THE DEVELOPMENT AND ROLE OF NOVEL FARM MANAGEMENT METHODS FOR USE BY SMALL-SCALE FARMERS IN DEVELOPING COUNTRIES

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Abstract

A key aspect of farm management is decision making and a variety of methods to assist with decision making are widely used in commercial agriculture, ranging from simple budgets through to complex computer models. The vast majority of the worlds' farmers however have relatively small units of land and are in developing countries. It is widely accepted that these farmers make rational decisions within the challenging, complex, and risky environments that they operate. Despite major training and dissemination initiatives over many years, supported by national governments and international organisations to encourage farmers and extension staff to use farm management budgeting methods, uptake has remained extremely low. This paper reports on a research project funded by the UK Department for International Development, that firstly identified what small-scale farmers wanted from decision making methods and then worked with farmers and advisors in Ghana and Zimbabwe to develop and evaluate new and appropriate methods. These methods, in particular participatory budgets, have subsequently been successfully used in a range of developing countries. Results from activities conducted to evaluate participatory budgets are presented together with experience of their use for a variety of farm management functions, including planning and decision making. The findings demonstrate that they provide a useful method for small-scale and for non and semi-literate farmers operating in challenging environments, as well as for extension and research staff working with them.

Keywords: participatory budget, participatory farm management method, PRA, decision making, planning, response farming

The Need for New Farm Management Methods

Farm management is essentially about decision making and farm management methods are widely used in commercial agriculture. These include various budgets such as gross margins, net margins, profit and loss accounts, balance sheets and more complex techniques including the use of linear programming models. However the majority of the world's farmers do not use such conventional farm management methods and neither do most of the government and non government agencies who work with them. This is despite several initiatives to facilitate their use, particularly in the 1980s as part of extension approaches funded by international organisations.

The majority of world's farmers is small-scale, operate in challenging, complex and risky environments, and are widely regarded to make rational decisions about their farms and other activities they are engaged in. Many of these farmers are non or semi- literate. Despite several authors identifying the need for more

appropriate farm management methods for small-scale farmers in developing countries in the 1980s (Harding, 1982; Rehman and Dorward, 1984) an extensive review of the literature and consultation of experts in the field indicated that no work had been conducted to address this need by 1996 (Dorward et al., 1997). This paper provides an overview of research subsequently conducted to develop and evaluate novel farm management methods for small-scale farmers in developing countries. A research project was funded by the UK Department for International Development (DFID) and was mainly conducted in Zimbabwe and Ghana. The paper also draws on experience of the use of the methods in a wide range of countries. The work involved:

Identifying the decision making requirements of small-scale farmers;

Developing and modifying new farm management methods with farmers and extension staff;

Evaluating the new methods through a variety of approaches and for different uses;

Disseminating the new methods through training, extension, and publication of training materials.

Developing New Farm Management Methods

Figure 1 summarises the main processes used in developing new methods. Small-scale farmers, extension staff and relevant experts were consulted to consider what types of decisions small-scale farmers make about allocating resources, how they do so and therefore what types of methods are needed. This included widespread informal consultation in several countries and formal and informal survey work in Zimbabwe. A comprehensive review of the international literature was also conducted. These activities were also used to establish why existing conventional farm management methods were not widely used and had failed to meet small-scale farmers' needs. The understanding gained was then used in the design of novel methods. Four main limitations of conventional farm management methods were identified and that novel methods would need to address:

