MUARIK BULLETIN, Vol. 3. pp. 1-10, 2000

Farmer identification of production constraints: An assessment of farmer participation in Uganda

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Abstract

Permitting farmers' needs constraints to define the demand structure for technological research and development is now considered to be essential if African National Agricultural Research and Extension systems (NARES) are to develop client-relevant technologies. Contemporary approaches advocate direct participation by farmers in these assessments. An important assumption made by those who advocate integrating farmer knowledge into research agenda planning is that farmers will identify and prioritise constraints differently from research scientists. If the assumption is accurate, then differences in constraint perceptions need to be identified and explored in order to improve the capacity for interpreting and utilising farmer knowledge to advance research agenda planning. This assumption is analysed using information from a survey conduced in 1994 of 543 farmers in 5 districts of Uganda, and a research review and prioritisation exercise conducted in 1994 with research scientist from the Ugandan National Agricultural Research Organisation (NARO). Constraint categories derived from the literature are used to compare and contrast commodity specific production constraints. Results indicate that farmer prioritisation of commodity specific constraints only partially differ from those provided by scientists. Also, farmers are more likely to specify visible biological constraints such as insects and vertebrate pests, and economic constraints such as labour and markets. Researchers on the other hand are more likely to specify varietal deficiencies and plant diseases. Reconciling perceptual differences can best be done by including farmers in priority setting exercises at the time when they occur.

Key words: Farmers, researchers, research planning, needs assessment , Uganda

Introduction

A priori assessments of farmer constraints are now considered essential in order for African National Agricultural Research and Extension Systems (NARES) to develop client-relevant technologies (Spencer, 1991; World Bank, 1998). Contemporary approaches advocate direct participation by farmers in these assessments (Chambers *et al.*,1989; Ashhy, 1990; Roling, 1990). Past experience with industrial research and development programs demonstrate that successful technological research and development programs are distinguished by a strong user orientation in advance of technology production (Zaitman, 1979). Permitting farmers' needs and constraints to define the demand structure for technological research and development can provide the basis for a strong user orientation. However, permitting farmers to identify constraints and using this knowledge to derive research agendas appears to be an advocacy, not practice. A common practice is for research agendas to be determined by researchers or prescripted by National Governments in order to meet their own scientific interests or developmental objectives. Local farmer knowledge about constraints, if collected, is often ignored or left unutilised by agricultural scientists (Chambers *et al.*, 1989).

Contrastingly, scientifically derived information is considered to be more reliable, transferable, if not superior (Kloppenburg, 1991). Rhodes and Booth (1982:129) acknowledge that "...scientists often perceive technical problems through different eyes than farmers." Second, farmers often have different goals from researchers. Small farmers may seek to minimise risks while researchers may be most concerned with yield maximisation. Some consider farmer-identified constraints to be highly subjective, random, unreliable, and of little use to researchers (Ilbery, 1978; Farrington and Martin, 1988).

An important assumption that guides those advocating the efficacy of using participatory methods is that farmers will identify and prioritise constraints differently from research scientists (Chambers, 1990). In order to justify the additional time and expenditure required to implement participatory research agenda and planning, this assumption needs to be validated. If the assumption is accurate, then comparing researcher and farmer knowledge will assist in the interpretation and utilisation of farmer knowledge to advance research agenda planning.

The term constraint is applied in the context of any condition or set of conditions that limit agricultural production in the agricultural development literature (Pinstrup-Anderson, 1982). Most commonly, they are identified as physical, biological, or socioeconomic factors that limit production (Pinstrup-Anderson, 1982; Shaner, 1982; Gladwin, 1983).

However, gaps exist in the methodology for understanding and using farmer specified constraints to orchestrate demand driven technological research and development. In this study, we used a participatory process to allow farmers to define constraints with the hope that comparing these with researcher derived constraints will expose perceptual differences and similarities and assist in the utilization of farmer knowledge.

