenditures. As data on salaries are available only for the FEWs, and not for staff in other positions, the shares of salary and non-salary operational expenditures in the total recurrent expenditures cannot be compared. The share of FEW salaries in the total recurrent expenditures, however, increased in each successive period: it increased from 20 percent in 1985/86 to 23 percent during 1986/87 - 1988/89, and to 26 percent during 1989/90 - 1990/91.^{4/} If this trend is indicative of staff salaries in general, it suggests that the share of non-salary operational expenditures has been declining over time, which may be cause for concern.

Personnel Resources

There was an effort after the introduction of T&V to "rationalize" the extension establishment. As a result, the total number of FEWs in Burkina Faso declined from 1,005 in 1985/86 to 839 in 1990/91 (i.e. by 17 percent). The average number of farm households per FEW, at the same time, increased from 679 to 1,001.

^{3/} See Annex 3 for a detailed discussion of the resource commitments to extension in Burkina Faso.

^{4/} Because of an apparent decision by the Government to increase salary levels, the total expenditure on FEW salaries expanded after the introduction of T&V despite a decrease in the number of FEWs (see the following paragraph). On a per FEW basis, this expenditure expanded from \$1,046 in 1985/86 to \$1,281 during 1986/87 - 1988/89, and to \$1,647 during 1989/90 - 1990/91.

There are, however, wide variations among CRPAs in the average number of farm households per FEW.^{5/} Further, the survey administered to FEWs indicated low education levels among them with only 16 percent of those interviewed having attended secondary school. Seventy-five percent had, nevertheless, completed a one-to-four year course leading to a technical diploma or certificate in agriculture. There were a total of 155 subject matter specialists (SMSs) in 1990/91, and about 170 zonal supervisors (the immediate supervisors for FEWs). Thus, while a ratio of 1 SMS to 5 FEWs seems high, 1 zonal supervisor to 5 FEWs roughly conforms to the ratio of 6 - 8 FEWs to a supervisor prescribed by T&V (Benor and others 1984). Seventy-eight (or 9 percent) of the 839 FEWs in Burkina Faso in 1990/91 were female.

^{5/} The average number of farm households per FEW in 1990/91 ranged from 2,086 in the Centre CRPA to 484 in Centre-Est (see Annex 3).

4. CHARACTERISTICS OF SAMPLE FARMERS

The examination of the experience with implementing T&V extension in subsequent chapters is undertaken with reference to certain characteristics of the sample farmers. Therefore, as background, this chapter looks at how the sample farmers are distributed according to the characteristics in question. These characteristics, discussed in detail in Annex 4, relate to (i) whether a farmer belongs to a T&V contact group, (ii) whether he/she is served by the T&V-based CRPA extension, (iii) farm size, and (iv) education and sex of the household head.

Farmer groups are the main contact points for FEWs under T&V extension in Burkina Faso. These groups, each comprising the heads of anywhere from roughly 25 to 50 farm households, were created out of the traditional government-supported "groupements villageois" (village groups) where the latter existed.^{6/} In villages where the groupements villageois did not exist, farmer groups were created afresh for extension purposes. In the case of the sample for this study, 21 percent of the farmers reported being members of T&V contact groups.^{7/} On the other hand, the proportion of the sample farmers reporting being served by the CRPA extension services was 31 percent, which suggests that FEWs' scheduled meetings with their contact groups are attended by appreciable numbers of farmers who are not members of these groups. Thirteen percent of the sample farmers indicated that they were served by other (non-CRPA) extension services including those operated by non-governmental organizations, other donors besides the World Bank, and the Société des Fibres et des Textiles (SOFITEX) for cotton.

The education levels among the sample farmers were low, with 67 percent having received no schooling. Less than 0.5 percent had attended secondary school, 5 percent primary school, 12 percent a religious school (generally up to the primary level), and 20 percent a functional literacy course. In terms of farm size, 43 percent of the sample consisted of medium-sized farmers, 31 percent of small farmers, and 27 percent of large farmers.^{8/} As only 4 percent of the sample farmers belonged to female-headed households, the results of the sample surveys in the subsequent text are not categorized according to the sex of the household head.

^{6/} The role of the T&V contact groups, and their relation to the groupements villageois, are discussed in detail in Annex 1.

^{7/} Thirty-eight percent of the sample farmers reported being members of the groupements villageois. This suggests that most sample farmers belonging to T&V contact groups were likely to be members of these groups.

^{8/} Small farmers were defined as those cultivating up to 2 hectares, medium-sized as those cultivating between 2 and 5 hectares, and large as those cultivating 5 hectares or more.

5. EXTENSION PARTICIPATION

The principal methods associated with the T&V-based CRPA extension consist of: (i) the *Activité de Travaux de Groupe (ATG)*; (ii) extension-farmer meetings to follow-up on ATG activities (*Activité de Suivi et de Visite des Exploitations, or ASVE*); (iii) the *Journée de Démonstration (JD)*; (iv) the *Visite Commentée (VC)*; (v) the *PAPEM (Point d'Appui de Prévulgarisation et d'Expérimentations Multilocales)*; (vi) on-farm research; and (vii) radio programs. This section discusses farmers' participation in these activities and their ratings of extension messages, based on the results of the farmer surveys.^{9/}

ATG Participation

The ATG sessions constitute the main forum for the regular meetings (central to the T&V system) between a FEW and his contact groups. At these sessions, in which farmers who are not members of T&V contact groups can also freely participate, a FEW disseminates the extension messages for the coming few weeks. In the case of the sample farmers, 29 percent reported participating in ATG sessions during the year preceding the survey. These included 87 percent of the farmers belonging to T&V contact groups, and 14 percent of the remaining farmers. They further included higher proportions of the literate (46 percent) and large farmers (47 percent) in the sample, than of the non-literate (27 percent) and medium-sized (31 percent) or small farmers (20 percent).

Frequency of ATG Participation

A FEW is reportedly expected to convene eighteen to twenty ATG sessions a year for each of his/her contact groups. Many of these sessions would, however, take place during the dry season when the imparted messages may not be of immediate relevance to farmers. But even if the yardstick is the six fortnightly sessions expected to be convened during the rainy season (of three-month duration), the frequency with which farmers participate in the ATG is low. A little over one-fourth of the sample farmers who reported participating in ATG sessions over the course of the preceding year indicated that they had attended six or more sessions. They included 34 percent of the T&V contact group members and 16 percent of the other farmers who had reported ATG participation. Notably, while the proportion reporting ATG participation during the preceding year was higher for large farmers, the percent of the participating farmers attending at least six sessions was higher for medium-sized (28 percent) and small farmers (25 percent) relative to large farmers (17 percent).

ATG Meeting Site

The preferred ATG meeting site for crop extension is the "champ école" (a group plot).^{10/} Meetings are, however, also held in public halls and in farmers' fields and homes. Accordingly, sample farmers were asked to specify the most frequent meeting site of the ATG

^{9/} This chapter summarizes the detailed discussion of farmers' participation in extension activities presented in Annex 5.

^{10/} The preferred ATG meeting site for livestock extension is a "demonstration herd site." Group members are generally expected to contribute an animal each for demonstration purposes.

sessions they had attended. The champ école was the most frequent meeting site for 56 percent of the sample farmers who had participated in ATG sessions during the previous year. It was the most frequent meeting site for 76 percent of the T&V contact group members, and 50 percent of the other farmers, who had participated in the ATG. Hence, other meeting places were equally important for farmers who were not members of T&V contact groups. As the champ écoles are "group" plots, this suggests that such farmers may have easier access to other meeting places. The champ école was the most frequent meeting place for roughly equal proportions (two-thirds) of the ATG participants organized according to whether they were literate or not. In terms of farm size, it was the most frequent meeting place for 74 percent of the large farmers, 65 percent of the medium-sized farmers and 63 percent of the small farmers who had participated in the ATG.

ASVE Participation

After each ATG session, a FEW is expected to accompany 15 - 20 percent of the contact group members (on a rotational basis) to one of their fields to elaborate on the messages disseminated at the ATG, especially in terms of their application. These follow-up sessions, which farmers who are not contact group members can also attend, constitute the ASVE. Less than 10 percent of all sample farmers, or 33 percent of all ATG participants, reported attending ASVE sessions during the year preceding the survey. Such low participation in the ASVE sessions might to some extent derive from the large size of the T&V contact groups (twenty-five to fifty farmers), inasmuch as FEWs schedule these sessions on a rotational basis with the contact group members. The advantages of smaller T&V groups need to be considered both because it is important for farmers to meet FEWs frequently in such settings as the ASVE where they can discuss their particular problems more easily, and also because smaller groups, by enabling a closer interface between FEWs and farmers, can enhance the quality of the ATG.

A higher proportion of the ATG participants who were not T&V contact group members (42 percent), than those who were (27 percent), reported attending the ASVE sessions, which attests to their eagerness to acquire information.^{11/} The differences in the proportions attending the ASVE were relatively small among the ATG participants classified according to farm size, and according to whether they were literate or not.

JD and VC

The JD is composed of demonstrations by successful farmers to which all other farmers from across a zone, and research and extension staff, are invited. In the case of the VC, groups of farmers visit the fields of a successful farmer, generally in the same village; they are accompanied by the local FEW and, in some instances, also by his/her supervisor and SMS. Reflecting the limited frequency with which the JD and VC are held, the proportion of sample farmers reporting having attended one during the previous year was roughly 7 percent in both cases. This included 16 - 17 percent of the T&V contact group members, and 4 - 5 percent of the other farmers, in the sample. In the case of both the JD and the VC, higher proportions of literate and medium-sized farmers attended.

^{11/} It may be less constraining for farmers who are not T&V contact group members to attend the ASVE sessions held in other farmers' fields, than for those farmers who are members and in whose fields these sessions are scheduled on a rotational basis.

PAPEM Visits

The PAPEM, of which fourteen are currently operational in Burkina Faso, constitute the sites of the adaptive research trials managed by the CRPA extension services. It is FEWs, and not necessarily farmers, who are expected to visit them. In general, even when transport and accommodation are provided by the CRPAs, it is only farmers living close by who visit a PAPEM. Thus, only 1 percent of the sample farmers indicated that they had visited a PAPEM in the past year. They consisted almost wholly of T&V contact group members who were literate, and who were large or medium-sized farmers.

On-farm Research

Eight percent of the sample farmers reported that they engaged in on-farm research. This generally involves a farmer setting aside a small piece of land on which experiments with new techniques are undertaken with the help of a FEW. The figure of 8 percent is appreciable, and points to an earnest desire among farmers to acquire new knowledge. Higher proportions of sample farmers who were T&V contact group members (20 percent) and literate (15 percent), than those who were not T&V contact group members (5 percent) or literate (7 percent), engaged in on-farm research. The proportion was also higher for medium-sized (8 percent) and small farmers (7 percent), relative to large farmers (less than 4 percent).

Radio Programs

Extension programs on the radio were considered useful by virtually all farmers who listened to them (97 percent), suggesting that they are an effective complement to the extension activities involving direct contact between FEWs and farmers. Further attesting to this effectiveness, nearly half of all listeners considered an increase in the length of the programs to be the best means of enhancing their role. Similarly, almost the entire 76 percent of the T&V contact group members in the sample who listened to these programs wanted their time changed to the evening hours when they would not interfere with their farming operations. Also, more sample farmers reported listening to the extension programs (44 percent) than owning radios (37 percent). This suggests that farmers who do not own radios listen with their neighbors and friends because they value the information they gain.

Ratings of Messages

Virtually all farmers aware of the extension messages considered them to be "applicable."^{12/} Consistent with this, the results of the FEW survey indicated that nearly all FEWs considered the messages disseminated by them to be relevant. They also considered farmers to be receptive to these messages. A pattern emerges when farmers rating the messages to be "applicable" are distinguished from those rating them to be "highly applicable." More farmers who were T&V contact group members or literate, relative to those who were neither,

^{12/} "Applicable" (used interchangeably with "useful" and "effective" in this study) is defined as "having a positive impact on production." The enumerators explained this to the sample farmers.

gave a "highly applicable" rating. Similarly, a majority of the large farmers in the sample (76 percent) gave a "highly applicable" rating, compared to only a third of the small farmers.

This suggests that farmers who have greater direct contact with extension (e.g. T&V contact group members), and farmers who are literate, appreciate extension messages more because they are likely to be better informed of the content of the messages and of their correct application methods. They are also likely to have better skills. Insofar as a high proportion of the large farmers gave a "highly applicable" rating, it further suggests that farmers who are likely to have easier access to inputs, credit, and other factors of production, have a greater appreciation of the messages. An implication of this is that extension should do more follow-up work with small farmers in order to identify their constraints and help them benefit more from the messages. Another implication, however, is that the messages being disseminated may not be the most appropriate for farmers with limited resources.

6. AWARENESS, TESTING AND ADOPTION

Discussed in detail in Annex 6, the analysis of farmers' awareness, testing and adoption of extension messages is undertaken in the context of twelve important practices: (i) soil preparation, (ii) seed treatment, (iii) improved cultivars, (iv) seed drilling, (v) organic fertilizer, (vi) chemical fertilizer, (vii) pesticide application, (viii) animal draft, (ix) motorized draft, (x) crop rotation, (xi) anti-erosion methods, and (xii) agro-forestry. There are two dimensions to the analysis of adoption reported here. One focuses on the overall patterns and timing of adoption. The other considers the adoption of individual practices by agro-climatic zone.

Awareness

While relatively high for everyone, the proportions of sample farmers professing awareness of extension messages were higher for the T&V contact group members. More than 90 percent of the T&V contact group members, and 80 percent of the other farmers, indicated that they were aware of the extension messages for the following seven practices: soil preparation, seed treatment, seed drilling, organic fertilizer, chemical fertilizer, animal draft and anti-erosion methods. These proportions were lower for the remaining five practices (improved cultivars, pesticides, motorized draft, crop rotation and agro-forestry) and amounted to 78 - 86 percent for the T&V contact group members, and 53 - 70 percent for the other farmers.

The practice of which the lowest proportions of T&V contact group members (78 percent) and other farmers (53 percent) expressed awareness related to improved cultivars. There are two possible reasons for this. One is the general paucity of improved crop varieties for drier environments characterized by a short growing season such as found in Burkina Faso, which has implications for agricultural research. The second reason could derive from a consumer preference for traditional varieties, and farmers' consequent indifference to acquiring information about improved varieties.

Testing

Farmers are often encouraged to "test" extension recommendations on small areas before adopting them more widely. However, the proportions of sample farmers reporting testing were lower than those reporting awareness or adoption, suggesting that many farmers adopt recommendations without first testing them. The largest proportions of T&V contact group members undertook testing for seed treatment (43 percent), seed drilling (39 percent), soil preparation (34 percent), chemical fertilizer (36 percent) and animal draft (33 percent). Seed treatment was also the practice tested by the largest proportion of sample farmers who were not T&V contact group members (28 percent).

Adoption Patterns and Timing

The adoption rates for the different practices are generally modest. The highest proportions of sample farmers reported the adoption of organic fertilizer and seed treatment (67 percent), and soil preparation (60 percent). About one-third to one-half of the farmers indicated that they had adopted crop rotation, seed drilling, anti-erosion methods, animal draft and chemical fertilizer. The practices adopted by the lowest proportions of farmers were improved cultivars and pesticides (21 percent), agro-forestry (14 percent), and motorized draft (1 percent).

As noted earlier, farmers were asked when they had first adopted the extension messages for each practice. The results indicate that a major portion of the total adoption reported by farmers in 1990/91 (when the surveys for this study were implemented) had occurred prior to the introduction of T&V.^{13/} Nevertheless, what needs to be stressed is the relatively high portion of total adoption that seems to have occurred in the short period following the introduction of T&V (i.e. between 1986/87 and 1990/91), which suggests an acceleration in adoption rates after T&V was introduced.^{14/} For most practices, this portion exceeded 25 percent. It was particularly high for improved cultivars (42 percent), and agro-forestry and pesticides (34 percent), i.e. the practices with the lowest overall adoption rates (besides motorized draft which had been adopted by only 1 percent of the sample farmers).

For every practice, total adoption was higher for T&V contact group members and literate farmers. On the other hand, the portion of the total adoption occurring after the introduction of T&V was higher for farmers who were not T&V contact group members (relative to those who were) in the case of five of the twelve practices, and for non-literate farmers (relative to literate farmers) in the case of seven practices. Similarly, this portion was highest for small farmers for six practices, although total adoption was higher for large or medium-sized farmers in all cases.^{15/}

Adoption by CRPA and Agro-climatic Zone

Although the twelve practices covered in this study were chosen because they have wide applicability, their relative importance varies by agro-climatic zone. This to some extent explains the modest overall adoption rates. The salient features of the five agro-climatic zones of Burkina Faso, including their production and rainfall patterns and population configurations, are described in Annex 2. Of the five, the driest -- and ecologically the most precarious -- is the Sahelian zone. Thus, Nord (97 percent), Centre-Nord (86 percent) and Sahel (81 percent), located within it, had the highest proportions of sample farmers among all CRPAs reporting the adoption of the extension messages for organic fertilizer. Nord (along with Comoe in the South-West zone) also had the highest proportion adopting anti-erosion methods (52 percent).

Consistent with the importance of the Western zone for grain and cotton production, the Mouhoun CRPA had the highest proportions of farmers reporting the adoption of the extension messages for crop rotation (89 percent) and animal draft (61 percent, along with the Centre-Sud CRPA). It also had the highest proportion reporting the adoption of improved cultivars (51 percent), after the Hauts-Bassins CRPA. Nord, which traverses both the Western and Sahelian zones, had the highest proportion for seed treatment (83 percent). The zone covering the Central Plateau has high population densities and severely eroded soils. Consequently, Centre-Nord (86 percent), Centre-Sud (79 percent), and Centre (78 percent), had high proportions of farmers

^{13/} The timing of adoption is considered with reference to the introduction of T&V in individual CRPAs.

^{14/} The hypothesis that T&V accelerated adoption was specifically tested through statistical analysis (see Chapter 9 and Annex 9), and the results of that analysis are consistent with those reported here.

^{15/} For all practices except anti-erosion methods and agro-forestry, the proportion reporting that they had adopted was highest for the large farmers in the sample (see Annex 6). For anti-erosion methods and agro-forestry, this proportion was highest for the medium-sized farmers.

indicating the use of organic fertilizer; Centre had the highest proportion of farmers among all CRPAs practicing agro-forestry (28 percent). Given that the Eastern zone also has major soil fertility problems, high proportions of sample farmers in the Centre-Est and Est CRPAs reported the use of organic fertilizer and anti-erosion methods.

The South-West is the zone with the greatest agricultural potential. Consistent with this, the CRPAs located within it had high adoption rates for almost all practices. Comoe had the highest proportions of sample farmers among individual CRPAs reporting the adoption of soil preparation (99 percent) and anti-erosion methods (52 percent). Hauts-Bassins had those for improved cultivars (62 percent) and chemical fertilizer (80 percent). Hauts-Bassins had large proportions of farmers reporting the adoption of the extension messages also for soil preparation, seed treatment, crop rotation and seed drilling, as did Sud-Ouest for those for soil preparation and crop rotation.

7. FARMERS' CONSTRAINTS AND PROBLEMS 16/

Constraints

For seven of the twelve practices covered in this study, farmers who had not adopted explained their main reason in terms of insufficient knowledge of the practices.^{17/} This implies weaknesses in the extension services delivered to farmers. At the same time, it calls into question the results presented in Chapter 6 which showed high proportions of sample farmers being aware of all practices. The implication is that many farmers may be aware of the extension messages in a general form, but lack the detailed knowledge of their content and correct application methods necessary for adoption. It could be that farmers do not perceive the general messages as being relevant to their particular circumstances, and do not seek more detailed information. Thus, this again points to the need for extension to work more closely with farmers, and to the benefits of smaller contact groups insofar as they would enhance the ability of the FEWs to demonstrate the relevance of messages to individual farmers' circumstances. It also further reinforces the need for FEWs to meet farmers more frequently in ASVE sessions to follow-up on the advice imparted at ATG meetings.

For the remaining five practices (organic fertilizer, seed treatment, chemical fertilizer, and animal and motorized draft), farmers indicated that a financial constraint prevented them from adopting the extension messages. While the other four practices entail direct investments in purchased inputs, the financial constraint in the case of organic fertilizer is likely to arise from farmers' inability to pay for labor and transport. Only a small proportion of the sample farmers cited the unavailability of inputs as an important reason for not adopting.

As indicated earlier, FEWs were also asked what they thought were the main constraints preventing farmers from adopting extension messages. Not surprisingly, only a small proportion of the FEWs (8 percent) felt that insufficient knowledge was a constraint. They considered financial problems and the unavailability of inputs to be the main constraints. As for impediments to their own effectiveness, FEWs cited the poor condition of feeder roads and the large number of social events which caused farmers to miss scheduled meetings.

Topics for More Extension Help

Topics on which farmers want more extension help can serve to guide extension interventions. The topics on which the sample farmers wanted more help cover three areas: (i) animal health and nutrition, (ii) environmental risks, and (iii) diversification into high-value crops. Given the paucity of extension messages for livestock which is an important economic activity in Burkina Faso because of its dry climate, 63 - 79 percent of the farmers who were T&V contact group members, and 57 - 69 percent of those who were not, desired more messages focusing on animal health, animal feeding and crop residue management. Similarly, reflecting the concern engendered by Burkina Faso's weak soils and uncertain rainfall, 72 - 75 percent of

^{16/} See Annex 7 for a detailed discussion of farmers' constraints and the topics on which they want more extension help.

^{17/} The seven practices are crop rotation, improved cultivars, agro-forestry, pesticides, anti-erosion methods, soil preparation and seed drilling.

the T&V contact group members, and 66 - 73 percent of the other farmers, expressed a need for more messages relating to organic fertilizer, anti-erosion methods and water management. The numbers of farmers wanting help with diversifying into more lucrative enterprises were smaller. Fifty-four percent of the T&V contact group members and 47 percent of the remaining farmers wanted more extension messages for horticulture, and 39 percent of the contact group members and 33 percent of the remaining farmers for rice production.

8. SOURCES OF INFORMATION 18/

T&V assumes the existence of a strong spread effect, with messages diffusing to other farmers from those reached directly by extension. Thus, farmers who are not members of T&V contact groups are expected to acquire their knowledge of improved practices both indirectly from other farmers, and directly by attending extension workers' scheduled meetings with contact groups. In line with this, a higher proportion of the sample farmers who were not members of T&V contact groups ascribed their awareness of extension recommendations to other farmers (41 percent) than to FEWs (36 percent).19/ Attesting to the dynamics underlying this process, 70 percent of the T&V contact group members in the sample, and 23 percent of the non-members, reported discussing extension advice with other farmers. As would be expected, FEWs were the primary source of information on improved practices for most of the farmers belonging to T&V contact groups.20/

18/ This chapter briefly summarizes the discussion of farmers' sources of information presented in Annex 8.

19/ It was only for pesticides, improved cultivars and chemical fertilizer that more of the farmers who were not T&V contact group members ascribed their knowledge of improved practices to FEWs than to other farmers. In their study of T&V in northern India, Feder and Slade (1986) also found that for awareness of pesticides, fertilizer and other complex practices, extension workers (rather than other farmers) were the main source of information. They rationalized it as a desire on the part of farmers to obtain information on complex or expensive practices from a direct source (rather than indirectly), as the cost of making mistakes in the case of these practices is high.

20/ The radio and input suppliers were also more important as sources of information for other farmers than for the T&V contact group members.

9. STATISTICAL ANALYSIS OF AWARENESS, TESTING AND ADOPTION

The main hypothesis examined was that T&V led to earlier and more awareness, testing and adoption than would have occurred otherwise.^{21/} Two separate specifications were used to examine this hypothesis: one of these evaluated the rate of change in farmers' awareness, testing and adoption of practices at the village level; the second was concerned with seeing whether the probabilities of individual farmers becoming aware, testing and adopting increased after the introduction of T&V. In addition to examining this hypothesis, an analysis was also undertaken of the factors influencing farmers' participation in extension activities, and of the timing of awareness, testing and adoption.

The data utilized consisted of a time-series for 1984-91, developed on the basis of farmer-reported timing of awareness, testing and adoption. As such, as noted earlier, there is a possibility of recall error associated with these data. The explanatory variables used included geo-climate indicators; measures of farmer human capital (age, sex, education, and main occupation) and of farm characteristics (size, number of plots, and extent of hired labor used); and an indicator of the CRPA in which a farm was located as the policy processes affecting farmers' decisions are expected to vary across CRPAs. Five variables were used to represent the supply of extension: (i) a FEW: farm households ratio measured at the zonal level, (ii) an indicator of the year in which T&V was introduced in a province, (iii) the total number of farmers covered by extension in a province, as officially reported, (iv) the proportion of FEWs in a province with less than five years' experience, and (v) a variable denoting a vacant FEW position for villages where that was the case.

Determinants of Participation

It can be useful to have an idea of the factors affecting contact group membership, as these groups are the main vehicle through which extension influences decisions in the agricultural sector at large. In the analysis that was undertaken, an indicator of whether a farmer was a member of a T&V contact group was related to the variables indicated previously.^{22/} The results showed that large farmers -- both in terms of area cultivated and the number of hired workers used -- were more likely to be T&V contact group members. This likelihood was also greater for younger and full-time farmers, and for farmers in areas with higher ratios of FEWs to farmers, although education did not emerge as being an important determinant. The probability of being a T&V contact group member varied widely among CRPAs, which appears to reflect the influence of differences in policies and other factors such as infrastructure.^{23/}

^{21/} The analysis reported in this chapter is discussed in detail in Annex 9.

^{22/} Probit regression was used for estimation, as the dependent variable was a zero-one variable. This variable took the value of one if a farmer was a T&V contact group member, and zero otherwise.

^{23/} Except in the case of education, the results appeared to be reasonable. Large and full-time farmers may participate more in extension activities than other farmers because they stand to benefit more. The result in the case of education was, however, contrary to expectation, as participation in contact groups and extension activities would a priori be expected to increase with higher levels of schooling.

Rate of Change Analysis

The analysis of the rates of change in awareness, testing and adoption, for which the data on individual farmers were aggregated by village, incorporated an S-shaped learning curve. Such a curve can be used to signify a process where the rate of change in the proportion of farmers who are aware, or who have tested or adopted, is low in the early years, but accelerates as farmers learn from those becoming aware or testing and adopting earlier. Then, as adoption nears completion, this rate again contracts. The model used related the proportion of village farmers who were aware of, or had tested or adopted, a practice to: (i) a time variable, the observations on which were the years from 1984 to 1991, (ii) the variable indexing the introduction of T&V in a province, (iii) a variable denoting the existence of non-T&V extension services in a village, and (iv) participation in T&V contact groups as predicted by the analysis reported in the previous paragraph. The geo-climate indicators, and measures of farm size and education, were also included as explanatory variables. Ordinary least squares (OLS) was used for estimation.