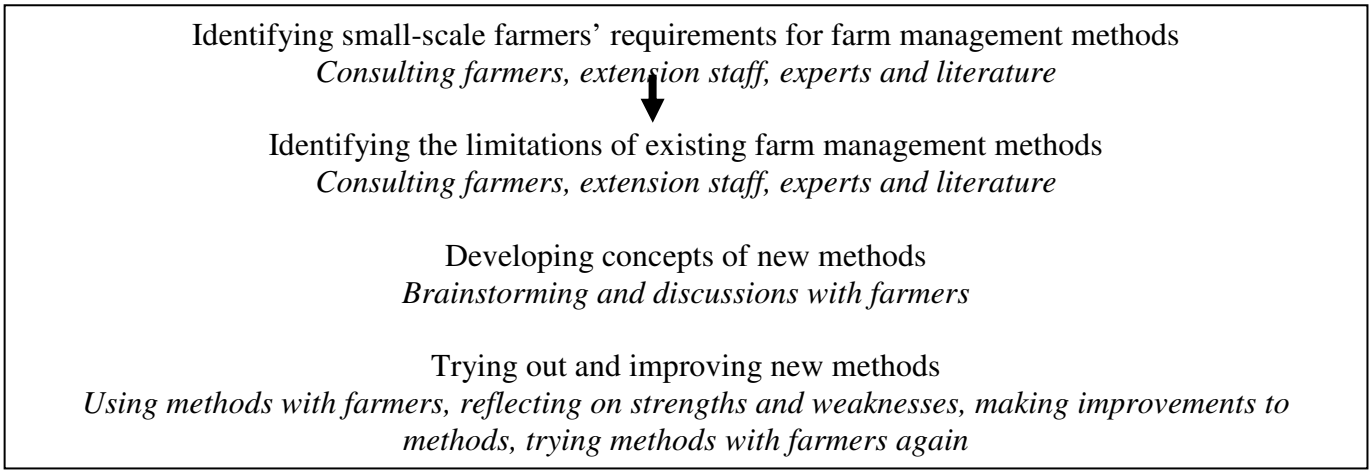
1. Conventional farm management methods focus on financial measures e.g. profit, cash, or worth. They generally work on the premise that profit maximisation or increasing worth are the main objectives of users. In reality small-scale farmers operating in harsh and unpredictable environments frequently have other objectives such as to reduce risk through improving food security. Resources other than cash are therefore important in decision making.

2. Conventional farm management methods focus on the final output (e.g. profit at the end of the production period) and do not take into account changes with time during a production period or season. Changes during the production period may be crucial to small-scale farmers (e.g. availability of food, livestock forage, labour, cash) and unpredictable natural and economic conditions may have major impacts. Therefore farmers often take important decisions during a season, depending on conditions at that particular point (e.g when it is evident how good the rains have been, how much labour they have or how healthy a crop looks). Stewart (1986) has described this as 'response farming'.

3. Conventional farm methods are relatively complex and difficult to use, particularly for non or semi-literate farmers. They are therefore not easily used by the majority of the world's farmers, either on their own or with advisers.

4. Conventional methods often require a limited amount of equipment to use eg personal calculators or even computers. Even the use of pen and paper can be inappropriate with non or semi-literate farmers.