Methodology

Information from two sources are used to analyse perceived agricultural production constraints. The first is a research review and prioritisation exercise conducted by the Ugandan National Agricultural Research Organisation (NARO) in 1994. The second is a 1994 survey of 543 farmers in 5 districts of Uganda (Masindi, Mukono, Iganga, Soroti and Muhende). The NARO priority setting exercise was based on inputs by a group of 60 participants, consisting mostly of senior and mid-level personnel from NARO, Extension, Makerere University, Uganda Farmers Association, Uganda Coffee Development Authority and Uganda Seed Project. This information was presented in the monograph "Agricultural Research Priorities and Programs" (1994) published and released by NARO with assistance from The International Service for National Agricultural Research (ISNAR). The 1994 Ugandan farmer survey was based on a multi-staged sampling procedure to select districts, counties, sub-counties, and villages as research sites. Systematic samples of 25 farmers were drawn from each village. Farmers were asked to list their three most important crops and most important production constraints associated with each crop. Responses reflect a subjective perception of constraints based on unique farmer experiences with the production of each crop. This procedure is consistent with the participatory methodology which emphasizes farmer perceptions of production constraints. The range of possible constraint responses was not known prior to the study. A wide array of constraint responses were recorded and later grouped across commodities using categories derived from the literature.

General constraint categories derived from farmer responses were compared with NARO responses (Table I). In Table 2 individual constraint responses by farmers for each crop are compared with NARO rankings across 7 crops including maize, finger millet, sorghum, banana (cooking), cassava, groundnuts, and coffee.

Findings

Whether NARO and farmers use the same topical areas to describe constraints is examined in Table 1. There is general agreement between farmers and researchers on a number of weed, post-harvest and insect constraints. Farmers are somewhat more likely than NARO informants to perceive insects and less likely to perceive diseases as priority constraints. Considerable differences exist in the rankings of priorities by farmers and NARO informants for all other constraint categories. Farmers mentioned vertebrate pests as priority problems on two commodities (maize and cassava) whereas this was not mentioned by NARO informants. Farmers identified labour, physical conditions (drought and poor soils), and marketing as priority constraints across commodities. These were not mentioned by NARO personnel for any of the commodities. NARO informants specified the lack of improved agronomic management practices, generally labeled as rotational or cropping system constraints, and lack of improved varieties as important constraints. No farmer mentioned agronomic management as a constraint, although specification of labour constraints may be considered to be a surrogate for this constraint area. Lack of improved varieties was mentioned by farmers only for cassava and groundnuts.

Crop specific constraints ranked by NARO informants and by farmers are listed in Table 2. In the case of maize, farmers and NARO informants agree that maize streak and stalk borers are important constraints. There was also similarity in the ranking of several other constraints, although the terminology used to describe these differed. NARO informants ranked weeds, particularly Striga, as a constraint, while farmers judged the lack of labour for weeding as the constraint. NARO informants specifically mentioned weevils while farmers mentioned the storage of maize as a problem. Constraints ranked by NARO informants, but which were not listed by farmers, included lack of improved varieties, inappropriate spacing, inadequate knowledge of intercropping, Northern Leaf Blight, and downy mildew. Constraints ranked by farmers but not by NARO, include vertebrate pests (monkeys, baboons, and wild pigs), marketing problems, drought, and termites.

Data on finger millet indicate that farmers and NARO informants agreed only on the importance of Striga as a constraint. The most important constraint identified by farmers for finger millet production was labour, particularly for weeding and harvesting. Although NARO informants mentioned Striga they did not mention other problematic weeds such as wild finger millet *(Elusine indica)*, nut grass *(Cyperus rotundus)*, or blackjack *(Bidens pilosa)*. NARO informants mentioned rotation and cropping system as constraints. Constraints listed by farmers but not by NARO informants included grasshoppers, drought, and army worms. Those listed by NARO informants but not by farmers included blast, Cylindrosporium leaf spot, tar spot, and lack of improved varieties.

Concerning sorghum, farmers and NARO informants agree on the two most important constraints: striga and stalk borers. Farmers also mentioned smut, labour for weeding, and storage problems. NARO informants mentioned lack of improved varieties, grain mould, and rotation and cropping system constraints.

NARO informants and farmers agreed on several of the priority constraints for bananas, which included weevils, nematodes, and sigatoka. Farmers mostly mentioned weevils as their priority constraint. Constraints listed by farmers but not NARO informants included drought, marketing, labour, and poor soils. By contrast, NARO informants tended to give greater importance to agronomic management practices such as poor stand population, improper tillage, inappropriate cropping systems, lack of pruning, Fusarium wilt and lack of genetic diversity.

