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An FSR/E Application: Identification of Targets for Technology Generation and Transfer

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Abstract

Identification of targets for technology generation and transfer processes has become one of the prime activities in current agricultural development programmes. This is mainly because adverse results encountered with the dissemination of agricultural innovations with blanket recommendations in past agricultural development programmes. The Farming Systems Research and Extension (FSR/E) methodology emphasizes the importance of identifying target categories or recommendation domains for agricultural research and extension programmes. The essence of this concept is to offer location specific recommendations to well defined homogeneous farmer groups after a process of experimentation designed on farmers' needs. This paper attempts to identify target categories in an agro-ecological zone in one of the southern rice-growing districts, *Matara*. A series of exploratory studies and a sample survey have been conducted in the study area. Results demonstrate that three recommendation domains can be identified based on the production conditions experienced by the farmers. Such targets can be explained on the basis of three landscape levels and farmers belonging to one area were confronted with similar problems. The upper area has experienced surface soil acidification and water stress whereas lower areas are subjected to salinisation and excess water condition. Such problems were also observed in the intermediate area, but at a comparatively low intensity. Further, differences were observed in yield potential and cropping intensity among the identified targets. Therefore, it is worthwhile to orient technology generation and dissemination programmes according to the three pre-identified target categories.

1 Introduction

During the past three decades research and extension efforts were directed towards

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increasing agricultural production with special attention given to the needs of small farmers. However, it is often argued that technology generation and dissemination processes were not geared to offer practical solutions to farmers' pressing needs. In fact, the famous experimental model and diffusion strategies have not yielded expected outcome. In this environment, issues such as inappropriate technologies, blanket recommendations, top-down approach, isolated research and weak institutional linkages were considered by policy makers, researchers, extension workers and other personnel involved in agricultural development. Different strategies were formulated and executed especially in the developing countries to overcome such adverse conditions and also to fulfil pressing farmer needs, the results obtained have not been satisfactory. The concept of **Farming Systems Research and Extension** (FSR/E) attracted the attention of scientists as it provides a conceptual framework to evolve technologies according to farmers' needs. The key concepts of FSR/E can be explained with the themes of (i) farmer orientation (ii) systems orientation (iii) as a complement to commodity and disciplinary agricultural research (iv) technology testing (v) interdisciplinary effort (vi) problem solving approach and (vii) feedback (Sands, 1986). It uses database analysis more reliably and effectively to define **recommendation domain** which is useful as a way of delimiting the level of specify to be followed. The methodological aspect of FSR/E has been well documented by Gilbert et al (1980), Collinson (1985, 1987) and Simmonds (1986). The FSR/E approach generally involves five stages: situation analysis, planning, on-farm testing and verification, evaluation and dissemination. The purpose of situation analysis stage is to describe and understand the prevailing production constraints in order to identify homogeneous targets for technology generation and transfer. Based on an experiment Doorman (1991) has demonstrated the validity of identifying such targets or recommendation domains. Further, Johnson and Claar (1986) and Byerlee et al (1991) have highlighted the vital need for pre-identified target groups in FSR/E programmes. The ecological sustainability of the approach has also been tested in the context of agriculture - aquaculture farming in China (Dalsgaard et al, 1995). Further, experimentation with diffusion effects was undertaken by Wijeratne and Chandrasiri (1993), ICRA (1994), and Wahbi et al (1994).

This study attempts to cluster fairly homogeneous client groups on agro- ecological and socio-economic variables and, consequently, identifies different farmers' needs within each target area.

2 Methodology

This study has been carried out in a southern rice-growing district of Sri Lanka, *Matara*. The coastal agro-ecological zone (WL_4) was selected for the investigation. A major part of this agro-ecological zone comes under the purview of **Nilwala Ganga Flood Protection and Reclamation (NGFPR) Scheme**. This scheme began in 1983 and stage I *(Kiralakelle)* was completed in 1986. The study domain belongs to the area covered by stage I of the NGFPR Scheme. After completion of the NGFPR scheme, rice farmers confronted **soil degradation** and **water imbalance** situations. As a result, many farmers experienced crop failures and abandoned their previously cultivated rice fields. It was found that crop failures were severe in four Assistant Government Agents' (AGAs') divisions in the agro-ecological zone (WL_4), namely, *Malimbada, Weligama, Thihagoda and Matara.* The location selection was done using the following criteria:

a) occurrence of crop failures,

b) dominance of rice culture and

c) dominance of small farmers.

Efforts were made to identify the main clusters for the study on the basis of *Grama Niladharis'* (GNs') divisions, on the information received from field visits to the area under four AGA's divisions and having discussions with AGA's, Irrigation Officers, GNs and farmers, in addition to the data gathered through case studies and available secondary sources. The above procedure facilitated identification of 28 GNs' divisions as the clusters with very severe crop damage. The farmers lists (5837 rice farmers) obtained from these 28 GNs' were considered as the **sampling frame** for the study. A proportionate sample (5% from each cluster) was drawn. The final sample consisted of 291 rice farmers.