Figure 1: The main activities in the development of new farm management methods

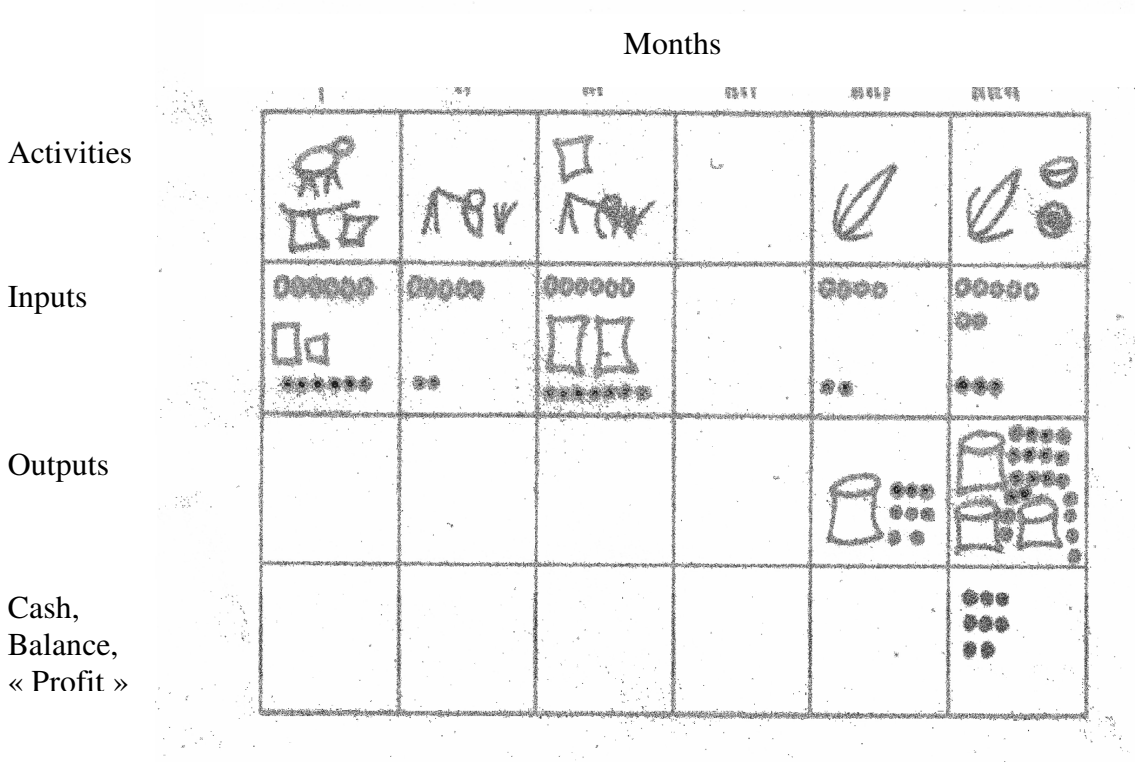


Participatory approaches, referred to as Participatory Learning and Action (PLA), have become widely used and furthermore demonstrate rural peoples' abilities to diagram, map and score. The emphasis on visualisation, together with analysis and ownership of information by farmers, provided valuable lessons. Participatory farm management methods were therefore developed that drew on both PLA and on understanding gained of small-scale farmers requirements for farm management decision making methods noted above. Initial ideas were brainstormed and then tried and discussed with Ugandan farmers and subsequently further developed and refined working with Zimbabwean small scale farmers.

Participatory Budgets

Of the methods that were developed, participatory budgets received the most attention and have subsequently been used the most widely. The remainder of the paper therefore focuses on participatory budgets. (Descriptions of all the methods and examples of their use are presented in a training manual, Galpin et al., 2000.) Participatory budgets examine the use and production of resources over time for an enterprise. Normally they are constructed for one production period e.g. a whole season for a crop. They are prepared by farmers with counters and symbols on a board or grid. Figure 2 illustrates the basic layout. The columns represent periods of time e.g. months or weeks. The top row is used to show (with symbols) the activities for the enterprise in each time period (e.g. ploughing and planting in month one, weeding in month three). The second row is used for all resources required for each activity. Types of resources are indicated by different counters and amounts of resources are quantified by the numbers of counters. The final row (or rows) is used for all resources produced (the outputs or products) and different counters represent types of resources and the amounts of counters represent the quantities produced. Balances of resources can be calculated and if farmers want to, enterprise 'profit' can be calculated by giving all resources cash values. Drawings and symbols can be used instead of counters. Copies of participatory budgets are normally made on flip chart paper for farmers and other participants to refer back to.

Figure 2. Example layout of a participatory budget



Participatory budgets build on lessons from a traditional board game played throughout much of Africa and in areas of south east Asia, known as 'mancala' ('tsoro' in Zimbabwe, 'oware' in Ghana). The game involves calculating and moving numbers of counters and often is played at high speed. It is played widely by non and semi-literate people thereby showing that they are often highly numerate. Participatory budgets can be used for several purposes including:

Analysing farmers' existing activities and use and production of resources;

Exploring the implications of making a change to an enterprise (e.g. using organic rather than inorganic fertiliser, introducing an intercrop);

Comparing different enterprises;

Planning a new enterprise.

These planning and decision-making functions of farm management can be conducted by individual or groups of farmers, often facilitated by an adviser. 'What if' questions can be identified by farmers and their possible outcomes (scenarios) explored e.g. what would happen if the rains failed or prices dropped in a particular month (rather like the use of a computer spreadsheet). Participatory budgets can also be used during production to help predict the effects of conditions once they are known (labour availability etc) and to make decisions on actions and allocation of resources for the remainder of the period. Finally, participatory budgets can be used by and with farmers to plan, conduct, and analyse the results from on-farm research. Although figure 2 illustrates their simple structure, participatory budgets normally contain much more information than is shown here. Also not reflected here is the learning that takes place during the creation of a participatory budget due to farmers and facilitators sharing information and discussing experience with each other.