There was general agreement that Cassava mosaic disease is the priority problem and that mites are also an important problem on cassava. Other constraints mentioned by NARO personnel focused on germplasm deficiencies including poor seed quality, lack of improved varieties, and genetic erosion of local germplasm. Farmers mentioned lack of improved varieties in reference to Cassava mosaic disease. They also mentioned vertebrate pests, particularly the mole rat in Iganga District, labour and poor soils.

Improved

Table 1. General constraint categories across comodities.

General constraint categories	Biological				Physical	Agronomic management	Lack of labour	Marketing	Technology improved varieties	storage	Lack of pesticides
	vertebrate Insects	Diseases	Weeds	Pests							
Maize	1(2)	3(1)	1(0)	0(1)	0(1)	2(0)	0(2)	0(1)	1(0)	1(1)	-
Finger millet	0(2)	3(1)	1(1)	-	0(1)	1(0)	0(2)	-	1(0)	-	-
Sorghum	1(1)	0(1)	1(1)	-	-	1(0)	0(1)	-	1(0)	1(1)	-
Banana	2(2)	2(1)	-	-	0(2)	4(0)	0(1)	0(1)	1(0)	-	-
Cassava	1(1)	1(1)	-	0(1)	0(1)	1(0)	0(1)	-	3(1)	-	-
Groundnuts	1(0)	1(1)	-	-	-	-	0(1)	-	1(1)	-	0(1)
R.coffee	1(1)	2(1)	0(1)	-	0(1)	0(1)	0(1)	0(1)	0(1)	-	-
Total	7(9)	12(5)	3(3)	0(2)	0(6)	9(0)	0(9)	0(3)	9(2)	2(2)	0(1)

R. coffee = *Robusta coffee*

Table 2. Specific crop constraints identified by NARO and farmer informants in Uganda.

NARO Informants	Crop	Farmer Informants
	Maize	
1. Maize streak virus		1. Stalk borer
2. Lack of improved varieties		2. Vertebrate pests
3. Inappropriate spacing plants		3. Marketing (Low prices)
4. Inadequate intercropping		4. Labour for weeding
5. Northern leaf blight		5. Maize streak virus
6. Weeds [principally Striga]		6. Post harvest storage
7. Weevils		7. Drought
8. Stalk borer		8. Termites
9. Downy mildew		9. Labour for harvesting
	Finger millet	
1. Striga		1. Labour for weeding
2. Blast		2. Labour for harvesting
3. Lack of improved varieties		3. Grasshopers
4. Cylindrosporium [finger millet]		4. Weeds (Striga)
5. Tar leaf spot [finger millet]		5. Drought
6. Rotation/cropping systems		6. Army worms
	Sorghum	
1. Striga		1. Stem borer
2. Stem borer		2. Striga
3. Lack of improved varieties		3. Smut
4. Grain mold		4. Labour for weeding
5. Rotation/cropping system		5. Post-harvest storage
	Banana	
1. Weevils		1. Weevils
2. Nematodes		2. Nematodes
3. Sigatoka		3. Drought
4. Poor stand (plant population)		4. Marketing problems
5. Fusarium wilt		5. Labour requirements
6. Lack of genetic diversity		6. Poor soils
7. Improper tillage practices		7. Sigatoka
8. Rotation/cropping systems		
9. Lack of pruning/de-suckering		
	Cassava	
1. Poor seed quality		1. Cassava mosaic disease
2. Cassava mosaic disease		2. Mites
3. Lack of improved varieties		3. Vertebrate pests [mole rat]
4. Green spider mite		4. Lack of labour
5. Rotation/cropping system		5. Poor soils
6. Lack of senetic diversity		6. Lack of improved varieties
	Groundnuts	
1. Lack of improved varieties		1. Rosette
2. Cercospora leaf-spots		2. Lack of pesticides
3. Thrips		3. Labour – weeding/harvesting
		4. Lack of improved seeds
	Robusta coffee	
1. Coffee leaf rust		1. Biting ants
2. Red blister disease		2. Weeds [couch grass]
3. Coffee berry borers		3. Labour – Weeding/harvesting
4. Lack of improved varieties		4. Marketing (low prices/delayed payment)
5. Drought		

*NARO = National Agricultural Research Organisation

Farmers overwhelmingly mentioned groundnut rosette disease and the lack of pesticides as major constraints on groundnut production. Generally, farmers were not aware that aphids are the vector for rosette but they were aware that the use of pesticides was vital if a good harvest was to be produced. Farmers also mentioned labour constraints particularly for planting, and lack of improved seed. NARO informants mentioned the lack of improved varieties, Cercospora leaf spot and thrips as top priority constraints.