The results were conclusive for testing and adoption, but weak for awareness. In the case of awareness, they reflected the incomplete nature of the time-series data which was limited to only those farmers who had tested or adopted.^{24/} For testing, the results showed that T&V had a significant positive impact for ten of the twelve practices; for the remaining two practices, the measured impact was positive but not significant. Similarly, for adoption, the results showed positive T&V effects for nine practices. Insofar as the inclusion in the model of either predicted participation in T&V contact groups or of the variable indexing the introduction of T&V in a province gave these same results, it tends to confirm that the effect of T&V is not confined to T&V contact group members but extends to other farmers. The results indicated higher rates of awareness, testing and adoption for villages with larger farmers and higher proportions of literate farmers.

Determinants of Awareness, Testing and Adoption

The results of the analysis of awareness, testing and adoption, based on data for individual farmers, were consistent with those of the reported village-level analysis.^{25/} They showed that participation in T&V contact groups increased the probability of being aware for five practices (improved cultivars, pesticides, animal draft, motorized draft, and crop rotation), and the probability of testing for all practices except motorized draft. In the case of adoption, the probability increased for all practices, although the measured effects were weak for organic fertilizer and anti-erosion methods. Like those for the village-level analysis, these results also indicated that education and farm size were positively related to awareness, testing and adoption.

^{24/} In the questionnaire, farmers were asked whether they had tested or adopted a practice. It was only if they had tested or adopted that they were asked to specify the year in which they had first become aware of the practice.

^{25/} Probit regression was again applied as the dependent variable was a zero-one variable indicating whether a farmer was aware, or had tested or adopted.

Timing of Awareness, Testing and Adoption

In this analysis, a variable intended to capture the effects of learning from other farmers who had become aware, or tested or adopted earlier, was included. The results obtained were consistent with those of both the village-level analysis and the analysis of the determinants of awareness, testing and adoption. In particular, they showed positive farm size and literacy effects on testing for all practices except motorized draft, and on adoption for all practices except motorized draft and anti-erosion methods. The results also confirmed the existence of the effect of learning from other farmers in all cases but one (the adoption of anti-erosion methods), and the positive impact of testing on adoption for all practices except organic fertilizer. In sum, the results reported in this chapter provide evidence of a T&V impact on testing and adoption (although those for awareness cannot be considered conclusive for reasons indicated earlier).

10. PRODUCTION IMPACT OF EXTENSION

As indicated earlier, the objective was to measure the impact of T&V extension on farm production. This study had farm-level data collected in 1990/91, but no data for a period preceding the introduction of T&V. Thus, a framework comparing the impact of T&V to that of the extension system it replaced -- in order to see how the impact of extension on production changed as a result of the introduction of T&V -- could not be used. Nevertheless, insofar as T&V was introduced in different CRPAs at different times over the 1986 - 89 period, it seemed possible to hypothesize that there might be an accumulated effect of T&V, with its impact on production increasing as a function of the number of years over which it had operated. It also seemed possible to hypothesize that there might be a difference in productivity between T&V contact group members and other farmers, although both sets of farmers were likely to have been affected. The analysis of the impact of T&V on production undertaken for this study, and reported in detail in Annex 10, is based on these considerations.

Three variables were used in this analysis to represent the supply of extension. The main variable used was the FEW: farm households ratio mentioned in the previous chapter. Commonly used in studies of this type, it is especially appealing because the supply of extension denoted by it is exogenous (being determined by the government), and outside the control of farmers. This variable assumes that increased extension staff services, in the form of a higher FEW: farm households ratio, will lead to more advice and information being available to farmers. The other two variables used were the "predicted" participation (in T&V contact groups), and "predicted" adoption from the analysis reported in the last chapter.^{26/}

A timing dimension was incorporated into the FEW: farm households ratio, as it was deemed that a FEW staff-year would have an impact on production in future years. Insofar as extension advice takes time to spread among farmers, this impact was assumed to be initially a rising one. It was assumed that this impact would subsequently decline as farmers gained experience and obtained additional information from non-extension sources. Thus, time weights conforming to this logic were estimated and incorporated into the FEW: farm households variable as an accumulated stock of staff years.

The statistical approach used consisted of a "meta" production function. In a meta production function, variables measuring the flows of services, such as those associated with agricultural extension, research and infrastructure, are specified directly, whereas in a conventional production function they are treated as "background" information. The functional form used was a simple Cobb-Douglas one. National prices were used to sum together the production of individual crops as the production function was estimated in an aggregate form.

It needs to be acknowledged that the farm-level data collected in 1990/91 were subject to measurement errors. In addition to the extension variables, the other variables used to explain the productivity differences among farms included inputs and community characteristics. They

^{26/} Participation and adoption are endogenous in that the decision to participate in a contact group or adopt is made by a farmer. Using them in a predicted form corrects for the endogeneity. Nevertheless, another problem with using these variables is that many of the factors which explain participation and adoption also explain production. Thus, the use of these variables in the analysis failed to provide conclusive results.

also included the geo-climate variables, measures of farmer human capital and farm characteristics, and variables indexing the different CRPAs, discussed in the previous chapter. The inputs consisted of the total cultivated area, family and hired labor, capital (measured as the value of farm implements), and the total number of parcels farmed. As for the community characteristics, they consisted of the number of years that T&V had been operating, and the village means for: (i) the proportions of T&V contact group members, (ii) participants in non-T&V extension, and (iii) proportions of literate farmers. These variables further included a measure of the number of farm households in a village.

Several versions of the model were estimated using OLS, and the seemingly unrelated regression (SUR) and three-stage least squares (3SLS) approaches. The results for the coefficients for the included non-extension variables were generally "reasonable", providing confidence in the estimates for the extension variables (see Annex 10). The 3SLS (.07) and SUR (.04) estimates for the FEW: farm households ratio were higher than the OLS estimate (.02), suggesting that there was a simultaneity bias which had the effect of biasing the OLS estimate downwards. The existence of this bias implies that the FEW: farm households ratio (i.e. the supply of extension) is greater in areas with more productive farms.

The results further indicated that not only the FEW: farm households ratio, but also the variables for: (i) the village means of the proportions of T&V contact group members, and (ii) the number of years over which T&V had operated, were important determinants of production. The coefficient for (i) indicated that the productivity levels of farmers who were T&V contact group members were 25 to 20 percent higher than those of farmers who were not (although the latter also benefitted from T&V). Similarly, the coefficient for (ii) indicated the presence of a significant accumulated impact of T&V, with the elasticity for the FEW: farm households variable being .024 units higher for areas with four years of T&V relative to those with one year.

11. ECONOMIC ANALYSIS

From the viewpoint of policy, it is important to have an idea of the marginal returns to investments in T&V extension. The production elasticities estimated for the FEW: farm households variable through the models discussed in the previous chapter can be transformed into marginal products and used to calculate these returns. As reported in detail in Annex 11, this was done for the present study.^{27/}

Marginal rates-of-return were computed with respect to the elasticity estimates from all three approaches used (OLS, SUR, and 3SLS). The interest was in seeing what the marginal return would be to investing in expanding the supply of extension by one more FEW around the sample mean (holding all inputs and other non-extension variables included in the models constant). First, marginal products were computed in terms of the elasticities. Then, in combination with the weights to capture the time-dimension of the impact of a FEW (see Chapter 10), the marginal products were used to construct benefit streams.^{28/} Finally, these benefit streams were adjusted for the cost of a FEW in 1990/91, and rates-of-return computed. These rates-of-return were 91 percent, 193 percent and 367 percent for the elasticity estimates from the OLS, SUR and 3SLS approaches, respectively.

In addition to these estimates relating to a short-term investment in one year of FEW time, marginal rates-of-return were also computed for hypothetical long-term investments in T&V extension using the OLS-estimated elasticities. Premised on the assumption that the investments would be made continually for an eight-year period, these computations were used to ascertain the added returns due to T&V contact group membership and to the accumulated effect of T&V. From a base of 86 percent which considered only the effect of the FEW: farm households ratio, the computed rate-of-return increased to 91 percent when the accumulated effect of T&V was added. It increased further to 187 percent when the effect of being a T&V contact group member was also added.

^{27/} The total value of crop production in Burkina Faso in 1991 was used as the basis for computing the marginal products.

^{28/} An investment in one year of FEW time was estimated to have an impact on production over the next five years.

12. CONCLUSION

Thus, the results of this study indicate that at present there would be a favorable payoff to further investments in T&V extension, and this payoff would be higher for farmers who are T&V contact group members, although other farmers would benefit as well. Calculations (Annex 11) also show that investments in T&V extension could contribute as much as 2 percent a year to the agricultural production growth rate for a few years (five to six years). They could continue to make a contribution to the production growth rate for a few more years after that (through about the tenth year), although at a lower rate. To sustain this contribution over a longer term would, however, require the development of suitable new technologies by the research system.

It is in the context of these results that the findings deriving from the descriptive analysis, undertaken in the earlier part of the study, need to be considered. Those findings suggest both low membership of T&V contact groups (21 percent of the sample farmers), and a low frequency of attendance at the ATG sessions, the main forum for the regular meetings between farmers and extension workers. The results relating to T&V's growth contribution, on the other hand, assume increases in contact group membership (to cover 40 percent of the farmers), and regular attendance at the ATG sessions. Thus, an operational implication of these results is that more farmers need to be inducted into T&V contact groups. While this may require an increase in the number of FEWs, the results show that the ensuing investments would have a positive payoff. They also show that expanding the membership of contact groups should not be difficult as appreciable numbers of farmers not belonging to these groups participate in scheduled ATG sessions, presumably because they value the information they gain.

Another implication relates to the large size of the T&V contact groups (twenty-five to fifty farmers). This may explain the low ATG attendance rates, insofar as it limits the interaction that an individual farmer can have with the FEW. Because of the limited interaction, the benefits that farmers expect to acquire from participating in the ATG may not be large. Therefore, some consideration needs to be given to the potential benefits that may accrue from a reduction in the size of the groups, although this would again have implications for staff numbers and the budget. Among other things, smaller contact groups can increase the benefits that group members derive from the critical ASVE sessions (where a FEW meets a portion of his/her farmers to discuss their particular problems and follow-up on the messages disseminated at the ATG meetings), inasmuch as these sessions are scheduled in individual group members' fields on a rotational basis. Finally, given the lower ATG participation rates for the small farmers in the sample relative to the larger farmers, the results of this study suggest that a special focus on small farmers for membership in T&V contact groups may be justified. The results also suggest that there is a demand for more extension messages relating to livestock and the environment, and that the development of such messages is likely to have a positive payoff.

ANNEX 1: KEY DESIGN FEATURES OF T&V-BASED EXTENSION IN BURKINA FASO

Traditionally, under the training and visit (T&V) system, as it evolved in Asia, individual contact farmers have been the direct focus of extension activity, with messages expected to spread further from them to other farmers through more informal channels (Benor and others 1984). While this was the case in Africa also (i.e. in Kenya) when T&V was first introduced there, a gradual change has now occurred with individual farmers being replaced by farmer groups as contact points for extension. Groups are a common feature of rural society in Africa, with farmers forming them both for collective action (e.g. to construct and rehabilitate infrastructure) and to increase their negotiating strength (e.g. to obtain credit and market output). By focusing on them, rather than on individual contact farmers, an extension worker is able to reach a much larger number of farmers directly. Indeed, in Burkina Faso, groups have been the focus of extension from the outset of the introduction of T&V in 1986.

Groups may be even more important in Burkina Faso than in other parts of Africa. Encouraged to form by the government and frequently mobilized by it for various social and political purposes, it is estimated that there are over 5000 groupements villageois (village groups) in the country. Therefore, when T&V was first introduced, extension workers approached these existing village groups, and created contact groups for T&V extension out of them. In those villages where such groups did not exist, extension workers organized contact groups afresh for T&V extension. Possibly one to three to a village, these T&V contact groups consist of the heads of anywhere from twenty-five to fifty farm households each.

Burkina Faso is divided into thirty provinces which, in turn, are organized into twelve CRPAs (Centres Régionaux de Promotion Agro-Pastorale, or regional centres for agro-pastoral promotion). These CRPAs, delineated along ecological lines (see Annex 2), are administrative units designed to facilitate, as their name signifies, crop and livestock development. Thus, crop and livestock services in Burkina Faso are organized by CRPA. In line with this, the World Bank-supported T&V system is implemented nationally through the extension services operated by the CRPAs.

In addition to the national CRPA extension, there are also other extension services functioning in Burkina Faso. Operated by other donors (besides the World Bank), and by non-governmental and parastatal organizations, these extension services exist in projects and other limited areas and tend to be commodity-specific. An example of such an extension service is that operated by the Société des Fibres et des Textiles (SOFITEX) for cotton.

In terms of the overall organizational structure for the T&V-based national extension in Burkina Faso (i.e., the CRPA extension), the Ministry of Agriculture and Livestock is at the apex. Within it is the Directorate of Agricultural Extension (Direction de la Vulgarization Agricole, or DVA) which is responsible for the administration of crop and livestock extension nationally. The CRPAs, which have the regional responsibility for crop and livestock extension, are hierarchically directly below. And under them, at the province level, are departments comprising of the provincial agricultural services (Service Provincial d'Agriculture, or SPA) and provincial livestock services (Service Provincial d'Elevage, or SPE). In these departments are located the agencies responsible for agricultural and livestock extension provincially.

Next at the district level come the agricultural extension zones (Zone d'Encadrement d'Agriculture, or ZEA) and the livestock extension zones (Zone d'Encadrement d'Élevage, or ZEE). Each zone, which may cover more than one district, is further sub-divided into agricultural extension units (Unité d'Encadrement d'Agriculture, or UEA) and livestock extension units (Unité d'Encadrement d'Élevage, or UEE). A zone may consist of four to five units and a unit, in turn, of six to twelve villages. It is at the level of the unit that field extension workers (FEWs) operate.

The FEWs, each responsible for a unit, are supported by zonal supervisors; a supervisor oversees around five FEWs. The responsibility for extension in a province rests with the provincial extension co-ordinator, who is supported by provincial subject matter specialists (SMSs), one each for crops and livestock. There is, in turn, a chief of extension (chef de service) at the CRPA level, who is responsible for all extension activities in the CRPA including the formulation of work programs and training of staff.

Because of Burkina Faso's dry environment, livestock production is an important economic activity accounting for about a fourth of the total agricultural Gross National Product (GDP). In this context, it needs to be noted that although with the advent of T&V, livestock extension has made some progress in Burkina Faso, it is still at an early stage of development there as elsewhere in Sub-Saharan Africa (SSA). There is only a limited number of livestock extension units and much of the livestock extension that is undertaken is at the zonal level. But even at the zonal level, the livestock services continue to be largely preoccupied with providing veterinary services. The paucity of livestock extension is to a certain extent explained by the nomadic nature of some of the pastoralism that is practiced in Burkina Faso, which makes it difficult to deliver services. It is, however, also due to the dearth of extension messages for livestock with those existing focusing almost exclusively on animal draft and the use of crop residues as animal feed. Against this, there is a large demand for extension messages dealing with animal health and nutrition (see Annex 7), and these are now beginning to be developed.

Turning to the extension methods used by the CRPAs, the principal method consists of regular meetings between FEWs and their contact groups, as is to be expected under T&V. A FEW is usually responsible for about eight contact groups. The main forum for these meetings is the *Activité de Travaux de Groupe* (ATG). It is at the ATG sessions that a FEW familiarizes farmers with the extension messages for the coming few weeks. In the case of crop extension, the preferred meeting place for the ATG is the *champ école* (a group plot), of which there are estimated to be some 6,000 to 7,000 in Burkina Faso; other meeting places consist of individual farmers' fields or homes, and public halls. In the case of livestock extension, the ATG sessions are held at the "demonstration herd sites," with group members generally contributing an animal each for demonstration purposes. After each ATG session, a FEW is expected to accompany some 15-20 percent of the contact group members on a rotational basis to one of their fields, where the techniques imparted at the ATG meetings are elaborated upon and advice provided on particular problems faced by individual farmers. These follow-up sessions, which non-contact group members can also attend, are referred to as the *Activité de Suivi et de Visite des Exploitations* (ASVE).

In addition to the meetings between FEWs and farmers, the other methods used by the CRPA extension to disseminate technical messages and train farmers include radio programs. They also include the *Journée de Démonstration* (JD) and *Visite Commentée* (VC). Convened at the zonal level, the JD is akin to a field day with all farmers from across a zone, as well as researchers and extension staff, being invited to witness demonstrations given by successful farmers. The VC, on the other hand, comprises visits (usually within a village) by small groups of farmers to the fields of another farmer who has successfully adopted the extension recommendations; farmers are

accompanied on these visits by the local FEW and, in some instances, by the FEW's supervisor and SMS also.

Along with regular meetings between FEWs and farmers, another key feature of T&V relates to the regular training of all extension staff including FEWs and SMSs. Thus, all FEWs in the service of the CRPAs are expected to receive training from SMSs once a fortnight. The topics covered at these training sessions focus on the messages to be disseminated by the FEWs to farmers in the coming few weeks. These messages vary among CRPAs depending on their agro-climatic conditions and development priorities.

As for the training of SMSs, the norm that became established in Asia and other African countries (e.g. Kenya) is for them to be trained by research scientists at workshops held each month. Thus, in Burkina Faso, three to four sessions are scheduled every agricultural season (lasting roughly three months) for such training of SMSs. The training sessions, held at research institutes, are organized for groups of CRPAs (generally two to three CRPAs), as the number of research scientists in Burkina Faso is small. Indeed, even the existing research scientists are sometimes unavailable for the scheduled training sessions, leading to a shortfall in the number of sessions actually accomplished in a season.

T&V also emphasizes the need for strong linkages between extension and research. While the sessions where research scientists provide training to SMSs constitute a forum for these linkages, another forum consists of the adaptive research trials undertaken by the CRPAs. These trials, managed by the extension services of the CRPAs, are located in the PAPEM (Points d'Appui de Prévulgarisation et d'Expérimentations Multilocales). The PAPEM play a key role in the extension-research linkages, as the trials undertaken there by the extension services involve the collaboration of research scientists from the Institut d'Etudes et de Recherches Agricoles (INERA), the premier agricultural research institute in Burkina Faso. This role was recognized in the World Bank's Staff Appraisal Report for the Burkina Faso Agricultural Support Services Project through which T&V was expanded on a national scale (World Bank 1988). The report saw the enhanced use of the PAPEM, of which fourteen are at present functioning, as a means of strengthening the linkages between extension and research which it considered to be weak. Farmers are also encouraged to undertake research on their fields with the help of extension agents.

ANNEX 2: STUDY DESIGN

This study is based on a sample survey of 3,609 randomly-selected farmers. Also interviewed were 783 of the 839 FEWs (i.e. 93 percent of the FEWs) employed nationally in the CRPA extension system. Implemented during the 1990/91 crop season, the sample surveys covered farmers from all twelve CRPAs. Thus, they are representative of the entire country.

T&V was introduced in Burkina Faso on a pilot-basis in parts of five CRPAs in 1986; these five are the Nord, Sud-Ouest, Hauts-Bassins, Mouhoun, and Est CRPAs (Table 1).^{29/} The pilot operation was expanded in 1987 over areas located in the CRPAs of Centre-Ouest, Centre, Centre-Nord, Sahel, Est and Centre-Est. More areas were included in it in its final phase in 1988, and these belonged to the Comoe, Centre-Sud, Centre and Centre-Nord CRPAs. T&V was formally adopted as the national extension system in 1989 when all areas that remained uncovered by the pilot operation were brought under it.

Agriculture in Burkina Faso is associated with high risks because of its weak soils, and low and uncertain rainfall. Among the five agro-climatic zones of Burkina Faso (the Sahel, the West, the Central Plateau, the South-West, and the East), the riskiest is the Sahelian zone. Covering the Sahel CRPA and the northern parts of the Centre-Nord and Nord CRPAs, it is the driest zone with the total yearly rainfall ranging only between 350 and 600 millimeters (Table 2). Moreover, this rainfall is of a limited duration and restricts crop production to under 100 days a year. Thus, the main economic activity in this zone is livestock production and the human population densities are low. The Sahel CRPA had just 16 people per square kilometer in 1990, but the largest number of livestock among the CRPAs (Table 3). Together, the three CRPAs of the Sahel, Centre-Nord and Nord included in the Sahelian zone accounted for 36 percent of the livestock population of Burkina Faso. While they also accounted for 22 percent of the national production of grains and 18 percent of groundnuts (during the 1987-89 period), much of this production occurred in parts of these CRPAs (i.e., of Centre-Nord and Nord) located in other zones.

Covering parts of the CRPAs of Nord and Mouhoun, the Western zone has a sub-Sahelian climate with the average rainfall ranging from 600 to 800 millimeters. Thus, the production of both livestock and crops is important. Mouhoun, located in this zone, had the largest share among CRPAs in the national production of grains (14 percent) and cotton (47 percent). The zone comprising the Central Plateau, which encompasses the Centre-Sud, Centre and Centre-Nord CRPAs, has a Sub-Sahelian climate in the north and a Sudanian climate in the south. In its northern parts (the Centre-Nord CRPA), rainfall averages 600-700 millimeters a year and cropping is possible for 100-120 days. By comparison, in its southern parts (the Centre and Centre-Sud CRPAs), rainfall is less variable, averages 700-1000 millimeters, and permits a crop cycle of up to 120-150 days.

^{29/} Prior to 1987, Burkina Faso was divided into eleven administrative units for the purpose of agricultural and livestock development. These administrative units were known as the Organismes Régionaux de Développement (ORDs). They were replaced in 1987 by the twelve CRPAs. Thus, in terms of the structure that existed at the time, the pilot operation in 1986 covered five ORDs - Yatenga (later the Nord CRPA), Bougouriba (the Sud-Ouest CRPA), Hauts-Bassins, Volta Noire (the Mouhoun CRPA), and Est.

The Central Plateau, however, has poor soils which lack many of the basic nutrients required by crops. It has, moreover, suffered serious environmental decline as a result of its high population densities which have led to the traditional bush fallow system being replaced by continuous cultivation. Therefore, despite its relatively favorable rainfall conditions, this zone does not account for a high level of crop production. Centre in this zone, where the capital city of Ouagadougou is located, is the most densely populated CRPA with 121 persons per square kilometer in 1990.

The zone with the most conducive environment for crop production is the South-West which has a largely Sudano-Guinean climate. Rainfall across this zone ranges from 800 to 1200 millimeters a year, and crops can be cultivated for a period of up to 150 days. It also has relatively fertile clayey soils and many perennial sources of water. At the same time, there is little population pressure with the population density averaging only thirty-one persons per square kilometer. This zone includes the CRPAs of Comoe, Centre-Ouest, Hauts-Bassins and Sud-Ouest, as well as parts of Mouhoun. After Mouhoun, Hauts-Bassins accounted for the highest shares in the national production of grains (13 percent) and cotton (36 percent) among CRPAs. With a share of 11 percent, Centre-Ouest followed Mouhoun and Hauts-Bassins in importance in terms of grain production.

Finally, in the Eastern zone, the climate is mainly of the northern Sudanian type with the yearly rainfall averaging between 600 and 900 millimeters. Although in parts of it, crop production can be undertaken for periods of up to 150 days, the infertile sandy soils that dominate constrain productivity. This zone covers the CRPAs of Centre-Est and Est, and while Centre-Est has a relatively high population density (fifty-eight persons per square kilometer), Est along with the Sahel CRPA has the lowest population density among CRPAs (sixteen persons per square kilometer). Centre-Est is the most important groundnut-producing CRPA, with its contribution to Burkina Faso's total production of groundnuts amounting to 30 percent. The Est CRPA makes relatively high contributions to the national livestock population (13 percent) and grain production (10 percent).

The 3,609 farmers surveyed in the twelve CRPAs for this study include the sample of farmers used by the Direction des Etudes et de la Planification (the National Directorate for Studies and Planning, or DEP) to derive the official agricultural production statistics. Indeed, the implementation of the surveys was entrusted to the DEP which undertook it as a part of its routine data collection activities during the 1990/91 crop season. These surveys comprised four questionnaires (see Appendix A), in addition to the data on crop areas and production which the DEP collected for its own use but made available for the present study.

It needs to be noted that the extension service was not involved in any aspect of the survey or data collection process, including the sample and questionnaire designs and enumeration. The questionnaires were designed by the authors, who further refined them during the course of testing and enumerator training; the enumerators belonged to the DEP. A particular objective during testing and enumerator training was to ensure that the form of the questions was consistent with local concepts and nuances of local languages. Another objective was to ensure that the enumerators were aware of these concepts and nuances, and would reflect them when translating the questions from French (in which they were formulated) into the local languages.

The selection of farmers was based on the DEP sampling procedure. This procedure consisted of two steps. In the first step, the DEP selected villages randomly from each of the twelve CRPAs; the probability that a village would be selected was made proportional to its size. In this way, a total of 401 villages in the twelve CRPAs were selected. Then, in the second step, six households were chosen randomly from each of the 401 villages. This yielded a total of 2,406 households (i.e. 401 times 6), which is the basic sample that the DEP uses to derive the national

agricultural production data. To this sample were added three more randomly selected farmers from each village for the express purpose of the present study. Thus, the total sample for this study became 3,609 households (401 villages times 9 households). However, while the mentioned four questionnaires formulated for this study were administered to all 3,609 households, the data on crop areas and production made available by the DEP were confined to its original sample of 2,406 households.

These data on area and production were reported by "parcel" for individual crops. They covered a total of some 17,000 parcels. While the data for 9,500 parcels (56 percent) were derived using crop cutting techniques, those for the remaining 8,500 parcels consisted of farmers' estimates.

Measuring the impact of T&V on crop production was a primary objective of this study. However, to measure this impact required that both before-after and with- without variation be controlled. This presented some problems in the case of Burkina Faso. Before- after variation in productivity could not be controlled for directly as production data were not available for the sample households for a period prior to the introduction of T&V. Nor could direct account be taken of with- without variation as all provinces had T&V in 1990/91 when the data for this study were collected. Thus, this study relied on the variations (i) between CRPAs adopting T&V at different times, and (ii) between farmers served directly by extension (i.e. T&V contact group members) and other farmers. It focused on two hypotheses: one was that there was likely to be an accumulated effect of T&V, with its impact on production being higher in CRPAs where it had started earlier. The second hypothesis was that T&V was likely to have a greater impact on the productivity of farmers who were T&V contact group members and participated directly in extension activities, although other farmers were also likely to benefit.