Evaluation of Participatory Budgets

A range of both formal and informal activities were used in the research project to test and evaluate participatory budgets and for a variety of uses. These are summarised in table 1 and involved conducting specific exercises in order to establish how well participatory budgets met specific criteria when used for different purposes and in different contexts. Some of the exercises were conducted in one session (eg using participatory budgets with farmers to plan a possible new enterprise) and others involved working over a longer period (e.g. using participatory budgets with farmers throughout a whole growing season). The activities were carried out over a three year period, and with farmers, extension staff and researchers and in different farming systems in Ghana and Zimbabwe and therefore enabled relatively comprehensive evaluation.

Table 1: Exercises and activities used to evaluate participatory budgets

Exercise or activity	Main information and observations
1. Field testing of participatory budgets by extension and farmers, to describe farmers existing enterprises and explore potential improvements and new enterprises. Series of short exercises with 23 extension staff in Zimbabwe.	Farmers, researchers and extension staffs' observations and scores e.g. for ease of use, usefulness
2. Long term evaluation with 22 extension staff incorporating use of participatory budgets into their work over seven months, in Zimbabwe.	Observations and uses recorded by extension staff. Evaluation workshop with extension staff at end of period. Experience of use of methods and strengths and weaknesses identified.
3. Exercises with farmers in two communities (one week each) to investigate the suitability of green manuring for vegetable farmers systems and resources. Ghana.	Documented report of results and of findings from the exercises. Farmers', researchers' and extension staffs' observations.
4. Long term needs assessment over one season. Compared farmers planned participatory budgets and actual practice during a season, and explored reasons for this, to better understand farmers systems and constraints faced. Ghana and Zimbabwe.	Analysis of data from planned and actual participatory budgets. Observations from farmers and facilitators.
5. Short controlled exercise with 10 extension staff and farmers to compare participatory budgets with approaches currently used by extension staff for exploring the feasibility of starting a poultry production enterprise, in Zimbabwe.	Extent and relevance of information covered using different approaches was compared. Observers' scores for extent to which feasibility of starting new enterprise (broken down into criteria) had been explored.

A variety of types of information and observations were identified prior to each activity. These included farmers', researchers', extension staff and trained observers' observations and scores for specific criteria ie for ease of use, usefulness, level of participation, extent to which methods used achieved the objectives

of an exercise (eg exploring the feasibility of a new enterprise), strengths and weaknesses, and the extent and relevance of information included in budgets and in exercises. Information and observations were recorded during or immediately after each exercise. Further, a feedback and evaluation workshop was held for the 22 staff that had used participatory budgets as part of their extension work during a season. Five of these were then selected as case studies and visited in their own areas where the extent to which participatory budgets had been used and their usefulness were explored with the extension workers and with farmers. Data from the long term needs assessments of farmers was analysed to compare farmers' planned and actual budgets and feedback sessions were held with the farmers.

The overall findings are summarised here and detailed results from each exercise are presented in Galpin et al. (2000); Dorward (1999) and Galpin, (2000). The following numbered sections relate to the activities in table 1.

Field Testing of Participatory Budgets by Extension and Farmers

Farmers, extension and research staff found participatory budgets highly useful. The mean scores from eleven groups of farmers opinions on the 'usefulness' and 'ease of use' of participatory budgets, after they had first used them were almost the maximum possible; 9.5 and 9.0 respectively (possible scores between 1 and 10, 1 represents the most negative score possible ie 'of no use at all' and 10 represents the most positive score possible). Following the first exercise using participatory budgets with farmers, extension workers (19) gave a mean score of 8.4 for usefulness of participatory budgets to farmers (using the same scale noted above). Informal observations of farmers and extension using participatory budgeting throughout the research in both countries supported these high scores.

Table 2. Summary of options identified by farmers and their potential impacts

Producer Group	*Green manure crop planting date*	*Tomato harvest date*	*Impact on timing*	*Benefits / Advantages*	*Costs / Risks*
Early irrigators	October	April/May - June/July	No change	• reduced cash expenditure on fertiliser • improved soil quality	• overall increase in labour required • incorporation very intensive due to hard ground • may lose green manure crop if drought - or very high labour costs for watering • risk of fire damage to green manure crop
Mound transplanters	September	July	No change	• lower input costs (no fertiliser required) • reduced labour peaks in January / February • other crops also benefit (including quality) • reduced weed growth	• increased labour required in August / September (planting green manure) and October / November (incorporation) • overall increase in labour required
Mound direct seeders	July	July (Onions: November)	No change	• green manure crop benefits other crops • increased cash from minor season crop (if grown)	• higher input costs (for farmers who do not currently use fertiliser) • requires cash outlay for minor crop (if grown)
Flat planters	March	September	Delay in tomato harvest by 2 months (price affected)	• no fertiliser costs • possible reduced rates of abortion and flower drop as temperatures are lower • possible benefit to subsequent crops	• increased labour particularly for incorporation • production costs 6 -10 % higher • higher disease incidence at harvest due to heavy rains