Exploratory studies were also conducted in the above GNs' divisions. Reconnaissance and case study data revealed that the two problems identified, namely **soil degradation** and **water imbalance** situations, have adversely affected rice cultivation in the selected locations. Based on the collected information, a questionnaire was developed as a data gathering tool. This was pre-tested with 20 farmers outside the sample and, later, relevant modifications were made.

The farmer interviews and field investigations were carried out during wet *(maha)* 93 - 94 season and dry *(yala)* season 94. The questionnaire was used to obtain information for the same seasons. Throughout the two seasons, a series of exploratory field investigations were made with special attention paid to the crucial stages of the field problems. Further, special field tests and on-farm observations were undertaken. Information gathered through the questionnaire was processed and transferred into working schedules. Data obtained through the case studies, field observations and field tests were also processed and recorded. Available secondary information was also utilised for the study.

3 Results and Discussion

3.1 Location

The study location belongs to the low country wet-zone and classified as agro-ecological zone WL_4. Topography is characterised by flat terrain. The rice soils in the area are generally acidic (Balasuriya, 1989). However, the major part of the selected domain is covered by the acid sulphate soils where the pH drops as low as 2.5 during the dry spells. Alluvial soils, gray sandy, loam soils and bog and half bog soils are found in the location.

The annual mean rainfall in the coastal agro-ecological zone approximates 1900 mm over the long term (Balasuriya et al , 1989) and the mean annual temperature is 28°C. The agricultural economy relies greatly on the rice-based farming system. Therefore farmers' sustainability depends on the net income generated by the rice enterprise. A two-fold pattern of land use system which consists of lowland and homegarden is common in the area. Rice is cultivated in 2 major cropping seasons, *yala* (March - August) and *maha* (September - February) which correspond to South West and North East monsoons, respectively. The long term monthly average rainfall pattern implies a bi-modal rainfall distribution having peak rainfalls during April - May and September - October (Balasuriya et al, 1989). Further, *yala* season received comparatively less rainfall. The agro-ecological zone WL_4 has experienced 2-4.5 month period of drought annually during the last five decades (Wijeratne 1988). Balasuriya et al (1989) have stated that during the period 1984-89 this domain experienced frequent spells of droughts particularly in the *yala* season, resulting in water stress, surface soil salinity and acidity. In fact, during the recent years, drought spells occurred intensively, causing severe crop failures. The coastal flood plain consists of 6,250 ha of rice cultivation of which, approximately 1,600 ha have been severely affected by the **soil degradation** and **water imbalance** situations (Wijeratne and Chandrasiri, 1991). Delphachitra (1988) has also documented that rice fields in the flood plain were severely affected. Farmers have totally abandoned their rice fields in the severely affected areas. Further, in surrounding locations too, farmers have experienced crop failures due to similar reasons. The field observations imply that the problems vary, to a high degree, are location dependent. The selected clusters cover the major areas subjected to crop failures due to the above problems.

3.2 Identification of farmer's problems

After completion of the NGFPR Scheme, although the flood damage to the location was minimised, rice cultivation in the domain encountered a series of **new** problems. As mentioned earlier, these problems can be broadly classified as **soil degradation** and **water imbalance**. The soil degradation is mainly caused by low pH levels and saline condition in the dry spells. Studies undertaken by Balasuriya (1989), De Silva (1986), Wijeratne and Chandrasiri (1991) have highlighted the above facts. It is evident that certain parts of the domain have been subjected to strong surface soil acidification, pH reducing to as low as 2.8 and lower. In certain locations soil was strongly salinised (Ec 4-9 m.mhos) when rice fields run dry (Balasuriya, 1989). The water imbalance situation is characterised by water excess condition in the rice fields located in the lower areas throughout the cultivation season and water deficit condition in the upper areas during dry periods. Even though the farmers have adopted modern High Yielding Varieties (HYVs) and started double cropping, the above problems have subsequently resulted in crop failures. Therefore, farmers could not receive a reasonable net farm income from their small plots. As a result, some farmers have totally abandoned their rice cultivation, whereas some have received marginal net returns as they cultivate their fields under these adverse conditions.

The above field observations, field tests, exploratory studies and also available secondary information facilitated further classification of the prevailing problems in the area. The water imbalance situation can be identified as **excess** or **deficit** water conditions whereas the soil degradation situation can be classified as **saline** and **acidic** conditions.

3.3 *Identification of targets: the recommendation domains*

The study reveals that the identified problems vary according to the **elevation of the landscape**. As an example, strong surface soil acidification and water stress during the dry spells were confined to the upper parts of the area. In fact, the field observations reveal that iron toxicity affects the plants when the soil pH reduces to as low as 4.5 - 3.5 under water deficit conditions. Salinisation and excess water conditions are experienced in the lower areas. However, between the above extremes the intermediate area was confronted with the same problems, but in most instances, in a tolerable form. It is also evident that yield potential, cropping index, crop failures due to identified adverse conditions and technology adoption differs in these three production conditions. Therefore, this study identified the **recommendation domains** on three landscape elevations, such as upper areas (>1 m MSL), intermediate areas (1 to 0 m MSL) and lower areas (0> m MSL). The clusters were classified according to these three recommendation domains. The bench marks were used to determine the elevations of the clusters. Table 1 shows the results.