The four questionnaires designed for this study focused on (i) the characteristics of the sample households, (ii) the awareness, testing and adoption of improved extension- recommended practices, (iii) farmer participation in extension activities, and (iv) the use of farm inputs and implements. In particular, the first questionnaire sought data on the number of persons in each household, their ages, sex, education levels, occupations (i.e. gainful farm and off-farm employment) and contributions to household income. It was important to have information on these factors as they affect the availability of family labor and investment capital, and the adoption of improved practices and farm productivity.

For each of the twelve practices considered in this study, the second questionnaire was concerned with the extent to which farmers were aware of the extension messages and had tested and adopted them. Farmers were asked to recall the year in which they had first become aware of, or had tested or adopted a practice, and to identify their initial source of information for the practice (extension workers, radio, other farmers, etc.) They were also asked to identify any constraints that prevented them from adopting it. The twelve practices which this study focuses on and which have been referred to earlier are soil preparation; seed treatment; the use of improved cultivars; seed drilling; the use of organic fertilizer; the use of chemical fertilizer; pesticide application; animal draft; motorized draft; crop rotation; anti-erosion methods; and agro-forestry. These were considered by extension personnel to be the major practices on which they deliver messages.

Along the lines of the discussion in Annex 1 of the main features of T&V-based extension in Burkina Faso, the third questionnaire was concerned with farmers' membership of village and T&V contact groups, and their participation in the activities of the CRPA extension. The questions focused on their participation in the ATG and ASVE sessions. They also focused on the frequency of these sessions and on the location of the ATG meetings (i.e. whether they were held in the champ

école or other locations). Other questions related to whether farmers had participated in the JD and VC, whether they had visited a PAPEM, and whether they engaged in on-farm research.

A set of questions sought farmers' perceptions concerning the relevance of the messages delivered by extension on each of the twelve practices considered. Another set pertained to topics on which farmers desired greater extension help. Farmers were also asked whether they listened to extension programs on the radio, how useful they found these to be, and what they thought could be done to improve their effectiveness.

The fourth questionnaire sought data on the farm equipment owned and used by households, and on the conventional inputs (e.g. labor) applied by them during the 1990/91 crop season. These data were required for the analysis of the impact of T&V on production.

Finally, a short questionnaire was administered to FEWs. It focused on their experience, and ratings of the in-service training and extension messages. It also asked them what they thought were the main constraints preventing them from performing effectively and farmers from adopting extension recommendations.

Table 1: Phasing of T&V

YEAR	ORD/CRPA	PROVINCE
1986	NORD	YATENGA
	SUD-OUEST	BOUGOURIBA PONI
	HAUTS-BASSINS	KENEDOUGOU HOUEY
	VOLTA NOIRE (MOUHOUN) (CENTRE-SUD)	KOSSI MOUHOUN SOUROU
	EST	GNAGNA TAPDA
1987	CENTRE-OUEST	PASSORE SANGUIE BOULKIEMDE SISSILI
	CENTRE	OUBRITENGA KADIOGO BAZEGA
	CENTRE-NORD	SANMANTENGA NAMENTENGA
	SAHEL	SENO
	EST	GOURMA
	CENTRE-EST	BOULGOU KOURITENGA
1988 (a)	COMOE	COMOE
	CENTRE-SUD	NAHOURI
	CENTRE	GANZOURGOU
	CENTRE-NORD	SANMATENGA NAMENTENGA BAM
1989	ALL REMAINING CRPAs	ALL REMAINING PROVINCES

(a) Starting in 1988, the agroecological regions (ORD) became CRPAs with only small changes in their geographical coverage.

Table 2: Regional Characteristics

	DOMINANT CLIMATE	RAINFALL (mm)	AREA ('000 Km ² .)	POPULATION ('000)	POPULATION DENSITY (Pop./Km ²)
Centre	Sudanian	700-800	10	1,209	121
C-Est	Sudanian	600-900	12	693	58
C-Nord	Sub-Sahelian	450-700	20	795	40
C-Ouest	Sudanian & Sudano-Guinean	700-1000	23	927	40
C-Sud	Sudanian	700-1000	13	649	50
Comoe	Suadano-Guinean	800-1200	18	297	17
Est	Sudanian	600-900	50	810	16
Hauts-Bassins	Sudano-Guinean	800-1200	25	882	35
Nord	Sudanian & Sub-Sahelian	450-700	16	797	50
Sud-Ouest	Suadano-Guinean	800-1200	17	504	30
Sahel	Sahelian & Sub-Sahelian	350-600	37	607	16
Mouhoun	Sudanian & Sudano Guinean	650-1000	33	1,041	32
Burkina Faso		450-1100	274	9,210	34

Table 3: Percent Shares of CRPAs in the National Production of Principal Crops (1987-89 average) and Livestock Numbers (1990)

	TOTAL LIVESTOCK	GRAINS	GROUNDNUTS	COTTON
Centre	9.0	7.2	3.9	2.4
C-Est	6.8	7.3	29.6	0.6
C-Nord	11.1	7.9	7.9	0.6
C-Ouest	8.0	10.9	6.6	2.4
C-Sud	6.6	5.6	5.3	1.2
Comoe	1.7	4.3	11.2	5.3
Est	12.9	10.0	9.9	-
Hauts-Bassins	3.7	12.8	4.6	35.5
Nord	9.7	7.4	9.2	-
Sud-Ouest	4.7	5.9	5.3	4.7
Sahel	15.3	6.3	0.6	-
Mouhoun	10.5	14.4	5.9	47.3
Burkina Faso	100.0	100.0	100.0	100.0

ANNEX 3: RESOURCE COMMITMENTS TO EXTENSION

This annex considers the financial and personnel resources committed to extension in Burkina Faso. The financial resources are considered first and then the personnel resources. The focus is on comparing the resources committed after T&V was adopted as the national extension system, with those committed during its pilot phase and before it was introduced in Burkina Faso. Relatedly, Appendix B presents the results of the short questionnaire administered to FEWs.

Financial Resources

The most striking aspect of the expenditures on extension relates to their decline following the adoption of T&V as the national extension system, by comparison with the period prior to its introduction in Burkina Faso (Table 4, and Appendix C, Table 30). The average yearly expenditure on extension during 1989/90 and 1990/91 when T&V was operating nationally (\$5,859,000 in 1991 constant terms) was 16 percent lower than the amount spent in 1985/86 (\$7,007,000), the year immediately preceding the commencement of the T&V pilot project; 1985/86 is the only year from the pre-T&V period for which data on the financial and personnel resources committed to extension are available. The percent decrease in the expenditure on extension between these periods proves to be even higher when this expenditure is expressed on a per farm household basis, because of the increase over time in the number of farm households (Table 5). The decrease in the average extension expenditure per farm household between 1985/86 (\$10.27) and 1990/91 (\$7.25) amounts to 29 percent (or \$3.02).

Nevertheless, the average expenditures each year during the period 1986/87-1988/89 (\$7,290,000), when T&V was in its pilot phase, exceeded those incurred both in 1985/86 and after T&V was adopted nationally. The decline between these expenditures and those incurred after the adoption of T&V nationally (a yearly average of \$5,859,000 for 1989/90-1990/91) was particularly sharp, amounting to some 20 percent. This decline derived more from the investment-related expenditures than from the recurrent expenditures, although both fell — the investment expenditures by \$1,121,000 or 65 percent, and the recurrent expenditures by \$310,000 or 6 percent. What this suggests is that much of the investment (in vehicles, buildings, etc.) entailed by T&V had been undertaken during its pilot phase. Consequently, only a small amount of investment needed to be made after T&V was adopted as the national system. Investment expenditures remained essentially unchanged between 1985/86 and the period of the pilot project, while the recurrent expenditures increased by some 5 percent or \$269,000 (when expressed on an average annual basis for the period of the pilot project).

Recurrent expenditures accounted for a much larger share of the total expenditures than investment expenditures in all three periods. Moreover, this share increased in each successive period. The increase was small between 1985/86 (75.5 percent) and the T&V pilot-phase (76.2 percent), but greater subsequently as the share of recurrent expenditures rose to 90 percent after T&V was adopted nationally (i.e. during 1989/90-1990/91) as a result of the large decline in investment expenditures noted previously.

A breakdown of the total recurrent expenditures into their salary and non-salary operating components is not possible because salary-related data were available only for the FEWs, and not for

staff in other positions. FEW salaries accounted for 20 percent of the total recurrent expenditures in 1985/86, 23 percent over the period of the T&V pilot project, and 26 percent during the period 1989/90-1990/91 after the adoption of T&V on a national scale. Thus, the share of FEW salaries in the total recurrent expenditures increased over each successive period. This was despite a substantial decrease in the size of the field-level staff after the adoption of T&V nationally, as discussed in the following section.

The total expenditure on FEW salaries increased by 21 percent from 1985/86 (\$1,051,000) to the period of the T&V pilot project (an average of \$1,271,000 a year), and then by another 9 percent after T&V was operating nationally (an average of \$1,391,000 a year for 1989/90-1990/91). Converted to per FEW terms, the salary expenditure amounted to \$1,046, \$1,281 and \$1,647 for the three successive periods, suggesting significant increases in the levels of staff salaries. At the same time, however, because of the decrease in the number of FEWs, the remaining recurrent expenditures (i.e. the total recurrent expenditures minus the FEW salaries) also showed an increase when expressed on a per FEW basis, albeit they declined in aggregate terms. The "remaining" recurrent expenditures (on a per FEW basis) increased from \$4,217 dollars in 1985/86, to \$4,316 a year during the period of the pilot project, and to an average of \$4,571 a year during 1989/90-1990/91 when T&V was operating nationally. If the remaining expenditures (which include the salaries of SMSs and supervisors) can be taken as representing the total support provided to FEWs, who are the critical element in the interface between extension and farmers, then this increase is propitious.

Personnel Resources

The number of FEWs decreased from 1,005 in 1985/86 to 839 in 1990/91, with the yearly average for the period of the T&V pilot project (1986/87-1988/89) being 993 (Table 6). Amounting to some 17 percent, this decrease between 1985/86 and 1990/91 was the result of an effort under T&V to rationalize the use of staff resources. Together with the increase in the number of farm households, this decrease caused the average number of farm households per FEW to expand by almost a half from 679 in 1985/86 to 1,001 in 1990/91.

However, the average number of farm households per FEW tends to vary widely among CRPAs. In 1990/91, this number ranged from as much as 2,086 in the Centre CRPA to 484 in Centre-Est, compared to an average of 1,001 for Burkina Faso as a whole. Other CRPAs besides Centre-Est with relatively low numbers of farm households per FEW were Hauts-Bassins (598), Comoe (667) and Sud-Ouest (711), all of which are in the South-West where the population densities are lower and agricultural potential higher than in other agro-climatic zones. In Centre-Ouest (892), which is also in the South-West, Est (959) and Nord (832), these numbers were moderate. They exceeded the average for Burkina Faso in Mouhoun (1,058), Sahel (1,423) and Centre-Sud (1,909), in addition to Centre.

These differences are the combined outcome of the variations among CRPAs in the numbers of both farm households (see Annex 2) and FEWs. The distribution of the 839 FEWs in Burkina Faso in 1990/91 ranged from 35 in the Centre CRPA to 104 in Mouhoun. Comoe (36), Centre-Nord (44), Sahel (52), Centre-Sud (59) and Centre-Est (64) also had relatively low numbers of FEWs. On the other hand, Centre-Ouest (83), Sud-Ouest (83), Hauts-Bassins (87), Nord (95) and Est (97), along with Mouhoun, had relatively high numbers.

Seventy-eight of the 839 FEWs (i.e. about 9 percent) were female. Nord (20 out of 95) had the largest number of female FEWs among the CRPAs, although Centre-Nord had the highest

proportion (13 out of 44, or 30 percent). Centre, Centre Ouest, Centre-Sud and Est appear to have had no female FEWs in 1990/91, while in the remaining CRPAs their numbers were relatively small.

The total number of SMSs in Burkina Faso in 1990/91 amounted to 155 (Table 6). Again, the distribution of SMSs varied widely across CRPAs. While Est had 21 SMSs, Centre had only 7. However, what is operationally relevant is not the total number of SMSs but their numbers relative to those of the FEWs they train. And when that is considered, their distribution among CRPAs comes out to be more even. The number of FEWs per SMS averages out to be 5 for the whole of Burkina Faso with the majority of the CRPAs having between 4 and 6. The ratio of 5 FEWs to 1 SMS seems high.

Of the 311 staff shown as supervisors in Table 6, 170 were zonal supervisors (the immediate supervisors for FEWs), while the remainder were livestock specialists. The ensuing ratio for Burkina Faso of 5 FEWs to a zonal supervisor is more or less in line with that of 6-8 FEWs to a supervisor traditionally prescribed under T&V.

Table 4: T&V and Pre-T&V Expenditures on Extension ('000 1991 US Dollars)*

	PRE-T&V	T&V PILOT STAGE				T&V NATIONAL		
	1985/86	1986/87	1987/88	1988/89	Average	1989/90	1990/91	Average
EXPENDITURES								
Investment	1,718	1,685	1,790	1,721	1,732	273	948	611
Recurrent	5,289	4,568	6,079	6,028	5,558	4,789	5,707	5,248
(FEW Salaries) **	(1,051)	(1,235)	(1,236)	(1,342)	(1,271)	(1,368)	(1,413)	(1,391)
Total	7,007	6,253	7,869	7,749	7,290	5,062	6,655	5,859
FEW Salaries as % of Recurrent Expenditures	19.9	27.0	20.3	22.3	22.9	28.6	24.8	26.5

* A constant exchange rate of US \$1 = 272 CFA is used to convert the CFA amounts presented in Appendix C, Table 30.
 ** Included in the recurrent expenditures.

Table 5: FEWs, Farm Households, and Expenditures

	PRE-T&V	T&V PILOT STAGE				T&V NATIONAL		
	1985/86	1986/87	1987/88	1988/89	Average	1989/90	1990/91	Average
Number of FEWs	1,005	1,005	990	983	993	850	839	845
Number of Farm Households	682,000							808,500
Salary Expend. per FEW (1991 dollars)	1,046	1,229	1,248	1,365	1,281	1,609	1,684	1,647
Expenditure per Farm Household (1991 dollars)	10.27							7.25
Number of Farm Households per FEW	679						1,001	

Table 6: Staff Numbers, 1990/91

	FEWs			SUBJECT MATTER SPECIALISTS	SUPERVISORS	FARM HOUSEHOLDS PER FEW	FIELD-LEVEL EXTENSION WORKERS PER	
	Male	Female	Total				Subject Matter Specialist	Supervisor
Centre	35	0	35	7	22	2,086	5	2
C-Est	55	9	64	18	14	484	4	5
C-Nord	31	13	44	11	20	1,909	4	2
C-Ouest	83	0	83	14	40	892	6	2
C-Sud	59	0	59	8	43	1,458	7	1
Comoe	28	8	36	9	14	667	4	3
Est	97	0	97	21	36	959	5	3
Hauts-Bassins	77	10	87	16	27	598	5	3
Nord	75	20	95	20	30	832	5	3
Sud-Ouest	73	10	83	11	14	711	8	6
Sahel	47	5	52	8	27	1,423	7	2
Mouhoun	101	3	104	12	24	1,058	9	4
Burkina Faso	761	78	839	155	311	1,001	5	3

ANNEX 4: CHARACTERISTICS OF SAMPLE FARMERS

Prior to the analysis in subsequent annexes of the survey data, this annex focuses on the distribution of the sample farmers according to certain characteristics. These characteristics relate to (i) membership of village and T&V contact groups, and extension contact; (ii) whether the farmer belongs to a male- or female-headed household; (iii) education of the household head; and (iv) farm size. It is with reference to these characteristics that the survey results concerning farmers' participation in extension activities, and their adoption, awareness, and testing of extension messages, are considered in subsequent annexes.

T&V Contact Group Membership and Extension Contact

Consistent with the discussion in Annex 1 of the key role that groups play in Burkinabe village society, 45 percent of the farmers sampled for this study reported belonging to sundry farmer associations (Table 7). Thirty-eight percent belonged to the groupements villageois, almost 3 percent to cooperatives, and 4 percent to other farmer organizations. In terms of the farmers surveyed in individual CRPAs, the highest proportions belonging to these various farmer associations were in Hauts-Bassins (78 percent), and Nord (60 percent).

The proportion of sample farmers who reported being members of T&V contact groups amounted to just under 21 percent. As is to be expected, virtually all of these contact group members were also members of the groupements villageois from which they were originally generally drawn, as noted in Annex 1. Thus, among individual CRPAs, Hauts-Bassins (55 percent) and Nord (48 percent) — along with Centre (70 percent) — also had the highest proportions of sample farmers belonging to T&V contact groups. Hauts-Bassins and Nord were in the first group of CRPAs to adopt T&V (1986), while in Centre it was introduced the following year (see Annex 2). The location within it of the DVA (the Directorate of Agricultural Extension), which is responsible nationally for the T&V program, might explain why Centre has the highest proportion of sample farmers belonging to T&V contact groups.

While almost 21 percent of the sample farmers reported being T&V contact group members, as many as 31 percent indicated that they were served by the CRPA extension (i.e. the T&V-based national extension). This suggests that appreciable numbers of non-members attend extension workers' scheduled meetings with contact groups, which is a desirable feature, and in keeping with T&V's objective of achieving a spread effect through the contact groups. In all, 39 percent of the sample farmers reported being served by extension of one form or another. Whereas 31 percent were served by the CRPA extension, roughly 13 percent had contact with other extension services including those operated by SOFITEX (the cotton parastatal), non-governmental organizations (NGOs), and other donors (besides the World Bank) in projects supported by them. As this implies, about 5 percent of the sample farmers had direct contact with more than one extension service.

Male- and Female-Headed Households

While the responses of roughly 3 percent of the sample farmers were not clear, 93 percent belonged to male-headed households and only a little over 4 percent to female-headed households (Table 8). Thus, no attempt is made in the ensuing annexes to report results by the sex of the household head as that may not provide a representative picture of female-headed households. It however needs to be noted that in general, there is only a small number of female-headed households in Burkina Faso, although as many as one-fourth of all farmers might be female. A special effort has been made under T&V to reach these female farmers with contact groups being organized specifically for them. As a result, the number of female farmers contacted by the CRPA extension is estimated to have increased from around 15,000 in 1988 to almost 300,000 in 1992 (Nebie 1992).

Education Levels

Education levels appear to be low among farmers in Burkina Faso with 67 percent of the sample farmers reporting that they had not received any formal education (Table 8). Another 13 percent did not report their literacy level. Of the 20 percent reporting that they had received an education, more than half (12 percent) had attended a religious (Islamic) school generally up to the primary level; 5 percent had attended a primary school, while 2 percent had undertaken a functional (alphabetization) course. Less than 0.5 percent of the sample farmers had received a secondary education.

Farm Size

The farm size distribution is derived from the sub-sample of 2406 farmers (i.e. the DEP sample) on which the production data are based as discussed in Annex 2. Small farmers are defined in this study as those cultivating up to two hectares, and medium-sized as those cultivating between two and five hectares. Farmers cultivating more than five hectares are considered to be large. Accordingly, 43 percent of the sample consists of medium-sized farmers, 31 percent of small farmers, and 27 percent of large farmers (Table 8).

Table 7: Group Membership and Extension Coverage

	PERCENT OF ALL SAMPLE FARMERS
GROUP MEMBERSHIP	45.2
Groupements Villageois (Village Groups)	38.2
Co-operatives	2.6
Other Farmer organizations	4.4
T&V CONTACT GROUP MEMBERS	20.5
REPORTED EXTENSION COVERAGE	* 39.2
CRPA Extension	31.1
SOFITEX	0.9
NGOs	3.3
Project-specific extension (non-World Bank)	4.6
Other extension	3.8

* This is less than the sum of the figures below (43.7 percent), as 4.5 percent of the sample farmers reported being served by more than one extension service

Table 8: Characteristics of Sample Farmers

PERCENT OF ALL SAMPLE FARMERS	
SEX OF HOUSEHOLD HEAD (a)	
Male	92.8
Female	4.3
EDUCATION (b)	
Primary School	5.1
Functional Course	2.4
Religious School	11.6
Secondary School	0.3
Post-Secondary Education	0.1
Not Literate	67.2
FARM SIZE	
Small	30.8
Medium	42.7
Large	26.5

- (a) The responses of 2.9 percent of the sample farmers were unclear.
 (b) 13.3 percent of the sample farmers did not report their education level.

ANNEX 5: EXTENSION PARTICIPATION

Using the results of the sample surveys, this annex focuses on farmers' participation in the different activities associated with the CRPA extension. As noted in Annex 1, these activities include the ATG and ASVE sessions, as well as the JD, the VC, visits by farmers to the PAPEM, and on-farm research undertaken by farmers (under extension supervision). In the following presentation, participation in these activities as reported by sample farmers, and their evaluation of extension messages, is related to the characteristics of the farmers along the lines of the discussion in the previous annex. The presentation also examines the role of the radio programs that the extension service uses to complement the aforementioned activities.

ATG Participation

The questions posed to farmers focused on the previous twelve-month period. In this vein, the discussion considers three facets of farmers' participation in the ATG sessions. These relate to (i) whether they had participated in ATG sessions during the previous twelve months; (ii) the total number of sessions they had participated in during that period; and (iii) the most frequent meeting place for these sessions.

Twenty-nine percent of all sample farmers reported participating in ATG sessions during the course of the previous year (Table 9). This was about 40 percent more than the proportion reporting membership of T&V contact groups. Consistent with this, a little over 14 percent of the sample farmers who did not belong to T&V contact groups indicated that they had attended ATG sessions. Of the farmers belonging to these contact groups, nearly all (87 percent) reported attending ATG sessions.

Following from a higher level of literacy among the farmers belonging to T&V contact groups, a higher proportion of the sample farmers who were literate (46 percent) than those who were not (27 percent) reported participating in ATG sessions. In terms of farm size, the proportions participating were 47 percent for the large farmers in the sample, 31 percent for the medium-sized farmers, and 20 percent for the small farmers. Thus, larger farmers appear to benefit more from the ATG sessions, suggesting that, in the future, there should perhaps be more explicit targeting of small and medium-sized farmers for participation in these sessions.

ATG Attendance

A FEW is reportedly expected to schedule eighteen to twenty ATG sessions for each of his/her contact groups during the course of a calendar year. A large number of these sessions are, however, held during the dry months when there is little cultivation of crops. It is possible that many farmers abstain from attending the sessions in the dry months as they may not be of immediate relevance to them. Indeed, under the general principles of T&V, FEWs in their "fortnightly" meetings with farmers are expected to impart messages focusing on the operations that farmers would be undertaking in the coming few weeks. Nevertheless, there is the counter-argument that farmers are likely to have more time to attend the sessions held during the dry period as they would then not be preoccupied with their agricultural operations. In any event, taking the sessions expected to be

held during the rainy season (of about three-month duration) as the lower limit on the number of ATG sessions that a farmer may attend in a year, the yardstick for judging the adequacy of the number actually attended by a farmer becomes six.

Only about 8 percent of the sample farmers reported attending six or more ATG sessions during the previous year.^{30/} This is just a little over one-fourth of all sample farmers who indicated being ATG participants. While the proportion of ATG participants reporting attending six or more sessions was higher for T&V contact group members (34 percent) than for non-members (16 percent), it was low in actual terms in their case also. This proportion comes out to be about equal (25-27 percent) for sample farmers organized according to whether they were literate or not.

As for farmers organized by farm size, it is noteworthy that the proportion of the ATG participants reporting attendance at six or more sessions was higher for small (25 percent) and medium-sized farmers (28 percent), relative to large farmers (17 percent). This suggests that small and medium-sized farmers may place a higher value on the information they acquire through the ATG, plausibly because it compensates for their more limited access to inputs and other factors of production. Thus, it reinforces the earlier suggestion that there should be more targeting of small and medium-sized farmers for ATG participation.

Meeting Site

As would be expected, the highest proportion of sample farmers who had attended ATG sessions during the previous year (56 percent) reported the most frequent site of their sessions to be the champ école. This included 76 percent of the farmers who were T&V contact group members. The proportion of farmers not belonging to these groups who reported the champ école to be the most frequent site of the ATG sessions they had attended was lower and amounted to 50 percent. Thus, other meeting sites were equally important for farmers who were not T&V contact group members. The next most frequent ATG meeting site for sample farmers after the champ école was a public hall, followed by individual farmers' fields and homes, generally in that order.

In terms of the distribution of the ATG participants by whether they were literate or not, the proportion citing the champ école as the most frequent ATG meeting site was roughly the same (around two-thirds) in both cases. For the distribution by farm size, this proportion was highest for large farmers (74 percent), followed by medium-sized (65 percent) and small farmers (63 percent). This again suggests that large farmers benefit relatively more from extension contact through the ATG.

^{30/} According to extension personnel in Burkina Faso, several reasons may explain the low attendance at the ATG sessions. First, the contact groups tend to be relatively heterogenous with significant differences in the resource and technology levels of farmers. Thus, not all group members may find it useful to attend all sessions. Another reason could relate to the large size of the groups (with each consisting of 25 - 50 farmers) which limits the amount of attention that a FEW can pay to individual farmers. A third reason may be that the messages disseminated sometimes have little relation to farmers' real concerns.

ASVE Sessions

In that an ASVE session entails a meeting between a FEW and a portion of the farmers attending an ATG meeting to follow-up on the ATG activities, a farmer is expected to attend a smaller number of ASVE sessions than ATG meetings. In this vein, 33 percent of the sample farmers who had participated in ATG meetings during the previous year (i.e. 9.6 percent out of 29.2 percent) reported attending ASVE sessions. This proportion was higher for farmers who did not belong to T&V contact groups (42 percent) than for those who did (27 percent).