Adapted From Dorward et al. (2003)

Long term evaluation with 22 extension staff incorporating use of participatory budgets into their work over seven months

Extension staff that had been trained in the use of participatory budgets were asked to use them in their own work, where they saw suitable opportunities to, in the seven months following the training. They used them with farmers mainly for comparing various enterprises (i.e. to investigate which was more suitable and feasible) and for planning new enterprises. Enterprises commonly considered with farmers included poultry broiler production, vegetable gardening, maize and beans. Other uses included exploring the marketing and timing of some operations, replacing artificial fertiliser with compost, and investigating labour use. Extension workers' opinions on participatory budgets were obtained during a feedback workshop and in addition several were visited in their own working locations. Feedback was obtained through use of questionnaires, interviews and a participatory activity where strengths and weaknesses identified by staff were scored and discussed. Extension staff considered participatory budgets to be useful for enabling farmers to identify and select the best enterprises for them, plan enterprises, and work out whether they have made a profit or not. They considered them suitable for non-literate and literate farmers and several reported that using participatory budgets had improved relationships with farmers. Feedback was positive although other wider factors influencing the extent to which staff could use participatory budgets were also noted including a general lack of opportunities (i.e. new enterprises) for farmers to improve their livelihoods.

Exercises with Farmers in Two Communities (One Week Each) to Investigate the Suitability of Green Manuring for Vegetable Farmers Systems and Resources.

This exercise was conducted to test the use of participatory budgets for assessing the suitability of potential innovations with farmers prior to implementing on-farm trials i.e. at a relatively early stage of technology development and adaptation. Green manuring had been identified by research staff in the Brong Ahafo region of Ghana as a possible means of addressing poor soil fertility for farmers producing tomatoes in the wet season. Before deciding whether on-farm trials should be established, a one week participatory analysis was conducted in each of two communities. Working with farmers representing five different types of tomato farmers in each community, participatory budgets were used to: a) describe existing tomato production; b) explain the green manuring technology; c) jointly explore the timing and resource implications of introducing green manuring into the cropping system; d) develop alternative timings and activities for fitting a green manure crop into the tomato production system; e) identify the likely resource use and production implications of options identified in d). Table 2 gives a summary of the options and their potential benefits and costs identified by different types of tomato farmers.

For some types of tomato producers in each community it emerged that green manuring was not a sensible option and for others it may be with the adaptations suggested. These could then be explored by farmers and research staff in on-farm trials. The use of the participatory budgets had not only identified who the technology is likely, and importantly who it is not likely, to be suitable for, and how it can be adapted, but also what particular features need to be examined and focused on in trials and practical management. This case study illustrates that participatory budgets used in this way could improve the relevance and quality of subsequent on-farm research. Without this approach, several seasons of trials work could be conducted and associated resources used, before reaching the same findings (see Dorward et al., 2003). Furthermore the participatory budgets can be used by farmers and research staff for recording on-farm trial results (including resources) and for analysing and comparing findings.

Long Term Needs Assessment Over One Season.

In order to investigate the potential to use participatory budgets during a production period and as a means of better understanding the constraints farmers operate in and their farming systems, exercises were conducted in two different farming systems in Ghana and Zimbabwe. At the start of the season individual farmers created participatory budgets for the season ahead. They were then visited each month during the season and revised their participatory budgets to reflect what had actually happened. At each visit and at the end of the season, each farmer and the facilitator working with them compared what had

been planned with the actual practice, and discussed reasons for any differences. In Zimbabwe six small-scale resource poor farmers who relied on maize as their main staple crop were worked with and in Ghana 22 small-scale tomato growers.