Data on constraints encountered in robusta coffee production indicate that farmers constraints focused on labour, marketing, and drought. Their priority constraint was, however, biting ants which impact the harvesting of this crop. The prevalence of couch grass *(Digitaria scularum* (Schweinf)) as a farmer perceived constraint explains their ranking of labour for weeding as a constraint. NARO informants identified two disease constraints, namely, coffee leaf rust *(Hemilea vastatrix* Berk. & Br) and red blister disease *(Cercospora coffeicola* Berck. & Cooke), and the insect pest, coffee berry borer *(Stephamoderes coffeae* Haged). These diseases and insect pest were not listed by farmers.

Discussion

The assumption made by those who argue that local knowledge is different, thus requiring greater attention, is only partially demonstrated in this analysis. Farmers and NARO informants agree about some of the major constraints for each of the commodities reviewed here except for coffee and, to a lesser extent, groundnuts. NARO constraint rankings agreed with farmers regarding maize streak disease, stalk borer, and weeds on maize; stnga on finger millet; striga and stem borer on sorghum; weevils and nematodes on bananas; and, cassava mosaic and mites on cassava. In general, these constraints are widespread where the crop are grown, have had clearly demonstrated and visible impacts on crop yields, and have received research, extension and even media attention over the years. These areas of agreement appear to indicate high potential targets for future research investigation.

Some of the discrepancy in rankings may be explained by differences in terminology used by NARO and farmers. For example, with both sorghum and finger millet, NARO informants listed rotation and cropping system constraints, while farmers listed labour constraints particularly in regard to weeding. It has been established that rotating fields and extended fallow periods can provide some measure of control for weeds of fallowed land, and increase the period of time in which crops are grown in the same fields.

Additionally, farmers are more likely to specify constraints they can observe, associate with yield reductions, and thus experience. For example, farmers prioritised highly visible vertebrate pests and visible insects and diseases such as grasshoppers, termites, black ants, smut, and rosette. These constraints were not mentioned by NARO informants. Many other diseases and small insects (thrips) tend to not be known or recognised as yield reducing agents by farmers. Again, this contextual knowledge displayed by farmers lends credence to the assertion that farmer knowledge of constraints is determined more by ease of observation than precise knowledge of agents that cause yield reduction (Bently, 1992).

NARO informants ranked varietal improvement and its constraint counterpart, lack of improved varieties, as important constraints for all commodities. That farmers more rarely identify lack of improved varieties as a major constraint may allude to their lack of availability, suitability, or cost. Thus, an over-reliance on crop breeding programs to produce improved varieties for farmers who lack financial, infrastructural, or informational access to exogenous seed supplies at this juncture in Uganda's agricultural development might be questionable.

Several other issues emerge regarding plant breeding programs. The first is the acknowledged differences in selection criteria between farmers and scientists (Haugerud and Collinson, 1990). On-station plant breeding programs need to be exposed to farmer circumstances and priorities. An example is farmer recognition of drought as an important production constraint for four of the eight

commodities. Many parts of Uganda are or have recently been subjected to periods of reduced rainfall. Yet drought as a priority constraint is not mentioned by researchers. Although it is recognised that the symptoms of drought stress may invite or mask some disease symptoms, incorporation of drought tolerance into breeding programs would seem to be in order particularly for the preponderance of rain fed farming systems in Uganda. Another example is the well known use by farmers of multiple cultivars and intercropping, and labour constraints that prevent timely planting and weeding. This suggests that varietal selections need to be exposed to these conditions and the investigation of sub-optimal solutions (Carr, 1989). Although these notions may be referred to by NARO informants when they specify cropping constriants, the use of this term appears to lack the degree of specificity necessary for ranking rsearch priorities.

Finally it is revealing to note that NARO informants did not specifically mention labour, marketing, physical (drought and poor soils), or vertebrate pests as constraints. Several caveats are offered to explain thses discrepant findings. First, descriptions of the 60 persons who participated in the ranking exersise were not available. However, as stated in the monograph (NARO, 1994): "socioeconomic research is currently a relatively minor component of research activities in NARO." The absence of social scientists trained to provide emic descriptions of farmer production systems may be one explanation for these findings. Second, the proportion of farmers who participated in this exercise is not known. However, labour, marketing, and input availability are important constraints with farmers throughout much of Sub-Saharan Africa (Cleaver, 1993). That they did not figure prominently in the NARO rankings indicates that the proportion of farmers who participated was either low, or biased towards those with capital assets to off-set these constraints.