A somewhat higher proportion of the ATG participants who were literate (37 percent), than not literate (32 percent), reported attending ASVE sessions. On the other hand, the proportions of ATG participants who had attended ASVE sessions were roughly the same when considered according to farm size; these proportions amounted to 34 percent for small farmers, 33 percent for large farmers and 31 percent for medium-sized farmers. That a relatively small proportion of the farmers who had participated in the ATG reported attending ASVE sessions is to some extent a reflection of the size of the T&V contact groups. Insofar as a T&V contact group comprises as many as 25 - 50 farmers, and a FEW is expected to schedule ASVE sessions with 15 - 20 percent of these farmers every fortnight on a rotational basis, it restricts the frequency with which these farmers participate in ASVE sessions.

JD and VC Attendance

The numbers of JD and VC held in a year are generally small.^{31/} Roughly equal proportions of sample farmers (7 percent) reported attending the JD and VC during the previous year. In both cases, the proportions of farmers reporting attendance were higher for the T&V contact group members (16-17 percent) than for other farmers (4-5 percent). Similarly, they were higher in both cases for farmers who were literate (10-14 percent) than for those who were not (6 percent). In terms of farm size, the medium-sized farmers in the sample reporting attending the JD amounted to 8 percent, the large farmers to 7 percent, and the small farmers to 4 percent. On the other hand, less than 2 percent of the large farmers, compared to 7 percent of the medium-sized farmers and 5 percent of the small farmers, attended the VC. There are two possible explanations for this: one could be that the successful farmers whose fields are visited generally happen to be large farmers. The second explanation could be that large farmers, being more privileged, are unwilling to visit other farmers' fields for demonstrations.

PAPEM Visits

It is more important for FEWs than for farmers to visit a PAPEM. Thus, less than 1 percent of the sample farmers reported making visits to a PAPEM in the past year. These included 2.5 percent of the T&V contact group members, and a negligible number of other farmers. Of the literate farmers in the sample, the proportion reporting PAPEM visits amounted to about 2 percent, while in the case of the non-literate farmers, it was 0.5 percent. The sample farmers visiting a

^{31/} As noted in Annex 1, the JD consists of farmers from across a zone, and extension staff and research scientists, coming together to watch "demonstrations" given by successful farmers. In contrast, a VC constitutes a visit by a small group of farmers to the fields of another farmer (generally in the same village) who has successfully adopted the extension messages.

PAPeM included 2 percent of the large farmers, 1 percent of the medium-sized farmers, but no small farmers. Insofar as visits by farmers to the PAPeM can reinforce the training provided to them by FEWs at the ATG and ASVE sessions, more farmers need to be encouraged to make such visits.

On-Farm Research

An appreciable 8 percent of the sample farmers indicated that they were involved in on-farm research. This 8 percent included 20 percent of the sample farmers who were T&V contact group members, and 5 percent of the remaining farmers. Further, as in the case of the other extension activities, sample farmers undertaking on-farm research included a higher proportion of those who were literate (15 percent) than those who were not (7 percent). The proportion of large farmers in the sample involved in on-farm research (under 4 percent) was lower than that of either small (7 percent) or medium-sized farmers (8 percent).

Ratings of Extension Recommendations

Forty-six percent of all sample farmers who had knowledge of extension messages rated them to be "highly applicable," while another 53 percent rated them to be "applicable."^{32/} Thus, virtually all farmers with knowledge of extension messages (99 percent) considered them to be applicable. Of the sample farmers who were T&V contact group members or literate, more rated the messages to be "highly applicable" than "applicable." In contrast, more of the farmers who were not T&V contact group members or literate gave an "applicable" rating. This suggests that farmers who have greater direct contact with extension through higher participation in the ATG (i.e. the T&V contact group members and literate farmers) find extension messages to be more useful, plausibly because they acquire a better grasp of the content of the messages and their correct application methods. It may be that these farmers find the extension messages more useful also because they possibly have easier access to inputs (and credit) and can, therefore, apply the messages properly. This is supported by the fact that the majority of the large farmers (76 percent) with knowledge of extension messages rated them to be "highly applicable;" these farmers are likely to have the easiest access to inputs. On the other hand, of the small farmers with knowledge of extension messages, only 35 percent gave a "highly applicable" rating. The medium-sized farmers were about equally divided between those rating the messages to be "highly applicable" and "applicable."

Radio Programs

Radio programs appear to be an effective complement to the other methods used by the extension service to relay messages, as nearly all farmers who reported listening to them (97 percent) considered them to be useful (Table 10). The proportion of sample farmers owning radios (37 percent) was less than that reporting listening to these programs (44 percent), suggesting that farmers get together in groups to listen to the extension programs. Indeed, the difference between the proportion owning radios (53 percent), and that listening to these programs (76 percent), was larger in the case of the T&V contact group members than the other farmers. Of the other farmers in the sample, 36 percent reported listening to the extension programs, while 33 percent owned radios.

^{32/} "Applicability" (used interchangeably in this study with usefulness and effectiveness) is defined as "having a positive impact on production." This was explained by the enumerators to the sample farmers.

Increasing the length of the programs in question was considered a means of improving their effectiveness by the highest proportion of all listeners (47 percent). This included 55 percent of the listeners belonging to T&V contact groups, and 45 percent of those not belonging to these groups. Nevertheless, of the listeners belonging to T&V contact groups, the highest proportion (as much as 97 percent) recommended a change in the time of the programs in order to improve their effectiveness. Thus, these farmers want broadcasts in the evening when they will not interfere with their agricultural activities. Thirty-one percent of all listeners suggested a need to improve the content of the programs, and 21 percent a change in the days on which the broadcasts are made.

Table 9: Extension Participation, by Farmer Characteristics (as percent of all sample farmers belonging to the indicated category except where stated otherwise)

	ALL FARMERS	T&V CONTACT GROUP MEMBERS		LITERATE		FARM SIZE		
		YES	NO	NO	YES	SMALL	MEDIUM	LARGE
ATG Participation	29.2	86.8	14.4	26.8	46.2	20.4	30.0	47.3
ATG Attendance:								
1-5 Meetings	19.7	55.5	10.5	18.0	32.1	13.9	20.7	36.4
More than 5 Meetings	7.8	29.4	2.3	7.2	12.1	5.2	8.8	8.2
Most Frequent ATG Meeting Site: (a)								
Champ Ecole	55.5	76.3	50.2	63.8	66.1	62.7	64.5	73.7
Individual Farmer's Field	9.3	3.4	10.8	6.9	6.6	8.5	7.2	1.8
House	7.5	3.9	8.5	6.6	3.7	6.8	6.8	1.8
Meeting Hall	16.6	6.7	19.1	11.8	15.3	9.6	11.8	17.5
Other Sites	11.1	9.7	11.4	10.9	8.3	12.4	9.7	5.2
ASVE Attendance:								
1-5 Meetings	7.9	19.0	5.1	7.1	13.4	5.9	7.7	15.5
More than 5 Meetings	1.7	4.7	0.9	1.4	3.6	1.0	2.0	0.0
Attendance at JD	7.2	15.8	5.0	6.3	13.7	4.4	7.9	7.3
Attendance at VC	6.6	16.8	4.0	6.1	10.0	5.1	6.9	1.8
Visits to PAPEM	0.7	2.5	0.2	0.5	1.8	0.0	1.0	1.8
On-Farm Research	8.0	19.6	5.0	6.9	15.3	7.3	8.1	3.6
Rating of Extension Recommendation: (b)								
Highly Applicable	45.7	57.3	42.7	46.6	55.7	35.0	50.6	76.2
Applicable	52.7	41.7	55.5	51.7	43.7	62.6	48.2	22.2
Not Applicable	1.6	1.0	1.8	1.7	0.6	2.4	1.2	1.6

(a) As percent of all ATG Participants.

(b) As percent of all respondents.

Table 10: Radio Extension

	(as percent of farmers in the indicated category)	
	TOTAL SAMPLE	T&V CONTACT GROUP MEMBERS
Proportion Owning Radios	37.1	53.2
Proportion Listening to Extension Programs	44.1	76.0
Proportion of Listeners Rating Programs as Useful	97.0	95.0
Proportion of Listeners Suggesting Following for Improving Programs		
(i) Increasing Length	47.1	55.4
(ii) Improving Content	31.3	40.1
(iii) Changing Day	21.2	26.8
(iv) Changing Time	22.2	96.8

ANNEX 6: AWARENESS, TESTING AND ADOPTION

Following from the discussion of farmer participation in extension activities, this annex considers farmers' awareness, testing and adoption of extension messages. The focus is on twelve important practices for which the CRPA extension services formulate messages. These twelve practices relate to soil preparation, seed treatment, improved cultivars, seed drilling, organic fertilizer, chemical fertilizer, pesticides, animal draft, motorized draft, crop rotation, anti-erosion methods, and agro-forestry. As in the case of participation in the last annex, the awareness, testing and adoption of these practices is considered with reference to the characteristics of the sample farmers discussed in Annex 4.

Awareness

For each of the twelve practices, sample farmers were asked whether they were aware of the extension messages. As would be expected, for every practice, the proportion professing awareness of the messages was higher in the case of the T&V contact group members than the other farmers (Table 11). Almost all farmers belonging to T&V contact groups (92-98 percent) indicated that they were aware of the messages for soil preparation, seed treatment, seed drilling, organic fertilizer, chemical fertilizer, animal draft and anti-erosion methods. Around 80 percent or more of these farmers reported being aware of the messages for the remaining five practices (improved cultivars, pesticides, motorized draft, crop rotation and agro-forestry).

While lower than in the case of the T&V contact group members, the proportions expressing awareness of extension messages were relatively high also in the case of the sample farmers not belonging to T&V contact groups. As many as 93-94 percent of these farmers appeared to be aware of the messages for organic fertilizer and animal draft. Between 80 and 90 percent were aware of those for soil preparation, seed treatment, seed drilling, chemical fertilizer and anti-erosion methods. The proportions aware of the messages for the remaining practices were somewhat lower and amounted to 70 percent for crop rotation, 62 percent for pesticides and motorized draft, 54 percent for agro-forestry, and 53 percent for improved cultivars.

It is noteworthy that improved cultivars were the practice for which the lowest proportion of farmers, in the case of both those belonging and not belonging to T&V contact groups, professed awareness of messages. As will be indicated subsequently, the proportion of sample farmers reporting the adoption of improved cultivars (21 percent) was also low. There appear to be several reasons for this. One of these derives from the dearth of improved crop varieties suited to drier environments with a short growing season, such as found in Burkina Faso. Another reason could derive from farmers' response to a consumer preference for traditional varieties of food crops. A third reason may derive from inadequacies in Burkina Faso in the system for marketing seed.

Testing

For all practices, the proportions of farmers reporting that they had "tested" extension messages were lower than those reporting being aware of (or adopting) messages.^{33/} As in the case of awareness, for every practice, the proportion reporting testing was higher for the farmers belonging to T&V contact groups than for those not belonging to these groups. The highest proportions of T&V contact group members reported testing the messages for seed treatment (43 percent) and seed drilling (39 percent); about a third had tested the messages for soil preparation, chemical fertilizer and animal draft.

Seed treatment was also the practice tested by the highest proportion of farmers not belonging to T&V contact groups (28 percent). For none of the other practices did the proportion of these farmers reporting testing exceed 20 percent. The practices tested by the lowest proportions of farmers, in the case of both those belonging and not belonging to T&V contact groups, were motorized draft, agro-forestry and pesticide application, all of which entail significant cash outlays. These are also the practices with the lowest adoption rates as discussed subsequently.

Adoption

While the twelve practices considered were chosen because they had wide applicability, their relative importance tends to vary among agro-climatic zones. Thus, this discussion is organized into two parts. The first part focuses on the overall adoption patterns for the twelve practices, and relates them to the characteristics of the sample farmers. The second part considers the adoption of practices by agro-climatic zone and CRPA.

Overall Adoption Patterns

The proportions of farmers reporting the adoption of extension messages for different practices were generally modest. The practice adopted by the highest proportion of farmers (67 percent) was organic fertilizer, suggesting a response to the widespread environmental and soil fertility problems in Burkina Faso. Almost the same proportion had adopted the messages for seed treatment, with the next highest proportion (60 percent) adopting those for soil preparation. Fifty percent of the farmers had adopted the messages for crop rotation, 49 percent for seed drilling, 36 percent for anti-erosion methods, 34 percent for animal draft, and 32 percent for chemical fertilizer. Only 21 percent of the farmers indicated using improved cultivars or pesticides, 14 percent the messages for agro-forestry, and 1 percent those for motorized draft.

For each of the twelve practices, farmers who had adopted the extension messages were asked when they had first done so. Farmers' responses, as summarized in Table 12, suggest that a major portion of the adoption of the messages for each of these practices occurred before the introduction of T&V in individual CRPAs. The point to note, however, is the relatively high proportion of the total adoption for each practice which occurred in the short period of one to four years after the introduction of T&V.^{34/} Except for crop rotation (15 percent), organic fertilizer (16 percent) and

^{33/} "Testing" denotes the practice by farmers of using an extension recommendation on a small area (prior to adopting it more widely) in order to ascertain its impact.

^{34/} As indicated in Annex 2, T&V was phased-in across CRPAs between 1986 and 1989. The surveys for this study were undertaken in 1990/91.

soil preparation (21 percent), this proportion amounted to 25 percent or more for each of the remaining practices. This suggests a rapid acceleration in adoption after the introduction of T&V. The proportion of the total adoption first occurring after the introduction of T&V was particularly high for improved cultivars (42 percent), and agro-forestry and pesticides (34 percent) — i.e., for practices with especially low overall adoption rates — and animal draft (32 percent).

For five of the twelve practices (seed treatment, improved cultivars, chemical fertilizers, and animal and motorized draft), the proportion first adopting after the introduction of T&V was higher for farmers not belonging to T&V contact groups than for those belonging. Despite this, total adoption (i.e. for periods both preceding and following the introduction of T&V) was higher for the T&V contact group members in the case of every practice. This suggests that the farmers belonging to T&V contact groups are likely to have had greater contact with extension before the introduction of T&V also. In that for five practices the proportion first adopting after the introduction of T&V was higher for farmers not belonging to T&V contact groups confirms the active participation of these farmers in the ATG and ASVE sessions.

In terms of the classification of sample farmers by whether they were literate or not, total adoption in the case of all practices was higher for the literate farmers. On the other hand, for seven of the twelve practices, the proportion first adopting after the introduction of T&V was higher for the non-literate farmers, even though they had participated in the T&V extension activities (as discussed in Annex 5) to a lesser extent. This tends to suggest that as a result of the training provided to them, FEWs' communication skills have improved under T&V and they are able to achieve a better rapport with uneducated farmers than before.

Where the classification by farm size is concerned, the proportion adopting overall was highest for large farmers in the case of all practices except agro-forestry for which it was higher for the medium-sized farmers. Similarly, a higher proportion of medium-sized farmers than small farmers had adopted all practices other than organic fertilizer and motorized draft. Nevertheless, for half of the practices (seed treatment, improved cultivars, seed drilling, chemical fertilizer, pesticides and animal draft), the largest increase in adoption following the introduction of T&V occurred among small farmers. This increase was highest among large farmers for two practices (organic fertilizer and crop rotation), and among medium-sized farmers for another two (soil preparation and agro-forestry). Thus, what emerges is that small farmers have benefited the most in terms of the adoption of practices since the introduction of T&V, whereas earlier larger farmers had benefited more. This does not contradict the result reported in Annex 5 which showed that the majority of the small farmers gave an "applicable" rating to the extension messages, while the majority of the large farmers gave a "highly applicable" rating (see Annex 5, the section titled "Ratings of Extension Recommendations.") What it suggests is that extension should do more follow-up work with small farmers in order to identify and alleviate constraints which may prevent them from obtaining the full impact of the adopted practices.

Adoption by Agro-Climatic Zone

The *Sahelian zone* is the driest, and environmentally the riskiest region of Burkina Faso. Consistent with this, the three CRPAs of Sahel, Centre-Nord and Nord located within it had the highest adoption rates for organic fertilizer (Table 13). Ninety-seven percent of the sample farmers in Nord, 86 percent in Centre-Nord, and 81 percent in Sahel, reported using organic fertilizer. With 52 percent of the sample farmers there indicating the adoption of these methods, Nord (along with Comoe) had the highest adoption rate among all CRPAs for anti-erosion methods. The use of organic fertilizer in this zone is facilitated by its relatively high livestock population.

In the *Western zone*, grain and cotton production are important as noted in Annex 2. Thus, the Mouhoun and Nord CRPAs ^{35/}, which have areas in this zone, had high proportions of sample farmers reporting the adoption of the extension messages for soil preparation (80 and 64 percent, respectively) and seed treatment (67 and 83 percent, respectively); Nord had the highest proportion of farmers among all CRPAs reporting the use of seed treatment. Mouhoun had the highest proportions of farmers of any CRPA applying the messages relating to crop rotation (89 percent) and, with Centre-Sud, animal draft (61 percent). It also had the highest proportion of sample farmers using improved cultivars (51 percent), after Hauts-Bassins. Relatively high proportions of farmers in both Mouhoun (50 percent) and Nord (62 percent) reported the use of chemical fertilizers.

In line with its high population densities and severely degraded soils, relatively high proportions of farmers in the CRPAs in the *Central Plateau*, Centre-Sud (79 percent), Centre (78 percent), and Centre-Nord (86 percent), acknowledged the use of organic fertilizer. Centre had the highest proportion of sample farmers among all CRPAs (28 percent) practicing agro-forestry.

The *South-West* had high adoption rates for almost all practices, which is propitious since it is ecologically the most conducive of the five zones for agricultural production. The Comoe CRPA had the highest proportions of farmers among all CRPAs reporting the adoption of the extension messages for soil preparation (99 percent), and anti-erosion methods (52 percent). Similarly, Hauts-Bassins had the highest proportions of farmers using improved cultivars (62 percent), chemical fertilizers (80 percent) and pesticides (62 percent). It also had among the highest proportions of farmers indicating the adoption of the extension messages for soil preparation (80 percent), seed treatment (74 percent), crop rotation (74 percent), seed drilling (72 percent), animal draft (42 percent) and agro-forestry (27 percent). In the Sud-Ouest CRPA, 91 percent of the sample farmers reported the use of the messages for soil preparation, and 70 percent those for crop rotation.

Finally, in the *Eastern zone*, the maintenance of soil fertility is a major problem, as discussed in Annex 2. Thus, high proportions of sample farmers in both Centre-Est (85 percent) and Est (69 percent) reported applying organic fertilizer. Forty-four percent of the farmers in Est, and 38 percent in Centre-Est, also reported the use of anti-erosion methods. The proportion of farmers in Centre-Est using animal draft (52 percent) was relatively high.

^{35/} Some CRPAs cover more than one zone.

Table 11: Awareness and Testing of Practices, by Extension Status

PRACTICE	AWARENESS		TESTING	
	T&V Contact Group Members	Not Members	T&V Contact Group Members	Not Members
Soil Preparation	96	86	34	18
Seed Treatment	97	89	43	28
Improved Cultivars	78	53	24	8
Seed Drilling	98	89	39	16
Organic Fertilizer	98	93	28	18
Chemical Fertilizer	92	86	36	16
Pesticide Application	83	62	20	5
Animal Draft	98	94	33	14
Motorized Draft	82	62	3	1
Crop Rotation	86	70	27	15
Anti-Erosion Methods	94	82	24	13
Agro-Forestry	79	54	13	7

Table 12: Proportion of Farmers Adopting Practices, and Proportions Adopting Before and After the Introduction of T&V

	ALL FARMERS	T&V CONTACT GROUP MEMBERS		LITERATE		FARM SIZE		
		YES	NO	NO	YES	SMALL	MEDIUM	LARGE
Soil Preparation								
Adopting	60.3	70.8	55.0	59.2	68.8	54.6	61.3	77.3
Adopting before T&V	79.1	75.7	80.4	80.3	71.9	81.0	77.2	81.5
Adopting after T&V	20.9	24.3	19.6	19.7	28.2	19.0	22.8	18.5
Seed Treatment								
Adopting	66.9	82.8	56.2	65.1	79.4	59.3	68.6	85.5
Adopting before T&V	75.1	76.6	71.6	74.9	76.0	69.8	77.6	71.3
Adopting after T&V	24.9	23.4	28.4	25.1	24.0	30.2	22.4	28.7
Improved Cultivars								
Adopting	21.3	38.3	12.8	18.9	37.9	14.7	23.0	40.0
Adopting before T&V	57.9	60.5	52.8	57.8	58.3	43.5	62.3	65.9
Adopting after T&V	42.1	39.5	47.2	42.2	41.7	56.5	37.7	34.1
Seed Drilling								
Adopting	49.0	66.9	37.9	46.9	63.6	35.8	51.0	75.0
Adopting before T&V	73.4	72.6	74.1	73.2	74.4	71.6	73.6	72.2
Adopting after T&V	26.6	27.4	25.9	26.8	25.6	28.4	26.4	27.8
Organic Fertilizer								
Adopting	67.2	69.3	63.2	66.8	70.0	69.0	65.4	71.6
Adopting before T&V	84.5	83.3	84.5	84.7	82.7	85.7	85.0	73.3
Adopting after T&V	15.5	16.8	15.5	15.3	17.3	14.3	15.0	26.7
Chemical Fertilizer								
Adopting	31.9	53.1	20.7	29.2	50.8	21.4	35.3	52.3
Adopting before T&V	72.0	71.6	70.3	70.0	77.5	68.8	74.5	77.8
Adopting after T&V	28.0	28.4	29.7	29.3	22.5	31.2	25.5	22.2
Pesticide Application								
Adopting	20.5	38.0	10.8	18.3	35.8	11.2	21.9	46.4
Adopting before T&V	65.8	63.5	64.8	63.3	74.6	48.4	68.0	74.0
Adopting after T&V	34.2	36.5	35.2	36.7	25.4	51.6	32.0	26.0
Animal Draft								
Adopting	34.4	52.5	23.1	32.2	49.9	25.5	37.0	60.0
Adopting before T&V	67.9	68.7	61.2	67.3	70.8	63.6	67.2	78.3
Adopting after T&V	32.1	31.3	38.8	32.7	29.2	36.4	32.8	21.7

Table 12 (continued)

	ALL FARMERS	T&V CONTACT GROUP MEMBERS		LITERATE		FARM SIZE		
		YES	NO	NO	YES	SMALL	MEDIUM	LARGE
Motorized Draft								
Adopting	1.3	1.3	0.6	1.1	2.8	2.1	0.7	2.8
Adopting before T&V	50.0	44.4	30.0	51.7	44.4	33.3	33.3	100.0
Adopting after T&V	50.0	55.6	70.0	48.3	55.6	66.7	66.7	0.0
Crop Rotation								
Adopting	49.7	57.2	43.9	48.5	58.0	41.7	52.5	60.2
Adopting before T&V	84.4	81.2	85.6	85.6	79.8	82.9	87.0	73.7
Adopting after T&V	15.2	18.8	14.4	14.4	20.2	17.1	13.0	26.3
Anti-Erosion Methods								
Adopting	35.7	43.1	28.6	34.4	44.5	31.9	38.5	31.5
Adopting before T&V	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Adopting after T&V	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Agro-Forestry								
Adopting	14.0	18.7	9.1	12.9	21.1	11.4	14.3	12.7
Adopting before T&V	59.9	57.2	62.4	59.3	62.3	62.1	55.0	58.3
Adopting after T&V	40.1	42.8	37.7	40.7	37.7	37.9	45.0	41.7

Table 13: Practice Adoption, by CRPA (as Percent of Sample Farmers belonging to the indicated CRPA)

	SAHEL	CENTRE-NORD	NORD	MOUHOUN	CENTRE-SUD	CENTRE	COMOE	CENTRE-OUEST	HAUTS-BASSINS	SUD-OUEST	CENTRE-EST	EST
Soil Preparation	37.7	30.6	63.9	79.6	67.5	54.1	99.1	32.1	79.8	91.4	74.6	46.0
Seed Treatment	66.8	81.0	82.8	66.8	61.1	68.5	45.4	63.4	74.4	67.3	48.1	65.2
Improved Cultivars	20.9	10.5	10.9	50.8	10.2	9.8	11.3	2.6	61.7	27.8	11.2	11.8
Seed Drilling	81.1	22.0	36.1	65.5	62.9	57.6	63.4	34.2	72.0	39.8	30.5	15.2
Organic Fertilizer	81.1	86.3	96.6	57.2	78.9	78.1	49.1	42.8	37.4	68.3	84.6	69.3
Chemical Fertilizer	7.3	13.6	62.4	50.3	13.8	27.5	50.7	16.0	80.0	33.3	4.8	7.8
Pesticide Application	28.5	9.5	5.6	42.4	5.9	14.4	22.0	13.0	62.4	1.9	3.7	5.9
Animal Draft	5.0	14.2	43.2	60.7	60.7	46.0	4.7	21.9	53.9	9.9	51.9	26.1
Motorized Draft	0.0	0.0	0.4	0.3	1.1	4.8	1.9	0.0	2.9	0.0	3.7	0.0
Crop Rotation	12.6	57.1	30.6	89.0	57.7	55.3	37.0	43.5	74.1	70.2	21.8	28.9
Anti-Erosion Methods	20.4	35.8	52.0	33.5	26.7	42.4	52.3	13.4	41.7	36.0	38.1	43.8
Agro-forestry	6.3	6.5	19.2	4.8	18.3	27.7	23.3	2.4	27.4	10.6	0.5	15.8

ANNEX 7: FARMERS' CONSTRAINTS AND PROBLEMS

For each of the twelve practices considered in the previous annex, sample farmers who had not adopted the extension recommendations were asked to identify the primary reasons preventing them from doing so. Similarly, in the questionnaire administered to them, FEWs were asked what they perceived to be the main impediments to farmers' adoption of these practices. Further, in line with these questions, farmers were also asked to identify the areas in which they wanted more extension help in the future in order to overcome technical problems. This annex focuses on farmers' and extension workers' responses to these questions.

Farmers' Constraints

The reasons provided by farmers for not adopting the extension recommendations derived from five types of constraints: insufficient knowledge of the practices; labor shortages; not having the financial means; not having access to the required inputs; and the lack of extension services (Tables 14). Notably, for seven of the twelve practices, the largest proportion of the sample farmers who had not adopted explained their decision in terms of insufficient knowledge of the practices. For the remaining five practices, their major explanation was that they lacked the financial means.

Inasmuch as for seven of the twelve practices the explanation provided by a majority of the farmers for not adopting was that they had insufficient knowledge of the practices, there is cause for concern as this suggests weaknesses in the delivery of extension messages. These seven practices were crop rotation, improved cultivars, agro-forestry, pesticide application, anti-erosion methods, soil preparation and seed drilling. For the first four practices, around 50 percent of the farmers who had not adopted ascribed their decision to insufficient knowledge, while for the last three practices, between 30 and 40 percent did so.