The effects of the unpredictable natural and economic environments on farmers' enterprises and decision making during seasons were very evident in both locations. Farmers' practices were very different to plans expressed and consistent reasons for the differences were evident. Findings in Ghana included:

The major cause of disruption to planned activities was time spent at funerals (an obligation)

Early arrival of rains reduced labour demand for watering

Actual inputs were different to those planned mainly due to farmers responding to the crop condition and input availability. Prices for inputs predicted were broadly accurate

A glut of tomatoes on the market led to poor prices, reduced income and reduced expenditure on labour for picking (much of the crop remained unharvested).

Despite the small sample size in Zimbabwe some consistent observations were evident, including:

Unavailability of seed leading to inappropriate varieties being planted and low yields

Late arrival of rains and low rainfall had major effects including delayed land preparation and planting. This contributed to labour competition later in the season and to low yields

Again a major cause of labour shortage at important points in the season was the need to attend funerals

Lack of cash, or alternative requirements for cash at particular times eg for school fees, resulted in no fertiliser being applied and no weeding being conducted by some farmers

Illness and pregnancy in families resulted in reduced labour availability and delayed activities

Farmers at both locations were clearly practicing 'response farming' as described earlier in this paper and having to make major decisions on resource use and activities during the season in response to unpredictable changes in the natural, social end economic conditions. Social factors were clearly important in influencing farmers' responses. The use of the participatory budgets with farmers improved extension and research staffs' understanding of the constraints faced by farmers and the nature of their decision making. Farmers in Zimbabwe observed that the process of using the participatory budgets as described here was helpful and in particular with planning and allocation of resources. The participatory budgets enabled farmers to visualise the impact of unpredicted events as well as of alternative management responses, and to allocate their resources in the light of this. Tomato farmers in Ghana were also positive about the use of the participatory budgets in the exercise. All of them noted that it helped improved their timeliness of their activities and most (20) noted how it enabled them to determine profitability of their enterprise which was not normally calculated. It had also helped with establishing the contribution of components to the success or failure of the enterprise e.g. labour costs. Despite the very different farming systems, cultures and environments of the locations in Ghana and Zimbabwe, participatory budgets had been useful to farmers and facilitators working with them, to understand their systems and constraints and to carry out farm management functions of decision making, planning and control.

Short Controlled Exercise with Extension Staff And Farmers to Compare Participatory Budgets with Approaches Currently Used (To Explore The Feasibility Of Starting A Poultry Production Enterprise)

In addition to the approaches to evaluating participatory budgets described above, more controlled exercises were designed and conducted. Five extension staff that had been trained in use of participatory budgets and five untrained staff (in Zimbabwe) conducted the same exercise. Each member of extension staff worked with a separate small group of farmers. Trained observers recorded information on the extent to which aspects of the exercise were completed. The exercise was divided into tasks to: a) explore the viability of them starting a broiler enterprise 2) explore how the new enterprise would fit with existing labour availability; 3) examine the possibility of taking out a loan; 4) consider what may go wrong with such an enterprise; 5) consider the impact of half the birds dying one week before the first sale. The extension staff that had not been trained in use of participatory budgets were asked to use whatever methods they normally would for such an activity.

Scores for the extent to which, and how well, each task had been conducted were given based on observers' scores and on analysis of detailed records of the information used and generated. Mean scores for staff and farmers using participatory budgets were higher than for those using conventional methods by between 225% and 600% for task 1 and between 11% and 250% for tasks 2 to 5.

Conclusions

In addition to the activities reported above, participatory budgets have since been used for a range of purposes in a variety of other developing countries. Examples include farmers working with research or extension staff analysing dairy systems in Mexico, exploring the potential of IPM options in maize-dairy systems in Kenya and investigating rice production in Bangladesh. Feedback from staff involved in these and other activities have generally supported the findings above. Participatory budgets provide a method that is appropriate to many of the resource-use decisions that small-scale farmers face, the factors that influence subsistence and near subsistence farmers decision making, and the unpredictable and changing environments they operate in. Furthermore they provide a way for research and extension staff together with farmers to explore the suitability of innovations and to take into account important differences in farmers' access to resources and levels of poverty.

Acknowledgements

This work was mainly funded by the UK Department for International Development. The authors would also like to thank the Ministry of Food and Agriculture staff in Ghana and AGRITEX staff in Zimbabwe with whom much of the field work was conducted. In particular we would like to thank the many farmers in Ghana and Zimbabwe that we worked with..

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