Conclusion

Both farmer and researcher generated constraints represent contextualized knowledge: knowledge that is shaped by each individual's background and experience. Thus, it should not be surprising that there are differences between farmers and researchers in constraint definition and prioritisation. However, to ignore farmers' definitions of constraints and rely solely on researcher specified constraints is to impose research agendas on farmers. If the past is any indicator, this approach has not proven to be very effective in promoting agricultural change and improved agricultural production among small farmers in Sub-Saharan Africa.

If agricultural research is to be responsive to farmers' needs then using farmer perceptions of constraints needs to be integrated into researcher efforts to prioritise and address constraints. Since this is the stated mission of NARES, methods to more systematically collect and incorporate this knowledge should be developed. Several improvements are recognised and suggested by this current effort.

First and foremost, there must be enhanced collaboration and communication between farmers and scientists regarding priority problems and constraints. This can best be accomplished by including farmers in priority setting exercises at the time when they occur. However, financial and logistical constraints may impede farmer participation. Thus, it may be more effective to conduct and then convey farmer research priorities to scientists prior to or during research prioritization exercises. This would compel scientists to adapt and adjust their constraint specifications to farmers' needs. Reversing this process, by first having scientists determine priorities and then subjecting these to farmer evaluation risks reinforcing "elite misconceptions" (Howes and Chambers, 1980) and would require an additional procedural step to have farmer evaluations fed back to researchers.

Second, knowledge of farmer constraints alone is insufficient. Farmers and their attendant constraints need to be differentiated by social, economic and agro-ecological variables. Using the terminology of farming systems research, these variables would form a recommendation domain. However, the sociology of agricultural sciences is currently under-informed as to the interplay between antecedent factors that influence problem choice by farmers, and is under-equipped to utilise

farmer knowledge to specify constraints (Busch and Lacy, 1983). Thus, the concept of farmer-definition of constraints needs to be linked to the agricultural and societal context to be a more meaningful tool for deriving demand for agricultural research.

Third, reliance on biological agricultural scientists to identify constraints appears to bias the results. They inevitably see biological factors or processes as priorities. In this study, diseases and improved varietal development were consistently prioritised by biological scientists. This disciplinary bias detaches the constraint from its social and economic context. This is a false dichotomy and a major impediment to orienting research towards farmers' needs. It leads to excessive scientific reductionism which distracts from more problem-oriented, people-oriented research.

Fourth, constraint identification by farmers and researchers can and do vary. They are subject to seasonal vicissitudes, disciplinary background, and experience with each crop. Farmers' perceptions of priority constraints may vary depending on when they are interviewed in the crop cycle. Thus, constraint identification and prioritisation can not be one-time efforts. They need to reflect continuous effort. However, the logistics and costs of a continuous effort to ascertain constraints argues against using multi-disciplinary teams of research scientists for this purpose. Perhaps, this is a role that local extension agents or representatives of farmer associations could play provided they received training and support for this activity. They could then contribute to priority setting exercises serving as knowledgeable representatives of local farmer interests. This would also strengthen the role of extension within farming systems teams and their contribution to participatory agricultural research.

Ultimately, utilisation of farmer perceptions of production constraints by research organisations will depend on their valuation of this knowledge. This may require a reorientation of the institutional reward structure to one that rewards technology adoption and rural development. In turn, institutionalised alterations in the reward structure may require organised social action on the part of farmers. It is only when small farmers organize to express their collective interests that their priorities will be heeded. This is termed farmer empowerment. In addition to technology development, it is an important by-product of participatory agricultural research.

Perhaps, the most significant contribution made in attempts to incorporate farmer identified constraints is that it forces us to address the knowledge and power differential between farmers and researchers. Talking to farmers and addressing their problem is another small step toward farmer empowerment. That the African small farmer has been left out of the power equation cannot he denied. Thus, efforts to improve the methodology for assessing and using farmer identified constraints must continue.

Acknowledgement

We thank the International Programs in Agriculture Office at the Ohio State University, Makerere University and the Integrated Pest Management Collaborative Research Support Project for supporting this effort.

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