The reason cited by the second-highest proportion of farmers for not adopting the extension recommendations for soil preparation, improved cultivars, pesticide application and agro-forestry was financial constraints. In the case of the recommendations for seed drilling and anti-erosion methods, however, this reason was labor shortages. Improved cultivars (e.g. hybrids), pesticides and agro-forestry all entail the use of purchased inputs, and the financial constraint identified by farmers is plausibly related to this. On the other hand, in the case of soil preparation, the financial constraint is likely to be associated with farmers' inability to hire labor in order to supplement family labor. In the same way, the labor shortages cited by farmers for seed drilling and anti-erosion methods are likely to derive from a financial constraint to the extent that it prevents farmers from hiring additional labor.

The five practices for which the largest number of farmers explained their decision to not adopt in terms of financial constraints were seed treatment, organic fertilizer, chemical fertilizer, and animal and motorized draft, all of which require investments in inputs. Insufficient knowledge of these practices was the second most serious constraint identified by farmers for not adopting them. For organic fertilizer, a high proportion of the non-adopting farmers (20 percent) also explained their reason in terms of labor shortages, which are again likely to derive from financial problems preventing them from hiring labor. It is noteworthy that only a small proportion of farmers blamed their inability to adopt recommendations on the unavailability of inputs. Similarly, in the case of no

practice did more than about 2 percent of all farmers who had not adopted cite the lack of extension assistance.

In contrast to farmers, only a small proportion of the FEWs interviewed for this study (8 percent) considered insufficient knowledge to be a constraint on the adoption of practices by farmers (Table 14). To the extent that the existence of this constraint reflects on the performance of the FEWs, this is not surprising. Financial constraints were considered to be the main impediment to adoption by the highest proportion of FEWs (26 percent), followed by the unavailability of inputs (22 percent). Seventeen percent of the FEWs considered labor shortages to be the main impediment, 11 percent marketing problems, and 10 percent problems relating to land tenure.

Areas Identified by Farmers for More Extension Help

The topics on which farmers wanted more extension help are presented in Table 15. These topics reflect farmers' concern with three types of problems. These problems relate to (i) animal health and nutrition, (ii) the adverse environment, and (iii) diversification into higher-value crops.

While the proportions of both T&V contact group members and other farmers desiring more extension help were high, those of the T&V contact group members were relatively higher. This might be explained by the tendency generally for more informed individuals to consider their needs against a larger perceived set of potential techniques than less informed individuals. Seventy-nine percent of the T&V contact group members (the highest for any topic) wanted more messages on animal health, 71 percent on animal feeding and 63 percent on crop residue management. This is consistent with the discussion in Annex 1 of the limited nature of livestock extension in Burkina Faso and the demand by farmers for messages on animal health and nutrition. In the case of the sample farmers who were not T&V contact group members, 69 percent wanted more messages on animal health, 61 percent on animal feeding and 57 percent on crop residue management.

A large number of farmers expressed a desire for more extension messages on soil and water conservation measures, which is not surprising in view of Burkina Faso's dry climate and the degradation suffered by its fragile environment as a result of growing population pressure. Seventy-five percent of the farmers who were T&V contact group members desired more messages on the use of organic fertilizer, 74 percent on methods to prevent soil erosion, and 72 percent on water management. In the case of non-members, 74 percent desired more messages on anti-erosion methods, 73 percent on the use of organic fertilizer and 66 percent on water management, making soil and water conservation the area with the largest demand for more messages among non-members. As for diversification into higher-value crops, 54 percent of the T&V contact group members wanted more messages on horticulture and 39 percent on rice production. For non-members, these proportions were 47 percent for horticulture and 33 percent for rice production.

Table 14: Reasons Identified by Farmers and FEWs for Non-Adoption of Practices (percent of non-adopting sample farmers and extension workers identifying the indicated reason as the primary reason for non-adoption)

FARMERS:	INSUFFICIENT KNOWLEDGE OF PRACTICE	LABOR SHORTAGES	FINANCIAL CONSTRAINTS	INPUT CONSTRAINTS	NO EXTENSION ASSISTANCE	MARKETING PROBLEMS	INSECURE LAND TENURE
Soil Preparation	37.9	21.2	25.0	3.9	1.0	-	-
Seed Treatment	34.0	2.7	35.1	8.0	1.7	-	-
Improved Cultivars	50.3	1.7	20.9	13.2	0.9	-	-
Seed Drilling	30.9	26.8	22.5	4.6	2.3	-	-
Organic Fertilizer	20.5	19.6	23.8	15.4	0.8	-	-
Chemical Fertilizer	23.2	2.7	59.6	4.3	0.9	-	-
Pesticide Application	48.0	2.3	27.1	7.4	1.0	-	-
Animal Draft	17.4	9.0	61.0	5.6	0.6	-	-
Motorized Draft	34.9	4.4	52.5	3.2	0.3	-	-
Crop Rotation	53.2	4.4	1.8	0.7	1.0	-	-
Anti-Erosion Methods	39.3	26.6	6.7	1.3	1.1	-	-
Agro-Forestry	48.6	10.3	14.8	5.3	1.0	-	-
Extension Workers (a)	8.0	17.0	26.0	22.0	-	11.0	10.0

(a) This row sums up to 94 percent. Of the remaining FEWs, 3 percent considered the messages to be irrelevant, while 3 percent considered "other reasons" to be responsible for farmers not adopting messages.

Table 15: Priority Areas Identified by Sample Farmers for More Extension Assistance (percent of all sample farmers in indicated category)

	EXTENSION STATUS	
	T&V CONTACT GROUP MEMBERS	NOT MEMBERS
Animal Health	78.9	69.4
Animal Feeding	71.3	61.1
Crop Residue Management	63.3	56.5
Organic Fertilizer	75.4	72.8
Anti-Erosion Methods	73.8	73.8
Water Management	71.6	65.9
Horticulture	53.5	46.5
Rice Production	39.2	33.2

ANNEX 8: SOURCES OF INFORMATION

Direct advice provided by extension workers, and radio programs, are the principal methods used by the CRPA extension services to reach farmers as discussed in Annex 6. But also, as mentioned earlier, a strong spread effect is envisaged under T&V with messages expected to diffuse further to other farmers from those contacted directly by extension workers. Thus, a significant number of sample farmers, especially those who are not members of T&V contact groups, are likely to ascribe their knowledge of improved practices to other farmers. In this vein, sample farmers were asked to specify their initial sources of information for the twelve practices covered in this study. Based on the responses, this annex examines the relative importance of extension workers, radio programs and other farmers as sources of farmers' information on improved techniques.

As would be expected, extension workers were the source of information for the large majority of the T&V contact group members professing awareness of the twelve practices. For all the twelve practices combined, 74 percent of these farmers attributed their awareness to extension workers (Table 16). Other farmers were the source of awareness for only 14 percent, and radio programs for 7 percent.

On the other hand, in the case of the sample farmers not belonging to T&V contact groups, the largest proportion (41 percent) attributed their awareness of the practices to other farmers, although extension workers accounted for the awareness of a proportion almost as high (36 percent). The latter confirms the participation of appreciable numbers of non-contact group members in the scheduled ATG and ASVE sessions as discussed in Annex 5. Radio programs (12 percent) and other sources including input suppliers and retailers (11 percent) also contributed more to the awareness of farmers not belonging to T&V contact groups than to that of those belonging to these groups.

Consistent with the importance of farmers as sources of information for other farmers, 70 percent of the T&V contact group members who were aware of the extension messages for the twelve practices reported discussing them with other farmers. Nevertheless, a significant proportion of farmers who were not T&V contact group members (23 percent) also reported discussing extension advice that they had received with other farmers. This suggests that the farmers serving as sources of awareness for other farmers are likely to include some who are not members of T&V contact groups, but have participated in extension activities. In addition, there is likely to be a multiplication effect with these other farmers further relaying messages to yet other farmers, and so on.

The sources of awareness for individual practices do not reveal any special patterns (Table 17). Where T&V contact group members were concerned, extension workers accounted for the awareness of the overwhelming majority in the case of all practices. Further, with the exception of one practice, other farmers were a more important source of awareness for them than radio programs, although neither source was very important. The exception was agro-forestry, where radio programs accounted for the awareness of a slightly higher proportion of these farmers.

By comparison, in the case of farmers who were not T&V contact group members, other farmers were the main source of awareness for most practices. The exceptions were pesticide application, improved cultivars, agro-forestry and chemical fertilizers for which extension workers came out to be the source for a higher proportion of farmers. There is no particular pattern

discernible in this except that these are all practices which require investments in inputs. Nevertheless, for all practices, the differences between the proportions of farmers attributing their awareness to other farmers and extension workers were small. Radio programs contributed the least to the awareness of the farmers who were not T&V contact group members in the case of all twelve practices.

Table 16: Farmer-Farmer Discussion of Extension Messages and Farmers' Sources of Awareness, by Extension Status

	T&V CONTACT GROUP MEMBERS	NOT MEMBERS
Initiated Discussion of Extension Messages with other Farmers	69.5	22.6
Source of First Awareness (a)		
Extension Workers	74.2	36.1
Other Farmers	13.6	41.0
Radio	7.0	11.4
Other Sources (b)	5.2	11.5

(a) The average for all practices (see Table 17 for sources of awareness for individual practices).

(b) Including input suppliers, retailers, etc.

Table 17: Sources of First Awareness, by Practice (as percent of all sample farmers in the indicated category)

	T&V CONTACT GROUP MEMBERS			NOT MEMBERS		
	Extension Workers	Others Farmers	Radio	Extension Workers	Other Farmers	Radio
Soil Preparation	66.2	17.5	7.8	29.6	45.0	10.3
Seed Treatment	78.7	11.1	6.8	36.9	43.6	11.7
Improved Cultivars	77.1	12.5	6.7	41.5	38.9	9.5
Seed Drilling	78.4	11.7	5.9	36.1	41.1	11.5
Organic Fertilizer	63.5	19.8	5.2	24.8	43.9	8.7
Chemical Fertilizer	81.9	8.7	7.0	40.9	39.4	12.8
Pesticide Application	80.7	8.7	7.7	45.3	36.5	10.8
Animal Draft	77.3	13.6	5.1	38.3	46.0	9.6
Motorized Draft	62.0	21.4	10.6	32.8	40.2	13.7
Crop Rotation	69.8	17.3	5.8	27.8	45.6	8.7
Anti-Erosion Methods	80.0	12.2	4.7	36.3	41.7	11.5
Agro-forestry	74.8	8.8	10.7	42.3	30.0	17.7

ANNEX 9: STATISTICAL ANALYSIS OF AWARENESS, TESTING AND ADOPTION OF RECOMMENDED PRACTICES (Technical Efficiency)

Objectives and Overview

Extension programs seek to induce changes in farmer behavior to make them more efficient, i.e. to obtain more production from their land, labor, and other resources. Efficiency at the farm-level entails the use of best *technological practices* in each enterprise (e.g. on each plot) and efficient *allocation* of resources among enterprises. Economic studies usually refer to these two types of efficiency as technical efficiency and allocative efficiency.

The most direct efforts by extension staff to influence farmer efficiency center on technical efficiency. Twelve technical efficiency fields (practices) targeted by the T&V extension program in Burkina Faso are examined in this study (see Annex 6). For each field, a set of technical recommendations have been made to farmers. One of the special features of T&V extension in Burkina Faso has been the fostering of systematic "testing" of technologies by farmers. The farmer survey (see Annex 6) asked farmers whether they were aware, had tested, and had adopted the specified technologies. The survey also asked when awareness, testing and adoption had taken place. Annex 6 summarized the data on farmer responses.

Participation in formal T&V contact groups has also been an important vehicle for the delivery of T&V extension services. As noted in Annex 4, approximately 21 percent of sample farmers reported being members of T&V contact groups. Approximately 31 percent of sample farmers reported being served by T&V (CRPA) extension because significant numbers of non-members attend scheduled T&V contact group meetings. In addition, 13 percent of farmers reported extension contact with other extension services. Some of the NGO services have highly specialized interests. Five percent of the sample had contact with both the T&V (CRPA) system and another system.

The statistical analysis reported in this annex analyzes the effect of the T&V extension program on aggregate village-level awareness, testing and adoption of recommended technologies (and on the rates of change in this awareness, testing and adoption). It also analyzes the effect of the T&V extension on the *probabilities* that individual farmers would have been aware of, or tested, or adopted these technologies. The determining variables include geo-climate characteristics, farmer characteristics, and extension system characteristics.

Farmer participation in T&V extension groups and in other extension groups is at least partially determined by farmers themselves. Accordingly, measures of participation cannot be considered to be "exogenous" variables causing changes in farmer awareness, testing and adoption. A procedure for predicting participation to correct for endogeneity must be carried out.

In addition, the statistical model should recognize the processes of inter-farmer learning and communication of information. Annex 8 showed that other farmers were important sources of information for farmers. This is taken into account through "logistic" specifications.

The statistical strategy utilized in this annex is the following:

- (a) An analysis is first undertaken of the determinants of T&V participation and other extension participation.
- (b) "Predicted" T&V participation and other variables (including FEWs: farm households ratios and years of T&V) are used in a village-level analysis of the rates of change in recent years in awareness, testing and adoption of technological practices.
- (c) Predicted participation and other variables are then used in an analysis of the probabilities of individual farmers being aware, testing and adopting.

Study Objectives

The objectives of the statistical analysis in this annex are to test the following hypotheses:

- (a) That extension programs in Burkina Faso have facilitated earlier awareness, testing and adoption of recommended practices and that they have facilitated more rapid rates of change in awareness, testing and adoption by farmers.
- (b) That the introduction of T&V management discipline has *enhanced* the role of extension services in facilitating awareness, testing and adoption of recommended technological practices. This enhancement may be realized partly through direct T&V participation and partly through other channels.

It should be noted that T&V management has been introduced very recently. Of the thirty provinces in Burkina Faso, ten introduced T&V management in 1986, thirteen in 1987, six in 1988 and the remainder in 1989 (see Annex 2). If there are "lagged" and accumulated effects, it may be difficult to identify T&V effects because of the contemporaneous nature of the program. In addition, the reader should bear in mind the inherent problems with basic data collection. This is particularly the case for farmer's perceptions of "awareness". (In this study the awareness variable suffers from an additional problem because the date of awareness is available only for farmers adopting a given technology.)

Study Methods

Four levels of analysis are undertaken. In the first, farmer probabilities of participation in T&V and other extension are predicted using a probit analysis. In the second, a village-level rate of change analysis of awareness, testing and adoption is undertaken. In the third, a probability analysis of individual farmers ever being aware of, and having tested and adopted technology practices is undertaken. In the fourth, the timing of awareness, testing and adoption is analyzed.

A "panel" data set for the years 1984 - 1991 was constructed for this analysis. Observations by farm and year were obtained from survey "recall" data. For some variables, farm data were aggregated to the village- or province-level.

The T&V (and other extension) participation decisions by farmers were modeled as being determined by geo-climate and farm characteristics (reflecting the economic value of information), farmer characteristics (reflecting skills), and extensions system services. Political processes in different CRPAs are also determinants. The dependent variables in this analysis are 0-1 variables

(one for participation and zero otherwise). Thus, the "probit" regression method is the appropriate statistical method.

For the village-level analysis, the dependent variable is constructed to reflect "logistic" effects that can be considered to be learning effects. Standard multiple regression methods can be utilized with the village-level logistic proportion in each year as the dependent variable. The unit of observation is thus the village in each year.

For the farm-level analysis of the probability that farmers have ever become aware, tested or adopted, the dependent variable is also a 0-1 variable taking on the value of 1 for awareness, testing and adoption of the practice. The appropriate statistical model is again a probit model. The unit of observation is the farm. This model does not have a time dimension.

For the farm-level analysis of the timing of awareness, testing and adoption, the dependent variable is again an indicator variable, taking on the value of 0 or 1 for not aware and aware, etc. The event to be analyzed is becoming aware, testing, or adopting in a particular period. Thus, the observations are for each farm for periods before awareness, testing and adoption, and for the first period of awareness, testing and adoption, but not for subsequent periods. This is because these events are in practical terms not reversible (one cannot become unaware after becoming aware. Testing is usually done once or twice, and in practice, farmers do not "unadopt"). The appropriate statistical model is once again a probit model. This model also incorporates lagged village-level logistic proportions for awareness, testing and adoption to achieve a learning effect similar to that specified in the village-level proportions analysis.

Study Variables

Table 18 reports the variables utilized in the analysis undertaken in this annex. The endogenous variables include the two participation variables TVFARM and OTHEXT. The "predicted" values of these variables are treated as exogenous variables in the awareness, testing and adoption analysis. Logistic variables are dependent variables in the rate of change analyses. Lagged logistic variables are independent variables in the farm-level probit specification.

Exogenous variables include geo-climate indexes where each sample village has been given a dominant climate classification, and farm variables indexing the characteristics of farms and farmers.

Extension system variables are considered to be determined by government decisions and thus exogenous to farm-level decisions. These include the T&V indicator variable and the FEWs: farm households variable.

The Participation Decision

A farmer's decision to participate in a T&V contact group or in other extension groups is affected by the supply of extension services. The farmer, however, has a *demand* for information or services that is governed by such factors as his/her education, occupational commitment to farming, and farm size. Larger farmers are expected to demand more information because they have larger benefits to obtain. Full-time farmers should likewise demand more information. More educated farmers will demand more information if they feel that their skills and information are complementary.

Table 19 reports probit regression estimates for T&V participation and for participation in other extension programs. For both specifications, the explanatory variables include the farm area, employees, age, education, and the full-time farming variable. The specification for T&V participation includes the CRPA extension variables.

Table 19 indicates that the probability of being a T&V participant is greater:

- (a) The larger the farm in terms of both area and number of workers.
- (b) The younger the farmer.
- (c) The more full-time the farmer.
- (d) The higher the FEWs: farm households ratio.

There is little or no effect of farmers' education or of young extension staff on participation. There are substantial differences between CRPA political units in membership reflecting public sector infrastructure and related factors.

Table 19 indicates that the probability of participation in other (non-T&V) extension groups is greater:

- (a) The larger the farm as measured by the number of employees.
- (b) The younger the farmer.
- (c) The less educated the farmer.

There are also significant differences between CRPAs in the probability of participation in other extension, which reflects variations in the provision of other extension services.

Determinants of the Rate of Change in Practice Awareness and Adoption (Village-Level Analysis)

The first of two awareness-adoption specifications reported here is an analysis of the determinants of awareness, testing and adoption over time at the village-level. Relying on a "logistic" specification, the analysis is based on the aggregate behavior of farms in a village. It utilizes the panel data constructed from the farmer-reported timing of awareness, testing and adoption (see Annex 6). Individual farm data are aggregated to village averages in this analysis. (Further specifications reported here utilize individual farm data.) It needs to be emphasized that the analysis of awareness applies only to farmers who had adopted a given practice. For, as noted in the paragraph under "Study Objectives" earlier in this chapter, the date of awareness was available only for farmers who had adopted. This is because in the questionnaire administered to them, farmers were first asked whether they had tested or adopted a practice and it is only if they had done that that they were asked to specify the year in which they had first become aware of the practice.

The model of the determinants of the rate of change in the proportion of farmers who are aware of or have adopted is specified as:

$$X_t = 1/(1 - e^{(a - bt)}) \quad (9.1)$$

where X_t is the proportion of farmers who have become aware (or adopted) in time period "t." This specification has a built-in "logistic" or S-curve learning process. As "t" increases, X_t follows an "S" shape indicating that X_t changes slower with t when t is low; it subsequently changes more rapidly because farmers find it easier to learn from prior adopters. Then as adoption nears completion, the rate of change slows down. The parameter b determines the rates of change.

This model can be subjected to a simple econometric test by first transforming it to logarithmic form:

$$\ln[X_t / (1-X_t)] = a + bt \quad (9.2)$$

A simple ordinary least squares (OLS) regression of the transformed variable defined at the village-level will provide an estimate of b, the rate parameter.

This basic model can be extended by interacting the time variable with four extension variables:

$$\ln[X_t / (1-X_t)] = a + b(t) + c \text{ T\&V}(t) + d(\text{T\&VFARMQ})(t) + e(\text{OTHEXTQ})(t) + \text{other variables} \quad (9.3)$$

The T&V variable (equal to one after T&V management and zero before) tests whether introduction of T&V management had an effect independently of T&V participation. The T&VFARMQ variable is *predicted* participation from stage I (Table 19). This variable tests whether the participation per se enhanced awareness and adoption. The OTHEXTQ variable tests for enhancement by other (non-T&V) extension services. In addition, measures of farm size and education were included in the specification.

Table 20 reports the OLS estimates of the parameters for the full specification (9.3) for awareness, testing and adoption for each of the twelve technological practices.

The full specification included the dominant geo-climate dummy variables identified for each village in the data set. These coefficients are not reported in Table 20. The table reports coefficients and "t" ratios for the YEAR (T&V), YEAR (T&VFARMQ), YEAR(OTHEXTQ), and the MTPARCELS and MEDUC variables, where the M indicates village means calculated from the sample.

It is clear from Table 20 that the awareness equation is generally poorly identified. This is at least partly due to problems of measurement. Not only is awareness a subjective concept for farmers, but in this sample, the date of awareness is available only for farmers who actually test and adopt the technology. Accordingly, the awareness results should probably be considered unreliable.

The same cannot be said for the testing and adoption where objective measures and relatively complete data were available. The results for testing and adoption conform to expectations. Consider first the testing estimates. The joint test on the coefficients of YEAR(T&V) and YEAR(TVFARMQ) indicate that there are significant positive T&V effects on testing for ten of the twelve practices. Positive effects with low statistical significance are obtained for the other two practices, pesticide application and anti-erosion practices. (The latter practice is relevant only for a few CRPAs and this may explain the relatively weak results for this practice.)

When the separate T&V and T&V participation terms are considered, they show significant participation effects in all cases except pesticide application. The simple T&V effect coefficient is also significant in all but two cases indicating a T&V effect that extends beyond participation.

The predicted "other extension" variable is positive and significant only for agro-forestry practices. It is actually negative in a number of specifications. This could be interpreted as due to an anti-testing bias, but it is more likely due to the very specialized nature of the other extension programs.

The results for adoption are similar to those for testing. In fact much adoption follows testing. The F tests indicate significant positive effects for nine practices and weaker positive effects for two practices. Only the motorized draft practice shows negative (but not significant) T&V effects.

As with testing, there appear to be T&V adoption effects that operate independently of T&V participation in most technology fields.

The coefficients for farm size (MTPARCELS) indicate a generally higher level of awareness, testing and adoption for villages with larger farms. The coefficients for MEDUC also indicate a higher level of awareness, testing and adoption for villages with high proportions of literacy.

Determinants of Awareness, Testing and Adoption: Farm-Level Analysis

A farm-level analysis of the probability of awareness, testing and adoption can be developed. There are two versions reported here. The first is a probit analysis of the probabilities of awareness, testing and adoption as on the 1990/91 date (when the survey was undertaken). The second is a probit analysis of the probability of adopting at a particular date.

The basic structure of the models for the probabilities of individual farmers adopting is similar to that specified in the village-level analysis. Dependent variables include the predicted participation for individual farms, farm size and literacy. A dummy variable for farms managed by women is also included. Geo-climate dummy variables are also included in these estimates.

Table 21 reports the estimated probit coefficients for the T&V participation, other extension, farm size, literacy and female farmer variables for the 1990/91 ever aware, tested or adopted specification. Since all provinces had T&V management by 1990/91, it is not possible to measure a T&V impact in addition to T&V participation effects in this analysis.

On the whole, the individual farm probits for ever having become aware, tested or adopted are consistent with the village-level estimates reported in Table 21. T&V participation increased the probability of awareness for improved cultivars, pesticide application, animal draft, motorized draft and crop rotation.

T&V participation had significant positive effects on the probabilities of testing for all practices except motorized draft which is usually not promoted as much as animal draft.

T&V participation effects are found for the adoption of all technologies (with weak effects for organic fertilizer and anti-erosion practices).

Participation in other extension programs had little effect on awareness (although this is an unreliable measure) and no effect on testing except for agro-forestry practices. Positive effects on adoption were obtained for chemical fertilizer use, pesticide application, motorized draft, crop rotation, anti-erosion methods and agro-forestry. These practices tend to be somewhat more specialized than other practices, and there is some evidence for an other-extension impact on adoption.

Farm size has a positive impact on awareness, testing and adoption for almost all practices.

Farmers' schooling has a persistent positive impact on awareness, testing and adoption for almost all practices.

Table 22 reports the probit estimates for the probability of awareness, testing and adoption for each period.^{36/} The dependent variable is 0 if the farmer has not been aware, tested or adopted in time t and one if he/she became aware, tested or adopted in that period. Subsequent observations after first awareness, testing and adoption are not included in the analysis. In order to build in logistic-type learning from neighbors, these probits include lagged village-level logistic variables. Thus, for the awareness probit, prior village-level awareness is included as an explanatory variable. Lagged village-level testing is included in the testing probit. Both lagged testing and adoption at the village-level are included in the adoption equation to see whether testing has an effect on adoption.

In general, the predicted T&V participation variable has the same effects as measured in the probits for ever having been aware, tested or adopted (Table 21). The awareness probits are somewhat erratic as noted earlier. The testing probits show significant T&V effects for all but the motorized draft technology (as in Table 21). Significant T&V participation effects on adoption are measured for all technologies excepts motorized draft and anti-erosion.^{37/} (For both of these technologies other extension programs facilitated adoption.)

The effects of participation in other extension programs are also generally consistent with those reported in Table 21.

The effects of farm size (TPARCELS) and education (EDUC) are also similar to those reported in Table 21.

All lagged logistic variables (except for the adoption of anti-erosion measures) have positive and significant coefficients indicating an accumulated learning effect. Lagged village-level testing has a positive impact on the adoption of all technologies except organic fertilizer, when lagged adoption variables are included in the equation. This can be considered evidence for a testing impact on technology use.

^{36/} Again, it needs to be emphasized that the analysis of awareness applies only to farmers who had tested or adopted a given practice (see the sections in this chapter titled "Study Methods" and "Determinants in the Rate of Change in Practice Awareness and Adoption (Village-Level Analysis)."

^{37/} The specification did not include a dummy variable to indicate whether T&V (or other extension) was present in the village at the time of first testing or adoption. Such a variable was included in the equations used to predict participation in T&V and other extension. The estimate for predicted participation is thus expected to capture the effect of extension that reaches beyond contact group membership.