Table 1: Identification of target areas

Target area	Cluster Nos.	No. of farmers	Major problems
Upper	1 - 11	2562	strong soil acidification, water stress.
Intermediate	12 - 19	1771	acidification and water stress on a tolerable form.
Lower	20 - 28	1504	salinisation, excess water.

Source: Results of the field investigation

Next, efforts were made to categorise the 28 clusters according to the **intensity** of each identified problem. The field observations carried out during the reference seasons broadly classified these clusters but the results of the farmer survey facilitated identification of the clusters in a more precise manner on the intensity of the problems. Based on a scoring procedure, an index was constructed for each problem. The score range

(0-3) of each index was divided into four categories as high intensity of problem (3), moderate intensity of problem (2), low intensity of problem (1) and no problem (0). This classification is regarded as a proxy to the intensity of the problem. Subsequently, farmers of a particular cluster were given the appropriate scores for each problem and the total score for each problem was calculated separately. This, in fact, is regarded as the **actual score** for a particular problem for a particular cluster. At the same time, a **theoretical** maximum score was calculated for each cluster for a particular problem. This was done assuming that all the farmers have encountered high intensity (3) for a particular problem. As the sample number is fixed to a cluster, all the problems received the same theoretical maximum score. This maximum score was considered as 100% intensity of the problem index and this score range (0-100%) was divided into four **intensity categories** as low intensity (0-25%), moderate intensity (26-50%), high intensity (51-75%) and very high intensity (76-100%). Later, the actual score for a particular problem was converted into a percentage, according to the above index and relevant intensity category was assigned. Table 2 shows the classification of clusters according to the intensity of the problems.

The above findings reinforce the fact that the study area can be further categorized into three target areas as earlier conceived. In fact, the clusters confined to respective target areas imply similar adverse conditions. As an example, the clusters belonging to upper area have experienced water stress and acidification, whereas clusters confined to lower area have been confronted with excess water condition and salinization. Such empirical evidence implies that the production conditions prevailing in such clusters are similar. Therefore, it can be regarded that the farmers belonging to an identified target are a **homogeneous** category.

4 Conclusions

Empirical evidence of this study reveal that prior to the NGFPR Scheme, the study area has been subjected to frequent flood damage resulting in severe crop failures. In fact, the rice cultivation of the coastal agro-ecological zone was seriously affected. The scheme was planned and executed as a **flood protection** scheme and one of its main objectives was to protect 5,000 ha of rice land in the coastal flood plain. However, after completion of the scheme, farmers encountered new problems that can be broadly classified as **soil degradation** and **water imbalance** situations.

Although the study area was considered as one area, according to the nature and intensity of the problems three recommendation domains can be identified as upper, intermediate and lower. Farmers confined to a particular domain can be regarded as a **homogeneous** category as they encounter the same set of problems that require similar solutions. In fact, one recommendation domain can be considered as a cluster with similar production conditions. The upper area experiences low pH and water deficit condition whereas the lower area experiences a submerged situation and salinisation during the high tidal periods of the river. The intermediate area also shows acidification and water stress

Table 2: Classification of clusters according to intensity of the problems.

Cluster	Landscape	Intensity of the problem			
No.	Elevation (m.MSL)*	Acidification	Salinization	Water Stress	Excess water
1	>1m.MSL			xxxx	
2	-do-		xxxx		
3	-do-		xxx		
4	-do-	x		xx	
5	-do-			xxxx	
6	-do-	x		xxxx	
7	-do-				
8	-do-	xxx		x	
9	-do-	xxx	x		
10	-do-	xx		x	
11	-do-	xxx		x	
12	1 to 0m.MSL				
13	-do-	xxx		x	
14	-do-	xx		xx	
15	-do-	xx		xx	
16	-do-	xx		xx	
17	-do-	xx		xx	
18	-do-	xxx		x	
19	-do-	xxx		x	
20	< 0m.MSL	x			xxx
21	-do-	x		x	xx
22	-do-	x		xx	x
23	-do-	x	xxx		xx
24	-do-	x	xxx		xx
25	-do-	x	x		xxx
26	-do-	x	x		xxx
27	-do-	xx	xx		x
28	-do-	xx	x		x

*m. MSL - Meters from Mean Sea Level
Source : Results of the field investigation

Key to intensity of problems:
x - low
x x - moderate
x x x - high
x x x x - very high

conditions, but at a low intensity. According to the yield potential, the above three areas: upper, intermediate and lower, can be classified as low, high and intermediate yield potential areas in relative terms.

As the three target areas encounter different problems pertaining to rice cultivation, **farmer's needs** or expected solutions also differ among these target areas. Different treatments or technical packages should be employed to increase the rice production in the three areas.

This investigation used the concept of FSR/E to identify the prevailing problems in the study area. The situation analysis was done for two consecutive seasons and, based on the results obtained, three targets or recommendation domains have been identified. This classification can be used in the processes of technology generation and transfer in order to offer appropriate solutions and to fulfill the different farmer needs confined to separate client groups.

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