Conclusion

The adoption of better farm practices by farmers is important for two reasons. First, adoption is a measure of technical efficiency - albeit an imperfect measure because adoption is only the first step in the "best use" of technology. Second, the stress on specific practices is an important teaching vehicle for extension service to farmers.

In this annex, two statistical models have been utilized to analyze extension and T&V effects on awareness, testing and adoption of twelve specific farm practices. The first model used data aggregated to the village-level and tested T&V participation effects on the proportion of farmers in a village, aware, testing or adopting. The second used farm-level observations and tested the effects of T&V participation and other variables on the probabilities that a farmer was aware or had tested or adopted.

Estimates from the two models were consistent. Both showed that there were T&V participation effects on the testing and adoption of almost all technological practices. (The awareness results were less reliable for reasons noted previously.) The impact of other extension services was less consistent, in part because many of these programs had very specific technological targets in contrast to T&V extension where all practices were stressed.

The findings that larger farms and more educated farmers also tested and adopted earlier and more completely are consistent with expectations. Finally, the finding that testing affects adoption provides further support to the conclusion that the T&V extension program has facilitated the testing and adoption of improved farm practices in Burkina Faso.

Table 18: Variables and Definitions

All variables defined for each farm and each year 1984-1991

Endogenous Variables

TVFARM: Dummy = 1 if farmer is a member of a T&V contact group
OTHEXT: Dummy = 1 if farmer received advice from other extension sources
Note: Predictions indexed by 0

--- AW: Dummy = 1 if farmer reports awareness of technology practices ---
--- TST: Dummy = 1 if farmer reports testing of technology practices ---
--- AD: Dummy = 1 if farmer reports adoption of technology practices ---
L --- AW: Logistic of accumulated awareness (village) level
L --- TST: Logistic of accumulated testing (village) level
L --- AD: Logistic of accumulated adoption (village) level

Note: The above three variables at the village level are exogenous when lagged one year in individual farm probit analysis.

Exogenous Variables

Geo-climate Variables

(SDG, S, SS, O, E, S1, SO) These are dummy variables for the dominant climate in each village (see Annex 2, Table 2)

Political Variables

CRP1 --- CRP11 These are dummy variables for the CRPAs

Farm Variables

TAREA: Total area in farm
TPARCELS: Number of plots per farm
AGE: Age of farmer
EDUC: Dummy = 1 if farmer is literate
FARM: Dummy = 1 if main occupation is farming
NEMPLOY: Number of employees per farm

Note: Village means indexed by M

FEMALE: Dummy = 1 if farm is managed by a female

Extension System Variables

YRST&V: Number of years with T&V management
T&V: Dummy = 1 if province has T&V management
PCTCOVEX: Province level reported ratio of farms covered by extension
L5STAFF: Proportion of extension staff with less than 5 years experience
STAFFARM: Ratio of FEWs to farm households in a zone
VACANCY: Dummy = 1 if village extension staff position is vacant

Table 19: Participation Probit Regression Estimates

<i>Independent Variables</i>	<i>TVFARM</i>		<i>OTHEXT</i>	
	<i>Coefficient</i>	<i>"t"</i>	<i>Coefficient</i>	<i>"t"</i>
Intercept	-1.0902	-11.44	-1.7847	-9.45
TAREA	.0495	12.74	-.0046	-.75
NEMPLOY	.0224	5.38	.0153	2.43
AGE	-.0046	-5.87	-.0081	-6.76
EDUC	-.0190	-.39	-.1628	-2.03
FARM	.1335	2.86	-.0047	-.06
STAFFARM	101.8404	3.67	-	-
PCTCOVEX	-	-	-.2271	-1.43
L5 STAFF	-115.2560	-1.38	-	-
YRST&V	.0064	.94	-	-
CRPA1	.5179	7.35	1.8237	12.04
CRPA2	.6563	9.36	.9643	6.41
CRPA3	.2465	3.21	.0622	.35
CRPA4	-.0785	-1.08	.2912	1.94
CRPA5	.5291	7.70	.4864	3.25
CRPA6	.3454	5.06	.9270	6.33
CRPA7	.6217	8.15	.4754	2.95
CRPA8	.0776	1.07	.6471	4.09
CRPA9	.3523	4.78	.4526	2.84
CRPA10	.1308	1.75	.0831	.50
CRPA11	1.0149	14.30	.1313	.84
-2 log likelihood		1487		1750

Table 20: Village-Level Awareness, Testing and Adoption Levels

Practice	YEAR		YEAR(T&V)		YEAR(T&VFARMO)		YEAR(OTHEXTQ)		MTPARCELS		MEDUC		R ²	F	Prob. F
	Coeff	t*	Coeff	t*	Coeff	t*	Coeff	t*	Coeff	t*	Coeff	t*			
Soil Preparation															
Aware	.222	15.5	-.0005	-.59	.0025	3.02	-.0044	-7.79	.0074	1.25	.5124	5.06	.1910	1.94	0.1643
Test	.039	3.92	.0041	7.03	.0054	9.47	-.0022	-5.46	.0070	1.72	.5151	7.30	.1442	90.77	0.0001
Adopt	.171	11.9	.0029	3.55	.0057	6.99	-.0024	-4.25	.0013	.23	.4511	4.46	.1922	36.99	0.0001
Seed Treatment															
Aware	.238	16.3	-.0027	-3.24	-.0025	-2.92	-.0014	-2.50	-.0100	-1.67	.0105	.10	.1925	12.69	0.0004
Test	.068	5.71	.0017	2.52	.0019	2.83	-.0012	-2.65	-.0077	-1.57	-.0250	-.30	.0716	9.54	0.0020
Adopt	.209	13.9	.0011	1.30	.0005	.53	.0010	1.75	-.0109	-1.77	.1309	1.23	.1638	1.12	0.2899
Improved Cultivars															
Aware	.297	21.7	-.0031	-3.86	.0033	4.25	-.0012	-2.29	.0080	1.42	.3154	3.26	.2607	.0401	0.8414
Test	.059	8.27	.0018	4.24	.0045	10.96	-.0006	-2.18	.0030	1.02	.1197	2.36	.1370	76.67	0.0001
Adopt	.131	12.6	.0017	2.83	.0067	11.26	.0007	1.61	-.0077	-1.83	.2517	3.45	.2249	65.85	0.0001
Seed Drilling															
Aware	.364	19.0	-.0036	-3.85	.0004	.44	-.0042	-6.72	.0130	1.99	.2256	2.01	.2092	4.18	0.0411
Test	.065	6.64	.0028	4.87	.0046	8.19	-.0027	-6.91	.0096	2.37	.3670	5.26	.1094	56.75	0.0001
Adopt	.157	11.2	.0029	3.54	.0045	5.67	-.0016	-2.94	.0113	1.97	.1926	1.95	.1717	28.26	0.0001
Organic Fertilizer															
Aware	.199	15.1	-.0020	-2.62	-.00003	-.03	-.0024	-4.66	.0140	2.60	.0335	.36	.1616	2.38	0.1233
Test	.037	4.21	.0019	3.66	.0024	4.76	-.0011	-3.00	.0151	4.11	.0899	1.42	.0823	23.64	0.0001
Adopt	.139	11.1	.0012	1.60	.0008	1.18	.0001	.30	.0026	.52	.3502	3.98	.1486	2.59	0.1079
Chemical Fertilizer															
Aware	.367	22.5	-.0068	-7.22	-.0023	-2.43	.00007	1.01	.0194	2.91	.3819	3.32	.2474	31.27	0.0001
Test	.065	7.20	.0017	3.25	.0035	6.71	.0005	1.30	.0178	4.77	.1886	2.93	.0982	33.00	0.0001
Adopt	.135	10.9	.0016	2.19	.0040	5.68	.0042	8.71	.0189	3.74	.2616	3.00	.1906	20.58	0.0001
Pesticide Application															
Aware	.337	21.4	-.0055	-6.01	-.0005	-.55	.00007	.12	.0161	2.50	.3603	3.25	.2501	14.52	0.0001
Test	.025	3.47	.0007	1.82	.0003	.64	-.0005	-1.61	.0081	2.81	.2523	5.05	.0703	2.03	0.1544
Adopt	.113	9.82	.0009	1.41	.0033	4.96	.0009	2.04	.0010	.22	.4863	5.99	.1410	13.47	0.0002

(continued)

Table 20: (continued)

Practice	YEAR		YEAR(T&V)		YEAR(T&VFARMO)		YEAR(OTHEXTQ)		MTPARCELS		MEDUC		R ²	F	Prob.F
	Coeff	t*	Coeff	t*	Coeff	t*	Coeff	t*	Coeff	t*	Coeff	t*			
Animal Draft															
Aware	.401	24.0	-.0048	-4.96	.0020	2.14	-.0019	-2.83	.0088	1.28	.0673	.57	.2645	2.72	0.0990
Test	.060	6.17	.0032	5.60	.0053	9.36	-.0016	-4.02	.0101	2.51	.0777	1.12	.1121	74.48	0.0001
Adopt	.147	11.3	.0052	6.89	.0097	13.03	-.0024	-4.67	.0151	2.84	-.0192	-.21	.2161	132.07	0.0001
Motorized Draft															
Aware	.403	26.1	-.0072	-8.08	.0019	2.20	.0024	3.92	.0043	.68	.1957	1.79	.2606	11.76	0.0006
Test	.060	3.64	-.0001	.72	.0003	1.66	-.00007	-.62	-.0043	-3.93	.0978	5.19	.0418	1.8810	0.1703
Adopt	.013	3.90	-.0002	-1.07	-.0002	-1.19	.0005	4.06	-.0097	-7.05	.1322	5.60	.0577	1.7014	0.1922
Crop Rotation															
Aware	.225	16.7	-.0022	-2.87	.0016	2.02	.0001	.27	.0048	.88	.2234	2.34	.1548	.26	0.6117
Test	.036	4.42	.0014	3.06	.0025	5.37	-.0010	-3.21	.0117	3.50	.1756	3.05	.0687	23.65	0.0001
Adopt	.110	8.42	.0014	1.83	.0025	3.31	-.0005	-.94	.0027	.51	.0942	1.01	.0999	8.81	0.0030
Anti-Erosion															
Aware	.644	36.0	-.0084	-8.17	.0036	3.50	.0022	3.13	.0209	2.86	.1727	1.37	.4181	7.46	0.0063
Test	.221	19.3	-.0017	-2.60	.0036	5.53	.0008	1.70	.0083	1.77	.0532	.66	.2052	2.77	0.0959
Adopt	.464	31.9	-.0071	-8.45	.0028	3.32	.0017	3.04	.0168	2.82	.0033	.03	.3511	9.00	0.0027
Agro-Forestry															
Aware	.326	27.7	-.0039	-4.70	.0010	1.26	.0051	8.99	.0071	1.21	.1286	1.28	.2688	4.01	0.0454
Test	.044	5.21	.0013	2.62	.0017	3.49	.0017	4.97	.0104	2.99	.0835	1.38	.0860	12.42	0.0004
Adopt	.086	9.12	.0012	2.25	.0019	3.42	.0021	5.66	.0163	4.20	.1991	2.97	.1370	10.70	0.0011

Table 21: Probit Estimates: Ever Aware, Tested or Adopted, 1990/91

Practice	TVFARMO		OTHEXTO		TPARCELS		EDUC		FEMALE		-2 Log
	Coeff	"t"	Coeff	"t"	Coeff	"t"	Coeff	"t"	Coeff	"t"	Likelihood
Soil Preparation											
Aware	.0752	.65	-.6115	-7.73	.0209	3.24	.1390	1.40	-.0026	-.15	301
Test	1.0287	9.68	-.4987	-6.13	-.0006	-.91	.1907	2.03	-.2712	-1.61	237
Adopt	.2593	2.46	-.2674	-3.65	.0268	4.56	.0770	.83	-.2768	1.93	463
Seed Treatment											
Aware	.0092	.09	-.2599	-3.34	.0253	3.62	.1612	1.58	.0311	.19	210
Test	.6546	6.84	-.1851	-2.46	.0026	.46	.1109	1.25	-.0982	-.68	200
Adopt	.5707	6.05	.1025	1.40	.0202	3.27	.1655	1.81	.1561	1.10	118
Improved Cultivars											
Aware	.4744	5.09	-1.1970	-2.61	.0171	3.00	.3811	4.26	-.1828	-1.25	429
Test	1.0212	7.98	-.1717	-1.16	.0012	.15	.4743	4.43	-.3725	-1.39	243
Adopt	.9982	9.49	.0617	.60	.0018	.25	.5356	5.49	-.1479	-.74	498
Seed Drilling											
Aware	-.0443	-.44	-.3876	-5.15	.0329	5.05	.0242	2.12	-.0856	-.55	238
Test	.8519	8.38	-.2200	-2.76	.0137	2.32	.2253	2.45	-.0315	-.20	186
Adopt	.5487	5.82	-.0979	-1.35	.0382	6.53	.2861	3.17	-.0880	-.59	457
Organic Fertilizer											
Aware	-.3322	-3.14	-.3831	-4.35	.0318	4.16	-.0380	-.37	.0385	.21	371
Test	.6430	5.87	-.3586	-4.53	.0139	2.28	.1364	1.42	.2106	1.37	260
Adopt	.1094	1.23	-.1852	-2.34	.0323	4.97	.0466	.50	-.1945	-1.35	316
Chemical Fertilizer											
Aware	-.0633	-.60	-.2544	-3.44	.0399	5.94	.4906	4.70	-.0609	-.39	495
Test	.7969	7.78	.0734	.82	.0239	4.00	.2440	2.57	.0071	.43	268
Adopt	.9249	9.04	.4876	5.79	.0191	3.20	.4367	4.68	-.2054	-1.18	636
Pesticide Application											
Aware	.4028	4.33	-.2445	-3.31	.0082	1.46	.4728	5.15	.0551	.38	518
Test	.7466	6.39	-.1366	-1.00	.0044	.56	.2852	2.52	-.0197	-.89	192
Adopt	1.0951	10.06	.2040	2.02	-.0012	-.17	.4279	4.33	.0176	.09	486

(continued)

Table 21: (continued)

Practice	TVFARMO		OTHEXTO		TPARCELS		EDUC		FEMALE		-2 Log Likelihood
	Coeff	"t"	Coeff	"t"	Coeff	"t"	Coeff	"t"	Coeff	"t"	
Animal Draft											
Aware	.3173	3.25	.4222	4.33	.0231	3.30	.1930	1.84	.0176	.11	274
Test	1.1629	10.14	-.3598	-4.38	.0119	1.91	.1668	1.75	-.2366	-1.33	234
Adopt	1.4510	13.27	-.3565	-4.80	.0297	4.87	.1596	1.71	-.2634	-1.63	547
Motorized Draft											
Aware	.2590	2.79	.6370	8.21	.0223	3.62	.3197	3.18	-.0763	-.53	600
Test	.3005	1.28	-.0912	-.56	-.0331	-1.53	.1687	.73	-.0825	-.20	26
Adopt	.7385	2.95	.3070	1.81	-.1101	-3.34	.3311	1.44	-2.1609	-.58	66
Crop Rotation											
Aware	.2052	2.22	.4803	6.09	.0130	2.20	.2894	3.07	.0054	.04	137
Test	.5333	5.11	-.2303	-2.83	.0005	.08	.1641	1.72	.2594	1.72	110
Adopt	.3950	4.29	.1496	2.06	.0124	2.19	.0795	.88	.1091	.79	377
Anti-Erosion											
Aware	.0328	.36	.6101	6.61	.0275	4.01	.1463	1.46	-.1414	-.94	470
Test	.5605	4.80	.0792	.94	.0097	1.51	.1829	1.83	.0355	.21	188
Adopt	.1577	1.80	.2135	2.89	.0174	3.10	.1592	1.82	-.0565	-.38	143
Agro-Forestry											
Aware	.0417	.46	.7360	9.50	.0190	3.22	.1942	2.02	-.1245	-.88	511
Test	.5071	3.91	.4207	4.25	.0143	1.88	.1137	.93	-.2015	-.92	128
Adopt	.2711	2.56	.4813	5.16	.0203	2.93	.2934	2.79	-.2345	-1.17	180

Table 22: Estimates of Farm-Level Probability of Awareness, Testing and Adoption

Practice	TVFARMO		OTHEXTO		TPARCELS		EDUC		FEMALE		M Lag Aware		M Lag Test		M Lag Adopt		-2 Lag
	Coeff	"t"	Coeff	"t"	Coeff	"t"	Coeff	"t"	Coeff	"t"	Coeff	"t"	Coeff	"t"	Coeff	"t"	Likelihood
Soil Preparation																	
Aware	.3322	6.61	-.2839	-6.46	.0144	4.44	-.0173	-.33	-.0611	.73	2.0571	25.94	-	-	-	-	1274
Test	.8602	12.65	-.1712	-2.88	.0071	1.64	.1170	1.72	-.2949	-2.15	-	-	2.8876	21.33	-	-	824
Adopt	.9504	14.76	-.1565	-3.42	.0160	4.47	-.0388	-.68	-.2429	-2.43	-	-	.2483	2.08	2.4010	26.26	1888
Seed Treatment																	
Aware	.5863	12.69	-.1352	-3.16	.0130	3.96	.0477	.89	-.0001	-.001	1.6376	19.65	-	-	-	-	686
Test	1.1008	16.06	-.0873	-1.65	.0035	.92	.0663	1.06	-.0471	-.43	-	-	2.4501	21.04	-	-	975
Adopt	.9198	17.75	.0324	.75	.0151	4.58	.0697	1.29	.1127	1.32	-	-	.6884	5.99	1.2383	12.31	775
Improved Cultivars																	
Aware	-.3720	-7.40	-.0382	-.76	.0189	5.64	.2085	3.89	-.1519	-1.64	3.0497	23.84	-	-	-	-	920
Test	.2699	2.96	.0408	.38	.0119	2.07	.2989	3.74	-.1800	-.90	-	-	3.6693	17.28	-	-	514
Adopt	.3724	5.13	.0989	1.32	.0114	2.31	.3122	4.66	-.1320	.87	-	-	1.2890	5.69	2.1282	11.92	912
Seed Drilling																	
Aware	.0986	2.21	-.1789	-4.13	.0143	4.62	.0753	1.45	.0161	.21	2.2450	26.16	-	-	-	-	987
Test	.6239	9.13	-.0608	-1.08	.0160	3.99	.1217	1.83	.0388	.33	-	-	3.0067	21.08	-	-	725
Adopt	.7801	13.43	-.0903	-1.95	.0270	7.69	.1109	1.89	.0223	.21	-	-	1.1610	7.94	1.8869	17.08	1461
Organic Fertilizer																	
Aware	.5048	10.60	-.3210	-6.73	.0237	6.22	-.0743	-1.31	-.0618	-.72	2.2688	27.86	-	-	-	-	1557
Test	1.1274	13.01	-.0883	-1.45	.0061	1.34	.0942	1.28	.1695	1.36	-	-	3.0391	22.58	-	-	1127
Adopt	1.0209	17.71	-.2066	-4.41	.0164	4.47	-.0501	-.87	-.1928	-1.98	-	-	.1071	.90	2.3242	25.91	1762
Chemical Fertilizer																	
Aware	-.3640	-8.04	-.0937	-2.10	.0226	7.36	.1733	3.43	-.0988	-1.32	2.3608	24.62	-	-	-	-	1005
Test	.4158	5.56	-.0114	-.18	.0250	6.20	.1554	2.26	-.0844	-.68	-	-	3.3240	21.17	-	-	767
Adopt	.6803	9.74	.2236	3.79	.0237	6.11	.2214	3.51	-.2406	-1.81	-	-	1.2107	6.86	2.1696	15.39	1449
Pesticide Application																	
Aware	-.4210	-8.65	-.0705	-1.49	.0180	5.55	.1858	3.63	.0047	.06	2.6295	24.13	-	-	-	-	928
Test	.2324	2.79	-.0197	-.18	.0131	2.21	.1671	1.82	-.0090	-.05	-	-	3.7517	19.21	-	-	557
Adopt	.4186	5.47	.1926	2.56	.0154	3.31	.2904	4.13	.0212	.15	-	-	1.1448	5.44	2.3748	14.35	1002

(continued)

Table 22: (continued)

Practice	TVFARMO		OTHEXTO		TPARCELS		EDUC		FEMALE		M Lag Aware		M Lag Test		M Lag Adopt		-2 Lag
	Coeff	"t"	Coeff	"t"	Coeff	"t"	Coeff	"t"	Coeff	"t"	Coeff	"t"	Coeff	"t"	Coeff	"t"	Likelihood
Animal Draft																	
Aware	-.2097	-4.97	-.0418	1.05	.0203	6.68	.0790	1.66	-.0533	-.74	2.0599	22.06	-	-	-	-	638
Test	.7898	9.97	-.1194	-2.04	.0170	3.96	.1496	2.15	-.1219	-.89	-	-	3.2045	20.10	-	-	673
Adopt	.9432	13.75	-.1033	-2.21	.0288	7.77	.0836	1.38	-.1586	-1.38	-	-	1.2115	7.10	1.8998	12.62	1131
Motorized Draft																	
Aware	-.5352	-11.21	.3059	7.16	.0147	4.82	.1421	2.82	-.0509	-.65	2.8080	6.17	-	-	-	-	539
Test	.0357	.20	-.0179	-.14	-.0195	-1.13	.1562	.84	-.0299	-.92	-	-	4.8299	4.11	-	-	37
Adopt	.0051	.02	.3129	1.85	-.0523	-2.21	.2856	1.53	-1.5447	-.56	-	-	4.6528	3.50	3.0311	2.60	98
Crop Rotation																	
Aware	.3076	6.40	.0488	1.09	.0109	3.34	.1542	2.94	-.1752	-1.95	2.3717	30.55	-	-	-	-	1318
Test	.9960	11.11	-.0578	-.87	-.0075	-1.54	.0853	1.11	.0270	.20	-	-	3.7962	25.71	-	-	1009
Adopt	1.0783	16.25	-.0252	-.49	.0080	2.16	.0658	1.07	-.1376	-1.25	-	-	.7136	5.31	2.3122	22.74	1801
Anti-Erosion																	
Aware	-.4333	-9.99	.1355	3.51	.0111	3.82	.0986	2.08	-.0636	-.85	3.8631	26.60	-	-	-	-	1089
Test	.0141	3.49	.1186	2.04	.0141	3.49	.1468	2.18	-.0063	-.06	-	-	2.8532	9.99	-	-	240
Adopt	-.4739	-8.45	.2009	4.12	.0186	5.31	.1065	1.91	-.0709	-.73	-	-	5.9570	16.60	-2.29876	-5.80	560
Agro-Forestry																	
Aware	-.3551	-7.29	.2538	5.54	.0143	4.47	.1039	1.93	-.1030	-1.23	2.8793	18.44	-	-	-	-	773
Test	.4376	5.16	.2631	3.56	.0085	1.58	.1172	1.30	-.0799	-.48	-	-	3.1129	9.68	-	-	226
Adopt	.2471	3.24	.2284	3.33	.0124	2.61	.2394	3.23	-.1006	-.68	-	-	2.7268	8.02	1.1125	4.02	350

ANNEX 10: PRODUCTION (ECONOMIC EFFICIENCY) EFFECTS OF EXTENSION

Introduction and Overview

Extension programs are designed to affect the full economic efficiency of farmers. This includes both "technical" efficiency and "allocative" efficiency. Technical efficiency encompasses the use of "best technical practices" in the "best" ways, i.e. with proper intensity. Allocative efficiency encompasses the allocation of farm resources (land, labor, and capital) among enterprises in such a way as to maximize farm *production*. Thus, full economic efficiency includes the use of best practices in the most effective way including "best effort" and allocative efficiency.

In this annex, a statistical analysis of the effect of extension on the economic efficiency of farmers in Burkina Faso is reported. It is related to the results reported in the previous annex in that technical efficiency is one component of economic efficiency. The measure of economic efficiency used in this study is a productivity measure. A number of previous studies of the productivity impact of extension have been undertaken (see Birkhaeuser and others 1991 for a review). The statistical model utilized in these prior studies was either an aggregate production function model or a productivity decomposition model in which production or productivity is related to variables measuring extension services supplied to farmers. The most serious flaw in a number of these prior studies has been the use of extension contact or technology adoption measures as explanatory variables. Any extension variable which reflects a choice or action by a farmer, such as the participation, awareness, testing and adoption measures analyzed in Annex 9, is an "endogenous" variable and cannot be utilized to measure the production impact of extension unless it is specifically modeled as an endogenous variable. Variables measuring the *supply* of extension services to groups of farmers have been used to avoid this problem in previous studies.

This study has available to it farm level data for the 1990/91 crop season that can be used to estimate either the aggregate production function or the productivity decomposition model. These data are subject to errors of measurement and to some weather errors. This study also has the participation, and technology practice awareness, testing and adoption variables analyzed in Annex 9. (However, many of the predicting variables used in the Annex 9 analysis also predict productivity.) In addition, an extension services supply variable (defined subsequently) is available.

There is an inherent "experimental design" underlying the farm-level data in that the T&V management system was introduced in a roughly random fashion at different periods. Some provinces received the T&V system four years prior to the 1990/91 crop year, some received it three years earlier, some two years earlier and some only one year earlier (see Annex 2). Since it is likely that there is an accumulated effect of T&V management, this design element offers potential for measuring a specified T&V management effect independently of an extension (supply) services impact.

There are three candidate variables available to index extension effects. The first is a measure of services provided at the village-level. This is a ratio of FEWs to farms served (with time weights). This is not farm specific, but instead measures the village level services provided. The second candidate variable is the *predicted* T&V participation variable analyzed in Annex 9. The third is the *predicted* technology practice adoption from Annex 9. Alternatively, instead of the predicted

participation and adoption, village means from the larger sample of these variables may also be considered to be "exogenous" to individual farmers.

Since T&V participation was itself the major determinant of technology adoption (Annex 9), and since technology adoption is itself only a part of full economic efficiency, it is possible that these variables will not dominate the extension services variables in this analysis.

Statistical Models

There are two statistical frameworks used in prior studies of the extension impact on production and both can be applied to the Burkina Faso data (Birkhaeuser and others 1991):

- (a) the first is the "meta" production function method. In the conventional production function, technological options, farmer information sets and infrastructure are considered to be "background" or fixed variables. In the meta specification, variables measuring these are incorporated directly into the specification. The typical specification is thus:

$$Y = F(X_1, X_2, X_n, Z, EXT, RES, INF) \quad (10.1)$$

where aggregate output, Y , is related to variable inputs $X_1 - X_n$ such as labor and fertilizer; fixed inputs, Z , such as land; and variables measuring the "flow" of extension services (EXT), research system services (RES) and infrastructure services (INF).

- (b) The second is a relatively simple modification of the first, where an aggregate input index is formulated:

$$I = G(X_1, X_2 - X_n, Z) \quad (10.2)$$

This enables the dependent variable to be defined as a productivity index, Y/I , and this total factor productivity index is then related to the meta variables.

$$Y/I = H(EXT, RES, INF) \quad (10.3)$$

The choice between these two specification depends on the quality of the input data. To form an input index, (10.2), cost share weights are required. Constant cost share weights are consistent with a Cobb-Douglas production function and cost minimizing behavior and these are typically used to form the index. The aggregate production function specification does not require cost share data and implicitly allows marginal products to differ from cost shares. It is thus a somewhat more flexible procedure in that production coefficients are estimated rather than being built into the specification. In addition, the aggregate specification is more flexible in allowing for the use of variables proxying for land quality. The presence of the land quality problem and the absence of good cost share data indicate the use of the aggregate production function for this study. An individual crop yield function is also utilized as a "partial productivity" estimate.

The key specification decisions are:

- (a) The meta-production function form (Cobb-Douglas or other);

- (b) The specification of the extension variables; and
- (c) Econometric considerations associated with possible endogeneity of the extension variables.

Functional Form Issues

For the aggregate production function, the Cobb-Douglas form is typically used. It is a general form and economizes on the number of coefficients estimated. Aggregate output was constructed using national prices to aggregate crop production. Livestock production was not included in output.

Specification of the Extension Variable(s)

Several extension variables have been used in prior studies. These include:

- (a) Farmer contact with extension;
- (b) Farmer participation in groups contacted by extension (see Annex 9);
- (c) Extension supply variables, i.e. FEWs relative to numbers of farm households in a region; and
- (d) Extension-induced technology adoption.

Birkhaeuser and others (1991) in their review of past studies point out that (a) and (b) are endogenous in that they are chosen in part by farmers. Thus, when more productive farmers seek out extension workers for advice more frequently than less productive farmers, one cannot say that extension "increased" their productivity. And, unless an econometric procedure to correct for endogeneity is devised, variable(s) (a), (b) and (d) cannot be used as independent variables. In Annex 9, a procedure to predict participation was used to explain awareness and adoption. That predicted participation variable is available for the present analysis as is the village-level mean. It should be noted, however, that extension information flows can be quite pervasive through farmer-to-farmer channels and through general community effects.

The *predicted* extension-induced adoption of technology from the Annex 9 analysis is also a candidate variable. Farmer-to-farmer information flows and the fact that first adoption is only part of the larger economic efficiency story may limit its explanatory power. An alternative variable is the village-level adoption of technologies.

Most prior studies of this type have utilized an extension services *supply* measure where extension supply is determined by governments and is not a farm-specific variable. The natural variable for this is a FEWs: farm households ratio indexing the supply of field services to a target group of farms. The supplying staff may use different techniques to reach farmers and may provide more services to some farmers relative to others. But given these practices, it is expected that more staff services will increase information and advice flows to farmers, and regions with more services will, on average, be more productive.

There is a timing dimension between a staff-year of services and productivity. Advice "trickles" from farm to farm and this takes time. Advice may also become reinforced with experience. Thus, a staff year of extension services will have an impact distributed over future years. In addition, farmers may have alternative sources of extension advice. And they may experiment and learn without extension assistance. Alternative information systems and farmer experimentation (not induced by extension) will erode the flow of productivity services from extension. The "time shape" of services from a staff-year will then be such that there may be rising weights for two or three years and then falling weights in following years. These weights must be estimated and incorporated into the staff-farm variable in the form of an accumulated stock of staff-years.

Other Econometric Questions

Extension services may be biased in favor of particular types of farms and this may create and endogeneity problem. A test for this is required.

Variables

Table 23 summarizes the variables utilized in this analysis. The two endogenous dependent variables of interest are total production (LTPROD) and total factor productivity (TFP). Input variables are total area cropped (LTAREA), labor employed (LWORKER) and capital (LCAP). It should be acknowledged that there are two "problems" with these variables. The first is that the labor and capital variables are probably measured with error. The capital items for most farmers are minor. It was not possible to obtain accurate data on labor hours and the total number of workers may not be an accurate measure.

The more serious issue, however, has to do with the intensity of land use. Farmers with more parcels farmed (holding total area constant) are farming more intensively. They are probably putting more labor and effort into farming. They may also be experiencing shorter "fallow" periods between crops. For these reasons the number of parcels farmed is treated as an input.

The extension variables are treated as exogenous variables in some specifications, but are treated as endogenous variables in the simultaneous equation estimates reported in the next section.

Household variables are expected to reflect skill differences between farmers.

Community-level variables are used as determining variables in the simultaneous equation specifications.

Geo-climate dummy variables are included in the production and TFP equation to control for geo-climate effects on production.

Political variables are included in the equations for staffing and participation.

Estimates: Time Weights

The relationship between the timing of extension expenditure and impact on farmers is not a simple one. Extension advice to farmers may have an accumulated effect in that current messages

reinforce prior extension messages. Farmer experience also affects the value of prior messages. Thus, an expenditure on extension in time t may have an impact in period t , and in subsequent periods. Conversely, there is also a depreciation or obsolescence effect on productivity in that extension messages are acted upon. Farm productivity due to these messages will not rise further after full implementation.

The methods available for analyzing timing effects include various distributed lag methods. The most general methods include several lagged variables (e.g. SF_t , SF_{t-1} , SF_{t-2} , etc.). Restricted methods place a structure on these time weights. These vary from exponentially developing weights (Koyck-Nerlove) to polynomial weights (Almon). One of the simplest procedures is to use a non-linear least-square search over a set of plausible weights.

Table 24 reports results from a structured search estimate of time weights. As expected, the high multicollinearity between the different time lag extension staff variables makes a general estimate infeasible. There is actually little difference in the Means Square Error for different weight structures. Weight set seven is the preferred weight structure and is used in further estimates utilizing the FEWs: farm households variable.

Characteristics of the Aggregate Production Function

Table 25 reports the basic aggregate production function specification and OLS estimates for two alternative forms of the FEWs: farm households variable. For all variables other than the extension variable, coefficient estimates do not differ appreciably by specification. These will be discussed briefly here. Further results will report only the extension and related variable coefficients.

The significant coefficient on the parcels variable indicates that this variable is measuring input intensity. Farms with more parcels, holding total cropped area constant, produce more. This variable is also likely to be reflecting land quality. Better land is more likely to be farmed in smaller parcels and smaller parcels receive more labor per unit of land area.

The capital coefficient is low, but given the fact that most capital is in the form of hoes and simple implements, the real cost share of capital is actually quite low.

The worker variable coefficient is not significant. There are two explanations for this. First, it should be acknowledged that the labor variable is not well measured. The measurement of labor is difficult in surveys of this type in most economies and particularly in African economies. The second reason is that the parcels variable is probably a better measure of the real labor inputs into crops than the labor variable. If the parcels coefficient is interpreted as a labor coefficient, this production function is "reasonable." It shows diminishing returns to scale and in this "hand agriculture" setting, this is likely to be a real phenomenon.

The crop-cut variable measures the proportion of the parcels on the farm where crop-cuts were used to measure yields. Yields appear to be higher for these parcels than for those where they are based on farmers' estimates. This could be a measurement phenomenon or it might also reflect more effort on crop-cut parcels.

The dominant climate variables appear to be measuring significant climate-induced differences in production (yields). Experiments using political variables (CRPA) produced roughly the same results.

As an alternative to and a check on the aggregate production function, a specification where parcel yield is the dependent variable and where parcels are "pooled" in a large data set is reported. Crop dummy variables are included in the pooled specification. The results are reasonably similar to those for the aggregate production function.

These estimates indicate that the production function framework is a reasonable, though far from ideal, statistical framework in which to analyze extension effects.

The Extension Variables

Table 25 reports coefficients for both the log and non-log form of the extension variable. Both are significant. The implied estimated elasticities are similar. There are two reasons, however, for preferring the logarithmic version. First, the R^2 is higher for this version, (and R^2 's are comparable since the dependent variable is the same). Second, the non-logged version implies that a unit increase in extension has a percentage impact on production and this is less reasonable than the logged version where a percentage increase in staffing has a percentage increase in the impact on production.

Table 26 reports six alternative versions of the aggregate production function. Four single equation estimates, and two two-equation estimates, are reported. First, consider the comparison between the single equation estimates and the two-equation estimates. Specification (1) is the estimate from the OLS equation reported in Table 25. Specification (5) is from a two-equation seemingly unrelated regression (SUR) system and specification (6) is a three-stage least square (3SLS) system in which the FEWs: farm households variable is treated as an endogenously determined variable. That is, the second equation in the two-equation system is designed to measure whether the location and staffing decisions responded to farm conditions including productivity levels.

The second equation for LSF7 included (political) dummy variables. The LSF7 equation indicates that staffing was higher in regions with more productive farms and in regions with more years of T&V management. It was lower in the regions with more schooling.

When the error terms in this second equation are taken into account in the SUR estimate, the coefficient on LSF7 rises from .0212 to .04. When the full simultaneity results are considered (3 SLS), the estimate rises to .0736. Thus, there appears to be a simultaneity bias in the OLS results, but it is a downward bias.

Specification (2) adds the mean village participation levels in T&V extension and in other extension to the basic regression. The finding here is that both participation and staffing services matter. The coefficients are quite large indicating 25 to 30 percent production gains for participants as opposed to non-participants who still benefit from extension staffing.

Specification (3) adds an interaction term between extension staffing and T&V participation (which is positive indicating complementarity), and specification (4) an interaction with the number of years of T&V experience. The latter variable indicates that there is a T&V accumulated impact in that provinces with four years of T&V have a staffing impact elasticity .024 units higher than regions with T&V extension for only one year. This is a substantial increase in extension impact.

It should be noted that some of these results are sensitive to the form of the staff variable. For example, the accumulated T&V impact is not found when the FEWs: farm households variable is in non-logged form.

It should also be noted that the predicted participation variables from Annex 9 (Table 21) were not significant when included in specifications (2), (3) and (4) in lieu of the village mean variables. This may indicate that there is a community dimension to T&V participation.

Finally, it should be noted that experiments with the adoption of practices (either in the predicted form, or village mean levels), did not show significant adoption effects on production when the staff variable was included in the specification. This supports the interpretation of extension effects that are broader than simple technology adoption and that promote overall farm management and allocative efficiencies.

Evidence for Crop Yields

Given the difficulty of accurately measuring labor and capital inputs, there is merit in applying the basic productivity specification to individual crop yields. These crop yields have differing numbers of observations and cannot be run as a SUR system. OLS is thus used. Table 27 reports the resulting coefficients for the area, parcels, MTVFARM, MOTHEXT, LSF7 and LSF7 x MTVFARM variables. These coefficients are comparable to those reported in Table 26. Results are reported for major individual crops and all crops combined (crop dummies are used in the pooled specification).

The results show that the number of parcels variable has a negative sign indicating that there is probably a fallow reduction effect on yields.

The T&V participation variable is significant for the case of each crop and the pooled result is very similar to that reported in Table 26 for aggregate production. In addition, T&V participation interacts positively with the FEWs: farm households variable in all but two cases.

The other extension variable is significant for soybean production and in the pooled regression with a lower coefficient than in the aggregate results.

The FEWs: farm households variable (LSF7) is significant in the case of all crops except rice and cotton, and has approximately the same coefficient in the pooled regression as in the aggregate estimates (Table 26).

Thus, these results are consistent with the aggregate production function results.

Table 23: Variables

Endogenous Variables

LTPROD:	Logarithm (ln) of total crop production at the farm level
LSF7 (SFF):	ln (ratio of FEWs to farm household in the basic extension unit) (time weight 7)
SF7(FS):	SF7 (proportion of female FEWs)
SF7 (Techs):	SF7 (proportion of FEWs with technical education)
LYIELD:	ln of crop yields

Exogenous Variables

Farm Level

LTPARCELS:	ln (total number of parcels farmed)
LTAREA:	ln (total area cropped)
LWORKER:	ln (number of employees plus family members)
LCAP:	ln (capital stock)
CROPCUT:	Proportion of parcels using crop cuts to estimate yield

Household Level

FEMALE:	Dummy = 1 if farmer is female
EDUC:	Dummy = 1 if farmer has primary education
AGE:	Farmer's age

Community Level

MTVFARM:	Village mean proportion of T&V participants
MOTHEXT:	Village mean proportion of other extension participants
HHS:	Number of households in the village
EDUC:	Mean village education
YRST&V:	Number of years with T&V management

Geo-climate Variable

SDG to S1:	Dominant climate dummy variables
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Political Variable

CRPA1 - CRPA11:	Dummy variable for CRPAs
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**Table 24: Time Weight Estimates for the
FEWs: Farm Households Variable**

Alternative Weight Structures						MSE	
<u>Set</u>	<u>t-1</u>	<u>t-2</u>	<u>t-3</u>	<u>t-4</u>	<u>t-5</u>	<u>SF</u>	<u>LSF</u>
1	1	1	1	1	1	.6551	.64156
2	1	.9	.8	.7	.6	.6551	.64161
3	1	.8	.6	.4	.2	.65496	.64166
4	1	.7	.5	.3	.1	.65494	.64170
5	1	.6	.2	.1	.1	.65494	.64179
6	.9	1	.4	.2	.1	.65491	.64166
7	.8	1	.4	.2	.1	.65491	.64164
8	1	.5	.2	.1	.1	.65495	.64183

**Table 25: Aggregate Production Function Estimates
(Basic Specification with Dependent Variable LTPROD)**

<u>Independent Variable</u>	(1)	(2)
Intercept	8.095 (86.35)	8.373 (83.09)
LTAREA	.202 (7.07)	.206 (7.29)
LTPARCELS	.496 (15.04)	.486 (14.87)
LWORKER	.0003 (.67)	.0003 (.65)
LCAP	.0008 (1.61)	.0008 (1.77)
AGE	-.001 (.98)	-.001 (.83)
FEMALE	-.146 (1.63)	-.154 (1.72)
EDUC	-.012 (.14)	.006 (.07)
CROPCUT	.164 (4.25)	.157 (4.13)
Climate SDG	.313 (6.18)	2.44 (5.63)
S	-.066 (.89)	-.089 (1.27)
SS	-.639 (10.15)	-.665 (10.67)
O	-.134 (1.94)	-.129 (.90)
E	.204 (2.86)	.278 (3.95)
S1	-.426 (4.67)	-.475 (5.20)
SF7	34.65 (2.71)	
LSF7		.0212 (6.53)
R ²	.319	.331
F	(61.8)	(65.76)
MSE	.6545	.0526

() indicates "t" values

**Table 26: Alternative Estimates of Extension Variables
(Aggregate Production Function)**

Extension Variables	Single Equation				SUR (5)	3SLS (6)
	(1)	(2)	(3)	(4)		
LSF7	.0212 (6.53)	.0198 (6.07)	.014 (3.26)	-.0089 (1.37)	.040 (12.65)	.0736 (5.50)
MTVFARM		.2913 (4.67)	.483 (4.21)	.5109 (4.47)		
MOTHEXT		.1695 (2.67)	.2425 (2.40)	.2397 (2.38)		
LSF7 x MTVF			.0293 (2.40)	.0226 (2.18)		
LSF7 x YRST&V				.0080 (4.75)		

Second Equation for LSF7

	<u>SUR</u>	<u>3SLS</u>
LTPROD	1.67 (11.54)	1.26 (3.29)
LTAREA	-.831 (4.91)	-.642 (2.78)
HHS	.0004 (.09)	.0006 (1.27)
YRST&V	.939 (5.39)	.836 (5.18)
EDUC	-1.62 (2.86)	-1.583 (2.77)
CRPA Dummies	inc	inc

() indicates "t" values

Table 27: Individual Crop Yield Regressions

Dependent Variables	Miller	Sorghum	Maize	Rice	Fonio	Cotton	Ground Nut	Pooled Crops
LTAREA	.038 (2.81)	.094 (7.16)	.099 (4.30)	.420 (4.21)	.166 (4.51)	.131 (2.76)	.075 (3.59)	.096 (10.95)
LTPARCELS	-.077 (5.11)	-.138 (9.47)	-.092 (3.30)	-.738 (5.55)	-.225 (5.35)	-.325 (6.05)	-.076 (2.87)	-.144 (14.3)
MTVFARM	.219 (4.06)	.272 (5.57)	.539 (5.61)	.397 (.84)	.538 (4.08)	.623 (3.89)	.279 (3.76)	.320 (10.12)
MOTHEXT	-.029 (.72)	.292 (6.89)	.113 (1.38)	.772 (1.44)	-.451 (.29)	-.051 (.24)	.137 (1.60)	.114 (3.97)
LSF7	.0042 (2.03)	.0044 (2.26)	-.0020 (.50)	.0223 (1.24)	-.0015 (.79)	-.0037 (.38)	-.0048 (.64)	.0009 (.72)
LSF7 x MTVFARM	.0183 (3.35)	.0152 (3.31)	.0477 (4.73)	-.0216 (.56)	.0582 (4.57)	.0147 (.95)	.027 (3.96)	.023 (7.47)
R ²	.122	.153	.149	.291	.210	.424	.187	.312
F	35	61	24	7.4	26	24	38	246

() indicates "t" values

ANNEX 11: ECONOMIC RETURNS TO INVESTMENTS IN EXTENSION

Several economic calculations can be made from the estimated coefficients reported in Annex 10. From the public finance point of view, one would like to know the "marginal" returns to investment in agricultural extension both before and after T&V management was introduced. One may also be interested in the "average" return to investment as might be calculated for a particular project. The statistical methods utilized in this study are not suited to estimating average returns, and in any event for on-going programs such as extension, the average return is not a practical calculation. This is because the option of having no extension program is not very practical. However, there is evidence for Burkina Faso that the "T&V participation" effect is important and this is amenable to a kind of average return since it is a "one-time" effect.

In this annex, several economic calculations are made based on the estimated coefficients from Annex 10. These provide a range of rates of return to investment that generally bear a marginal interpretation, i.e. they are returns to an increment in investment.

The T&V management impact is in part an investment, but in actuality is not an investment per se. Indeed, in Burkina Faso, expenditures on extension actually declined after the introduction of T&V management principles (See Annex 3). Because of this, it is impractical to think of returns to T&V management as an investment. It is more meaningful to consider the best estimate of returns to extension investment with and without T&V management.

There are effectively three pieces of evidence regarding the T&V management effect. In Annex 9, the T&V participation variable was shown to have accelerated the testing and adoption of practices. There was no strong evidence that practice adoption affected farm productivity, however, in Annex 10. There was a T&V participation impact on farm productivity and also some indication of an accumulated T&V impact on the effectiveness of staffing.

Table 28 summarizes the estimates of elasticity coefficients from Annex 10 (see Tables 25 and 26). The first step in the calculation of economic return is to convert the elasticity estimate into the marginal product of a staff year (or of an expenditure unit). To do so, one needs to note first that the LSF7 variable (Annex 10) is a weighted sum of staffing in the current and prior years. Accordingly, an additional staff year in time period t has an impact that extends into period $t+1$, $t+2$, $t+3$, $t+4$ and $t+5$, with the set 7 weights of .8, 1, .4, .2, .1.

Then one notes that the estimate of the elasticity is from the following equation:

$$\ln(P) = a + b \ln(SF7/HH) + \text{other variables.}$$

$$\text{Thus, } b = \partial \ln(P) / \partial \ln(SF7/HH)$$

This is the elasticity coefficient reported in Table 28. It bears the interpretation

$$b = \frac{\text{Percent change in production per farm}}{\text{Percent change in SF7 per HH}}$$

If the numerator is multiplied by the number of farms served by a FEW, the result is

$$b = \frac{\text{Percent change in production per FEWs}}{\text{Percent change in SF7}}$$

Since the multiple counting of staff makes the ratio of SF7 to FEWs in 1991 equal to 2.5, it follows that

$$b/2.5 = \frac{\text{Percent change in production per FEWs}}{\text{Percent change in FEWs}}$$

and this is also equal to

$$b/2.5 = \frac{\text{Percent change in the value of production per FEW}}{\text{Percent change in FEWs}}$$

Thus to find the change in production value per FEW, $b/2.5$ is multiplied by the mean value of production per FEW.

As noted in Table 28, the value of agricultural production per FEW in 1991 in Burkina Faso was \$1.07 million. Hence, for the OLS elasticity from Table 28, the value of production associated with one FEW year in 1991 was $.0212 \times \$1.07 \text{ million}/2.5 = \$9,074$. For other estimates, marginal products are as indicated.

A year of staff time in 1991, however, affects production in 1991, 1992, 1993, 1994, and 1995. Thus one year of staff time generates a stream of production values of:

$$\begin{aligned} \$7259 &= 9.074 \times .8 \text{ at the end of the first year after expenses} \\ \$9074 &= 9.074 \times .1 \text{ at the end of the second year after expenses} \\ \$3629 &= 9.074 \times .4 \text{ at the end of the third year after expenses} \\ \$1814 &= 9.074 \times .2 \text{ at the end of the fourth year after expenses} \\ \$907 &= 9.074 \times .1 \text{ at the end of the fifth year after expenses} \end{aligned}$$

This stream of benefits can then be compared with the cost of a staff year. Taking all extension costs (\$5,859,000 in 1991) and dividing by the number of FEWs (839), one obtains a total cost per FEW of \$6,983. This cost includes all system costs. Thus, an investment of \$6,983 would have generated a benefit stream as shown here. The interest rate at which the present discounted value of the stream is equal to \$6,983 is the marginal internal rate of return reported in Table 28.

The specification in Annex 10 where a participation variable was included indicated that T&V participation appeared to produce a 25 to 30 percent production increase. One specification also indicated that the staffing elasticity increased with T&V management.

Three calculations for "long-term" investments are made to illustrate the added T&V effects. The base case takes elasticity estimate (1) and computes the costs and benefits for eight consecutive years of investment. This is a base case calculation for a conservative estimate of extension investment.

The second case computes benefits adding the estimated T&V accumulated effect from estimate (2) to the base case.

The third case adds the T&V participation effects supposing a 25 percent production gain and 10 percent participation after 2 years, 15 percent after 3 years, 20 percent after 4 years, 30 percent in the 5th year, and 40 percent thereafter. This can be compared with the first case to obtain an added return to T&V management.

These calculations do show that extension investment yields a high return at present and that T&V management probably contributes to it.

Consider the growth implications of these calculations. For the base case, continued spending at current levels would create a long-run growth increment of 0.3 percent per year. This would rise to 0.4 percent for a few years if expenditures were to rise to a level of 1 percent of agricultural product. At the highest estimates of marginal products, a 1 percent growth rate would be obtained.

The added one time T&V gains factored into the base case would produce higher growth rates in the short-run. The growth rates would be 3.4, 2.1, 2.1, 2.6, 2.5 percent in the second through sixth year after the introduction of T&V and would fall to the long-run increment after the peak T&V participation was reached (presumed to be in the sixth year).

Thus, taking the basic estimates, it appears that the T&V extension program can increase growth rates for five to seven, and at most, ten years. This added growth, if achieved, will provide important relief from the population-food pressure but cannot be a long-term solution. When research programs in Africa become as effective as they have been in Asia, they can contribute another 1 to 2 percent growth on a long-term basis. Ultimately, Africa will have to address population growth policy to bring population and food growth rates into balance.

**Table 28: Summary of Estimated Productivity Coefficients
and Calculated Marginal Products and Marginal
Internal Rates of Return**

	Elasticity	Marginal Product of one FEW (1991 dollars)	Marginal Internal Rate of Return
OLS (Table 25)	.0212	9,073	91
OLS (4 yrs. T&V) Table 26	.0293	12,589	136
SUR (Table 26)	.040	17,161	193
3SLS (Table 26)	.0736	31,600	367
Estimated Participation Impact OLS (Table 26)	.25 - .29		

Economic Data 1991

Value of Agricultural Product	\$ 900 million
Expenditure on Extension	\$5,859,000
Ratio Stock to Annual SFF	2.5
Product per FEW	\$1.07 million
Cost per FEW	\$6983

Calculated long-term Internal
Rate of Return

(1) Base case	86 percent
(2) T&V accumulated	91 percent
(3) T&V accumulated plus participation	187 percent

APPENDIX A

MINISTERE DE L'AGRICULTURE ET DE L'ELEVAGE
SECRETARIAT D'ETAT A L'ELEVAGE
SECRETARIAT GENERAL

DIRECTION DES ETUDES
ET DE LA PLANIFICATION

BANQUE
MONDIALE

DIRECTION DE LA
VULGARISATION

ENQUETE AUPRES DES PRODUCTEURS
SUR L'ACQUISITION DES THEMES TECHNIQUES
ET L'IMPACT DE LA VULGARISATION AGRICOLE

IDENTIFIANT:

CRPA PROVINCE VILLAGE

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1 - C. R. P. A. :

2 - PROVINCE:

3 - DEPARTEMENT:

4 - Z - E :

5 - U - E :

6 - VILLAGE:

7 - N° D'ORDRE DE L'EXPLOITANT :

--	--	--	--	--

8 - NOM DE L'EXPLOITANT :

9 - AGE :

--	--	--

NOM DE L'ENQUETEUR

DATE DE PASSAGE :

COMPOSITION DU MENAGE

IDENTIFIANT

C R P A : _____ PROVINCE: _____

DEPARTEMENT : _____ VILLAGE: _____

DISTANCE ENTRE LE VILLAGE
ET LE CENTRE URB. LE PLUS PROCHE KM

N° DU MENAGE :

(1) No d'Ordre	(2) Nom et Prénoms des Membres du Ménage	(3) Lien de Pa- renté avec le C M	(4) Age	(5) Sexe	(6) Situation Matrimoniale	(7) Niveau d'Instruction	(8) Contribue t-il au revenu du Ménage	(9) Activité Principale	(10) Activité Secondaire	(11) Membre du Ménage décédé [inscrire le Code 1]
										
										
										
										
										
										
										
										
										
										
										
										
										
										

A - QUESTIONNAIRE VOLET AGRICULTURE

IDENTIFIANT

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- Quelles sont les Cultures pratiquées par l'Exploitant ?

--	--	--	--	--	--	--	--	--	--

1 - Mil

5 - Coton

2 - Sorgho

6 - Arachide

3 - Maïs

7 - Autres

4 - Riz

IDENTIFIANT:

1 - PREPARATION DU SOL

1 - L'Exploitant est - il informé du thème de la préparation du sol avant semis (Labour - billonnage - Zaï ... etc)

1 - OUI 2 - NON

1-2 Si Oui, Comment a-t-il été Informé ?

1 - VULGARISATEUR 4 - Moyens audio visuels
2 - RADIO 5 - Autres Exploitants
3 - Journaux ou affiches 6 - Autres sources

1 - 3 Exploitant a-t-il testé le thème ?

1 - OUI 2 - NON

1 - 4 Si Oui, quel est le temps écoulé entre l'information et le test ?

1 - 5 A-t-il adopté le thème ? 1 - Oui 2 - Non

1 - 6 Si Oui, a-) - quel temps s'est écoulé entre le test et son adoption définitive ?

b) - quel temps s'est écoulé entre l'information sur le thème et son adoption définitive au cas où il n'y a pas eu de test ?

1 - 7 Si Non, pourquoi ne l'a-t-il pas adopté ?

1 - Thème Inconnu ou méconnu 6 - Insécurité Foncière
2 - Manque de main d'œuvre 7 - Spéculation. jugée sans Intérêt.
3 - Ressource financière
4 - Intrants non disponibles 8 - Pas d'agent de vulgarisation
5 - Commercialisation 9 - Autres

1 - 8 L'Exploitant a-t-il au cours de la campagne agricole 1990 - 91 pratiqué la préparation du sol avant semis ? (Labour, billonnage, zaï ... etc) 1 - Oui 2 - Non

1 - 9 L'Exploitant pratique t-il la préparation du sol avant semis ?
1 - Sur toute ou plus de la moitié des champs de l'exploitant
2 - Sur moins de la moitié des champs de l'exploitant.

1 - 10 L'Exploitant pratique t-il la préparation du sol avant semis ?
1 - Manuellement
2 - Mécaniquement

1 - 11 Depuis combien d'années pratique t-il le thème ?

1 - 12 Nombre de champs sous application.

	Mil	Sorgho	Maïs	Arach.	Coton	Riz	Autres
0 %							
< 50 %							
> 50 %							

IDENTIFIANT:

4 - SEMIS EN LIGNE

4 - 1 L'Exploitant est-il informé du thème "semis en ligne" ?

1. Oui, 2. Non

4 - 2 Si Oui, Comment a-t-il été informé ?

1. Vulgarisateur 4. Moyens audio-visuels
2. Radio 5. Autres Exploitants
3. Journaux ou affiches 6. Autres Sources

4 - 3 L'Exploitant a-t-il testé le thème ?

1. Oui, 2. Non

4 - 4 Si Oui, quel temps s'est écoulé entre l'information et le test ?

4 - 5 A-t-il adopté le thème ?

1. Oui, 2. Non

4 - 6 Si Oui: a) quel temps s'est écoulé entre le test et son adoption définitive ?

b) quel temps s'est écoulé entre l'information sur le thème et son adoption définitive au cas où il n'y a pas eu de test ?

4 - 7 Si Non, pourquoi ne l'a t-il pas adopté ?

1. Thème Inconnu ou méconnu 6. Insécurité Foncière
2. Manque de main d'œuvre 7. Spéculation jugée sans Intérêt
3. Ressource financière 8. Pas d'agent de vulgarisation
4. Intrants non disponibles 9. Autres
5. Commercialisation

4 - 8 Comment l'exploitant a-t-il fait les semis au cours de la campagne 1990 - 91 ?

1. Manuellement, 2. Mécaniquement

4 - 9 Si les semis sont fait manuellement, l'exploitant le fait-il ?

1. En foule sur toute l'exploitation
2. En ligne sur toute ou plus de la moitié de l'exploitation
3. En ligne sur moins de la moitié de l'exploitation

4 - 10 Si les semis sont fait mécaniquement, l'exploitant le fait-il ?

1. Sur toute ou plus de la moitié de l'exploitation
2. Sur moins de la moitié de l'exploitation

4 - 11 Si en ligne, depuis combien d'années ?

4 - 12 Nombre de champs sous application ?

	Mil	Sorgho	Maïs	Arach.	Coton	Riz	Autres
0 %							
< 50 %							
> 50 %							

IDENTIFIANT:

5 - FUMURE ORGANIQUE

5 - 1 L'Exploitant est-il informé du thème de l'épandage de la fumure organique ?

1. Oui, 2. Non

5 - 2 Si Oui, Comment a-t-il été informé ?

1. Vulgarisateur 4. Moyens audio-visuels
2. Radio 5. Autres Exploitants
3. Journaux ou affiches 6. Autres Sources

5 - 3 L'Exploitant a-t-il testé le thème ?

1. Oui, 2. Non

5 - 4 Si Oui, quel est le temps écoulé entre l'information et le test ?

5 - 5 A-t-il adopté le thème ?

1. Oui, 2. Non

5 - 6 Si Oui: a) quel temps s'est écoulé entre le test et son adoption définitive ?

b) quel temps s'est écoulé entre l'information sur le thème et son adoption définitive au cas où il n'y a pas eu de test ?

5 - 7 Si Non, pourquoi ne l'a-t-il pas adopté ?

1. Thème Inconnu ou méconnu 6. Insécurité Foncière
2. Manque de main d'œuvre 7. Spéculation jugée sans intérêt
3. Ressource financière 8. Pas d'agent de vulgarisation
4. Intrants non disponibles 9. Autres
5. Commercialisation

5 - 8 L'Exploitant a-t-il pratiqué l'épandage de la fumure organique au cours de la campagne agricole 1990 - 91 ?

1. Oui, 2. Non

5 - 9 Depuis combien d'années pratique t-il l'épandage de la fumure organique ?

5 - 10 Quelles fumure l'exploitant épand t-il ?

1. Fumier 3. Résidus de récolte ou paille
2. Compost 4. Ordures ménagères

5 - 11 L'Exploitant possède t-il une fosse fumière ou une fosse compostière ?

1. Oui, 2. Non

5 - 12 L'Exploitant pratique t-il l'épandage de la fumure organique ?

1. Sur toute ou plus de la moitié de l'exploitation
2. Sur moins de la moitié de l'exploitation

5 - 13 Nombre de champs sous application

	Mil	Sorgho	Maïs	Arach.	Coton	Riz	Autres
0 %							
< 50 %							
> 50 %							

6 - FUMURE MINERALE

6 - 1 L'Exploitant est-il informé du thème de l'épandage de la fumure minérale ?

1. Oui, 2. Non

6 - 2 Si Oui, Comment a-t-il été informé ?

1. Vulgarisateur 4. Moyens audio-visuels
2. Radio 5. Autres Exploitants
3. Journaux ou affiches 6. Autres Sources

6 - 3 L'Exploitant a-t-il testé le thème ?

1. Oui, 2. Non

6 - 4 Si Oui, quel est le temps écoulé entre l'information et le test ?

6 - 5 A-t-il adopté le thème ?

1. Oui, 2. Non

6 - 6 Si Oui: a) quel temps s'est écoulé entre le test et son adoption définitive ?

b) quel temps s'est écoulé entre l'information sur le thème et son adoption définitive au cas où il n'y a pas eu de test ?

6 - 7 Si Non, pourquoi ne l'a-t-il pas adopté ?

1. Thème Inconnu ou méconnu 6. Insécurité Foncière
2. Manque de main d'œuvre 7. Spéculation jugée sans intérêt
3. Ressource financière 8. Pas d'agent de vulgarisation
4. Intrants non disponibles 9. Autres
5. Commercialisation

6 - 8 L'Exploitant a-t-il pratiqué l'épandage de la fumure minérale au cours de la campagne 90-91 selon les normes recommandées ?

1. Oui 2. Non

6 - 9 Depuis combien d'années pratique t-il l'épandage de la fumure minérale ?

6 - 10 Quelle fumure minérale épand-il ?

1. N P K
2. U R E E
3. BURKINA PHOSPHATE

6 - 11 L'Épandage se fait-il ?

1. Sur toute ou plus de la moitié de l'exploitation
2. Sur moins de la moitié de l'exploitation

6 - 12 L'Épandage est-il fait selon la dose recommandée ?

1. Oui, 2. Non 3. Ne Salt Pas

5-13 Nombre de champs sous application

	Mil	Sorgho	Maïs	Arach.	Coton	Riz	Autres
0 %							
< 50 %							
> 50 %							

IDENTIFIANT:

7 - PRODUITS PHYTOSANITAIRES

7 - 1 L'Exploitant est-il informé du thème utilisation des produits phytosanitaires ?

1. Oui, 2. Non

7 - 2 Si Oui, Comment a-t-il été informé ?

1. Vulgarisateur 4. Moyens audio-visuels
2. Radio 5. Autres Exploitants
3. Journaux ou affiches 6. Autres Sources

7 - 3 L'Exploitant a-t-il testé le thème ?

1. Oui, 2. Non

7 - 4 Si Oui, quel est le temps écoulé entre l'information et le test ?

7 - 5 A-t-il adopté le thème ?

1. Oui, 2. Non

7 - 6 Si Oui: a) quel temps s'est écoulé entre le test et son adoption définitive ?

b) quel temps s'est écoulé entre l'information sur le thème et son adoption définitive au cas où il n'y a pas eu de test ?

7 - 7 Si Non, pourquoi ne l'a-t-il pas adopté ?

1. Thème Inconnu ou méconnu 6. Insécurité Foncière
2. Manque de main d'œuvre 7. Spéculation jugée sans intérêt
3. Ressource financière 8. Pas d'agent de vulgarisation
4. Intrants non disponibles 9. Autres
5. Commercialisation

7 - 8 L'Exploitant a-t-il utilisé des produits phytosanitaires au cours de la campagne agricole 90-91 ?

1. Oui 2. Non

7 - 9 L'exploitant utilise-t-il des produits phytosanitaire ?

1. Sur toute ou plus de la moitié de l'exploitation ?
2. Sur moins de la moitié de l'exploitation ?

7 - 10 Depuis combien d'années ?

7 - 11 Nombre de champs sous application

	Mil	Sorgho	Mais	Arach.	Coton	Riz	Autres
0 %							
< 50 %							
> 50 %							

IDENTIFIANT:

9 - CULTURE MOTORISEE

9 - 1 L'Exploitant est-il informé du thème " pratique de la culture motorisée " ?

- 1. Oui, 2. Non

9 - 2 Si Oui, Comment a-t-il été informé ?

- 1. Vulgarisateur 4. Moyens audio-visuels
2. Radio 5. Autres Exploitants
3. Journaux ou affiches 6. Autres Sources

9 - 3 L'Exploitant a-t-il testé le thème ?

- 1. Oui, 2. Non

9 - 4 Si Oui, quel est le temps écoulé entre l'information et le test ?

9 - 5 A-t-il adopté le thème ?

- 1. Oui, 2. Non

9 - 6 Si Oui: a) quel temps s'est écoulé entre le test et son adoption définitive ?

b) quel temps s'est écoulé entre l'information sur le thème et son adoption définitive au cas où il n'y a pas eu de test ?

9 - 7 Si Non, pourquoi ne l'a-t-il pas adopté ?

- 1. Thème inconnu ou méconnu 6. Insécurité Foncière
2. Manque de main d'œuvre 7. Spéculation jugée sans Intérêt
3. Ressource financière 8. Pas d'agent de vulgarisation
4. Intrants non disponibles 9. Autres
5. Commercialisation

9 - 8 L'Exploitant a t-il pratiqué la culture motorisée au cours de la campagne 1990-91 ?

- 1. Oui, 2. Non

9 - 9 L'Exploitant pratique t-il la culture motorisée ?

- 1. Sur toute ou plus de la moitié de l'exploitation ?
2. Sur moins de la moitié de l'exploitation ?

9 - 10 Depuis combien d'années pratique t-il la culture motorisée ?

9 - 11 Nombre de champs sous application

Table with 8 columns: Mil, Sorgho, Maïs, Arach., Coton, Riz, Autres and 3 rows: 0 %, < 50 %, > 50 %

IDENTIFIANT:

10 - L'ASSOLEMENT - ROTATION

10 - 1 L'Exploitant est-il informé du thème de la succession culturelle ?

1. Oui, 2. Non

10 - 2 Si Oui, Comment a-t-il été informé ?

1. Vulgarisateur 4. Moyens audio-visuels
2. Radio 5. Autres Exploitants
3. Journaux ou affiches 6. Autres Sources

10 - 3 a-t-il testé le thème ?

1. Oui, 2. Non

10 - 4 Si Oui, quel temps s'est écoulé entre l'information et le test ?

10 - 5 A-t-il adopté le thème ?

1. Oui, 2. Non

10 - 6 Si Oui: a) quel temps s'est écoulé entre le test et son adoption définitive ?

b) quel temps s'est écoulé entre l'information sur le thème et son adoption définitive au cas où il n'y a pas eu de test ?

10 - 7 Si Non, pourquoi n'a-t-il pas adopté le thème ?

1. Thème inconnu ou méconnu 6. Insécurité Foncière
2. Manque de main d'œuvre 7. Spéculation jugée sans intérêt
3. Ressource financière 8. Pas d'agent de vulgarisation
4. Intrants non disponibles 9. Autres
5. Commercialisation

10 - 8 L'Exploitant a-t-il pratiqué la succession culturelle telle que recommandée au cours des deux dernières campagne agricoles ?

1. Oui, 2. Non

10 - 9 Depuis combien d'années pratique t-il la succession culturelle ?

10 - 10 La succession culturelle recommandée est elle pratiquée ?

1. Sur toute ou plus de la moitié de l'exploitation ?
2. Sur moins de la moitié de l'exploitation ?

10 - 11 Nombre de champs sous application

	Mil	Sorgho	Maïs	Riz	Coton	Arach.	Autres
0 %							
< 50 %							
> 50 %							

IDENTIFIANT:

11 - LUTTE ANTI-EROSIVE

11 - 1 L'Exploitant est-il informé du thème de la lutte anti-érosive ?

1. Oui, 2. Non

11 - 2 Si Oui, Comment a-t-il été Informé ?

- | | |
|-------------------------|-------------------------|
| 1. Vulgarisateur | 4. Moyens audio-visuels |
| 2. Radio | 5. Autres Exploitants |
| 3. Journaux ou affiches | 6. Autres Sources |

11 - 3 a-t-il testé le thème ?

1. Oui, 2. Non

11 - 4 Si Oui, quel est le temps écoulé entre l'information et le test ?

11 - 5 A-t-il adopté le thème ?

1. Oui, 2. Non

11 - 6 Si Oui: a) quel temps s'est écoulé entre le test et son adoption définitive ?

b) quel temps s'est écoulé entre l'information sur le thème et son adoption définitive au cas où il n'y a pas eu de test ?

11 - 7 Si Non, pourquoi n'a-t-il pas adopté le thème ?

- | | |
|-----------------------------|-----------------------------------|
| 1. Thème inconnu ou méconnu | 6. Insécurité Foncière |
| 2. Manque de main d'œuvre | 7. Spéculation jugée sans intérêt |
| 3. Ressource financière | 8. Pas d'agent de vulgarisation |
| 4. Intrants non disponibles | 9. Autres |
| 5. Commercialisation | |

11 - 8 L'Exploitant a t-il pratiqué au cours de la campagne 90-91 la méthode de lutte anti-érosive ?

1. Oui, 2. Non

11 - 9 Quelles sont les méthodes de lutte anti-érosive généralement utilisées ?

1. Cordon pierreux
2. Diguettes en terre
3. Végétalisation sur courbe de niveau
4. Diguettes ou cordons pierreux végétalisés
5. Autres

11 - 10 La lutte anti-érosive est-elle pratiquée ?

1. Sur toute ou plus de la moitié de l'exploitation ?
2. Sur moins de la moitié de l'exploitation ?

11 - 11 Sur quelles cultures la lutte anti-érosive est-elle pratiquée ?

- | | |
|-----------|-------------|
| 1. Mil | 5. Coton |
| 2. Sorgho | 6. Arachide |
| 3. Mais | 7. Autres |
| 4. Riz | |

IDENTIFIANT:

12 - AGROFORESTERIE

12 - 1 L'Exploitant est-il Informé du thème de l'agroforesterie ?

1. Oui, 2. Non

12 - 2 Si Oui, Comment a-t-il été Informé ?

- | | |
|-------------------------|-------------------------|
| 1. Vulgarisateur | 4. Moyens audio-visuels |
| 2. Radio | 5. Autres Exploitants |
| 3. Journaux ou affiches | 6. Autres Sources |

12 - 3 a-t-il testé le thème ?

1. Oui, 2. Non

12 - 4 Si Oui, quel temps s'est écoulé entre l'information et le test ?

12 - 5 A-t-il adopté le thème ?

1. Oui, 2. Non

12 - 6 Si Oui: a) quel temps s'est écoulé entre le test et son adoption définitive ?

b) quel temps s'est écoulé entre l'information sur le thème et son adoption définitive au cas où il n'y a pas eu de test ?

12 - 7 Si Non, pourquoi n'a-t-il pas adopté le thème ?

- | | |
|-----------------------------|-----------------------------------|
| 1. Thème Inconnu ou méconnu | 6. Insécurité Foncière |
| 2. Manque de main d'œuvre | 7. Spéculation jugée sans intérêt |
| 3. Ressource financière | 8. Pas d'agent de vulgarisation |
| 4. Intrants non disponibles | 9. Autres |
| 5. Commercialisation | |

12 - 8 L'Exploitant a-t-il pratiqué au cours de la campagne 90-91 l'agroforesterie selon les normes recommandées ?

1. Oui, 2. Non

12 - 9 Depuis combien d'années pratique t-il l'agroforesterie ?

12 - 10 Sur quelles cultures applique t-il l'agroforesterie ?

- | | |
|-----------|-------------|
| 1. Mil | 5. Coton |
| 2. Sorgho | 6. Arachide |
| 3. Maïs | 7. Autres |
| 4. Riz | |

12 - 11 L'exploitant pratique t-il l'agroforesterie ?

1. Sur toute ou plus 1/2 exploitation
2. Sur moins 1/2 exploitation

B - QUESTIONNAIRE VOLET ELEVAGE

13 - ANIMAUX

IDENTIFIANT: | | | | | | | |

13 - 1 Quelles espèces animales possède l'exploitant ?

- | | | |
|-----------|-------------|-----------|
| 1. Bovins | 3. Caprins | 5. Asins |
| 2. Ovins | 4. Camelins | 6. Equins |

| | | | | | | |

13-2 Quel est l'effectif des animaux par espèce élevée présent sur l'exploitation et quel est le sexe de leur propriétaire ?

EXPECES ANIMALES	Nbre de têtes par Propriétaire		Nbre de têtes n'appartenant pas à l'exploit.
	Homme	Femmes	
Bovins			
Ovins			
Caprins			
Asins			
Equins			
Camelins			

14 - MODE: Quel est le mode le plus pratiqué ?

- | | | |
|----------------|---------------|----------|
| 1. Transhumant | 2. Sédentaire | 3. Mixte |
|----------------|---------------|----------|

| | | |

15 - HABITAT

15 - 1 L'Exploitant possède t-il un habitat pour les animaux ?

- | | |
|---------|--------|
| 1. Oui, | 2. Non |
|---------|--------|

| |

15 - 2 Si Oui, cet habitat est pour ?

- | | | |
|-----------|-------------------------------|----------|
| 1. Bovins | 2. Petits ruminants | 3. Mixte |
| | - Superficie Bovins | |
| | - Superficie petits ruminants | |
| | - Superficie mixte | |

| | | |

| | | | | -2

| | | | | -2

| | | | | -2

15 - 3 Dans quel cas est l'habitat ?

- | | |
|------------------------------------|----------------------|
| 1. Simple enclos | 2. Couvert sans parc |
| 3. Partiellement couvert avec parc | |

| | | |

15 - 4 S'il est couvert, combien de fois est-il nettoyé par an ?

| | |

IDENTIFIANT:

C - ENCADREMENT DE L'EXPLOITANT

- 23 - L'Exploitant est-il un encadré agro-pastoral ?**
 1. Oui, 2. Non
 Si Oui, 1. CRPA 4. Projets spécifiques
 2. SOFITEX 5. Autres
 3. O N G
- 24 - L'Exploitant est-il membre de :**
 1. Groupement villageois ? 3. groupe de travail (GT) ?
 2. Coopérative ?
- 25 - L'exploitant est-il alphabétisé (en n'importe quelle langue) ?**
 1. Oui 2. Non
- 26 - Qui dans l'exploitation a participé aux ATG cette campagne ?**
 1. l'exploitant 2. son représentant
- 27 - Combien de fois l'exploitant ou son représentant a-t-il rencontré cette campagne l'encadreur ?**
 a) aux A. T. G. (nbre)
 b) aux A. S. V. E. (nbre)
 c) Autres rencontres de travail (nbre)
 - à l'initiative de l'exploitant
 - à l'initiative de l'agent
- 28 - Citez les lieux où l'encadreur rencontre le plus fréquemment l'exploitant ?**
 1. Champ Ecole 4. en salle de réunion
 2. Champ individuel 5. sur troupeau de démonstration
 3. Domicile 6. Autres
- 29 - Quand est ce qu'a eu lieu la dernière rencontre (mois/année)** /
- 30 - Quand l'exploitant espère-t-il la prochaine visite (mois/année)** /
- 31 - L'exploitant a-t-il assisté cette campagne aux :**
 1 - journées de démonstration
 2 - visites commentées
 3 - visites de PAPEM
- 32 - L'exploitant possède-t-il ?**
 1 - une micro-parcelle ?
 2 - une parcelle d'application ?
 3 - une parcelle d'essai ?

IDENTIFIANT:

D - L'EQUIPEMENT AGRICOLE

40 - Quel est l'équipement agricole dont dispose l'exploitant cette campagne ? (nombre)

Nature de l'équipement	Utilisé	Non Utilisé	TOTAL
Tracteur	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Charrue bovine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Charrue asine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Charrettes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Houes manga	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Brouettes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rayonneurs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Motoculteurs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Moto-pompes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pulvériseurs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pulvérisateurs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sémoirs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Corps sarcleurs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Corps butteurs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Herses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Egréneuses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ecrémeurs de lait	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Camions / remorques	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Daba	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hâches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Faucilles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pêles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

IDENTIFIANT:

41 - Animaux de trait (nombre).

Espèce animale	utilisés	non utilisés	Total
Bœufs de trait	<input type="text"/>	<input type="text"/>	<input type="text"/>
Anes de trait	<input type="text"/>	<input type="text"/>	<input type="text"/>
Chevaux de trait	<input type="text"/>	<input type="text"/>	<input type="text"/>
Chameaux de trait	<input type="text"/>	<input type="text"/>	<input type="text"/>

42 - Achat d'intrants agricoles

Intrants	Quantité en Kg	Valeur en F. CFA	Liquide (1) Crédit (2) Troc (3)
NPK	<input type="text"/>	<input type="text"/>	<input type="text"/>
UREE	<input type="text"/>	<input type="text"/>	<input type="text"/>
BURKINA PHOSPHATE	<input type="text"/>	<input type="text"/>	<input type="text"/>
SEMENCES SELECTIONNEES	<input type="text"/>	<input type="text"/>	<input type="text"/>
SEMENCES AMELIOREES	<input type="text"/>	<input type="text"/>	<input type="text"/>
AUTRES SEMENCES	<input type="text"/>	<input type="text"/>	<input type="text"/>
PESTICIDES	<input type="text"/>	<input type="text"/>	<input type="text"/>

MAIN D'ŒUVRE AGRICOLE

	Effectif	Nombre de jour de travail	Coût F. CFA	Mode de rémunération
MAIN D'ŒUVRE Utilisée dans l'exploitaton	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Pour le mode de rémunération : Inscribe les codes suivants :

- 1 - Pour paiement au comptant
- 2 - Pour paiement à crédit
- 3 - Pour paiement (association)
- 4 - Pour les dons (solidarité)

APPENDIX B

RESULTS OF THE FEW SURVEY

Education levels among the FEWs in Burkina Faso tend to be low, with only 16 percent having attended secondary school (see Table 29). Seventy-five percent of all FEWs had, however, completed a two-year course leading to a technical diploma in agriculture. With 32 percent of the FEWs with technical diplomas compared to 16 percent without these diplomas reporting less than ten years' work experience, a higher proportion of the FEWs with technical diplomas were more recent inductees into the extension service. Eighty percent of the sampled FEWs rated the "fortnightly" training provided to them by SMSs as being useful, and virtually all considered the extension messages disseminated by them to be relevant. Ninety percent of the FEWs indicated that farmers were receptive to these messages. The constraints identified by FEWs as preventing farmers from adopting the extension messages are discussed in Annex 7. The main impediments identified by FEWs to the effective delivery of their services were the poor condition of feeder roads, and the occurrence of large numbers of social events that caused farmers to miss scheduled extension activities (e.g. ATG sessions).

Table 29: Results of Field-Level Extension Worker Survey (percent of all respondent in indicated category)

	TECHNICAL DIPLOMA	NO TECHNICAL DIPLOMA
1. Technical Training	75	25
2. Years of Work Experience		
Up to 10 years	32	16
11-20 years	52	53
Over 20 years	16	31
3. Rating of In-service Training		
Useful	80	81
Not useful	1	1
Undetermined	19	18
4. Rating of Extension Messages		
Generally relevant	98	96
Not relevant	2	4
5. Rating of Farmers' Receptiveness of Messages		
Receptive	90	90
Not receptive	10	10
6. Constraints on Effectiveness		
Lack of Transport	14	19
Poor Feeder Road Conditions	32	33
Lack of New Messages	2	3
Social Events	37	33
Other reasons	15	12

APPENDIX C

Table 30: Extension Expenditures ('000 1991 CFA)

	PRE-T&V	T&V PILOT STAGE				T&V NATIONAL		
	1985/86	1986/87	1987/88	1988/89	Average	1989/90	1990/91	Average
Investment	467,164	458,304	486,822	468,199	471,108	74,252	257,799	166,026
Recurrent	1,438,636	1,242,554	1,653,602	1,639,539	1,511,898	1,302,728	1,552,364	1,427,546
FEW Salaries	285,835	336,031	336,131	365,118	345,760	371,982	384,332	378,157
Total	1,905,800	1,700,858	2,140,424	2,107,738	1,983,006	1,376,980	1,810,163	1,593,572

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