

Farm Household-Economics and the Design and Impact of Biological Research in Southern Africa*

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ABSTRACT

A farm-household economics approach is used to illuminate Mellor's labour constraint/rapid urbanization problem in the Southern African context. It is viewed as a rational decision by rural households to combine the benefits of indigenous land-use arrangements with the advantages of non-farm wage employment. The implications of this analysis for the design of technology consistent with the objectives and constraints of farm households are then discussed in relation to some general experiences in Southern Africa.

INTRODUCTION

In southern Africa, as in the rest of the continent, food production per capita from African rural areas declined through the 1970s. Unlike other parts of Africa where drought and civil disruption can be blamed for production declines, most southern African states experienced better than average rainfall through the 1970s and though civil disruption in Zimbabwe was a factor, declining per capita food production was universal.

The 1970s also witnessed an unprecedented flow of foreign aid capital into rural development. FAO spent 45 per cent of its global technical assistance budget in Africa and, overall, per capita aid amounted to US\$13.7 compared to US\$9.6 in the rest of the Third World.

As Eicher⁴ (p. 163) has said:

'Africa's inability to feed itself amid vast amounts of unused land and record levels of foreign aid is, on the surface, one of the major paradoxes of third world development'.

* The views expressed in this paper are the author's alone and do not necessarily represent those of associated institutions.

Development experts are seeking to understand why the green revolution technology formula that so successfully solved Asia's food crisis of the 1960s has had a much more limited impact in Africa. Most explanations involve discussion of the problems of supplying and delivering appropriate technology to small farmers. Supply problems include:

- (a) immature research services with historical emphasis on export crops and large commercial farming;
- (b) poor organisation and low morale of extension services;
- (c) difficult agro-ecology, climate and soils environment.

This paper suggests that there are also important differences on the demand side, in terms of the types of technology that small farmers find appropriate, in the different socio-economic circumstances facing African compared with Asian farmers.

Mellor¹³ alludes to these differences when he suggests that:

'Africa's poor record on food production is largely due to the labour constraint combined with rapid urbanization, rising urban incomes and rising remittances to rural areas. These all serve to reduce labor input into agriculture, slowing the expansion of area cultivated as well as of yields per acre. These same forces have a much less negative impact on agriculture under the labor surplus regimes of Asia'.

As Mellor points out, this does not mean that biological scientific research cannot contribute to solving the problem. However, it does mean that it is likely to be more difficult to focus research towards technologies that are acceptable to African farm-households, for whom increases in yields per area of land may not be the overriding concern. In addition, it means that technologies that are acceptable to farm-households may have a less direct and more limited production impact.

First it is suggested that the adoption of a farm-household perspective, which places labour rather than land at the centre of the analysis, can contribute to an understanding of the cause and nature of Mellor's labour constraint/rapid urbanisation problem. The implications of this analysis for the design of technology consistent with the demands of farm households are then discussed in relation to some general experiences in southern Africa.

LABOUR CONSTRAINTS AND INCOMPLETE URBANISATION

Becker's¹ household economics theory of the allocation of time has been used to develop a labour allocation model of the subsistence farm-household in southern Africa (see reference 12, Chapter 4). This model

focuses on the allocation of family labour-time to market and non-market (subsistence) activities according to the comparative advantage of household members in alternative activities. A major proposition that emerges from the model is that:

The time of household members with the greatest comparative disadvantage in market (wage) employment will be allocated to subsistence production first, followed by members with increasing comparative advantage in market (wage) employment until, either the household's requirement for the subsistence good is satisfied, or the next member's full cost of production is greater than the cost of purchase, in which case the balance of requirements will be purchased.

Two implications related to the labour constraint/rapid urbanisation issue stem from this conceptual model of the farm-household. The first has to do with the motivation to migrate to urban centres in search of wage employment and its effects on household labour supplies. The second has to do with the incomplete nature of this migration due to the benefits of maintaining a rural home base.

The motivation to migrate

Conventional theory, based as it is on the Asian experience, leads most radical and neoclassical analysts to see land shortage and population pressure as the major causes of declining per capita production that forces (according to the radicals) or induces (according to the orthodox neoclassicists) labour to seek off-farm wage employment. However, these analyses, based on the hypothesis of land shortage, pose an empirical paradox since researchers commonly find that available arable land is not fully utilised and that with more labour and complementary inputs, agricultural production could be significantly increased (e.g. reference 7, annexe 7: and reference 8, p. 191).

We can make some sense of these findings by noting first that, according to the comparative advantage argument of labour allocation, there does not have to be a shortage of land for migration to take place. More specifically, there does not have to be an absolute declining marginal return to farm work for part of a household's labour force to be allocated to off-farm employment. Indeed, the comparative advantage concept suggests that marginal returns per farm worker will tend to fall as wage labour is withdrawn from the indigenous farm household.¹

This follows from a consideration of the type of members who will tend to leave for wage employment compared with those that remain on the farm. In the prevailing wage employment market in southern Africa young, educated

and adult male members have the best off-farm job prospects. It will thus be the older, less well-educated and female members of the household who are left to do most of the farm work. This is an empirical observation that has also been made for tropical Africa,¹⁵ as well as many other parts of the third world.¹⁷ Furthermore, because of other household maintenance tasks (household chores, child care, schooling), these remaining members will limit the time they spend on farm production.

In these circumstances rural out-migration can and does take place before marginal returns to labour at the farm level begin to fall. Withdrawal of labour at this stage does not result in an increase in marginal labour productivity as in conventional models, but can lead to labour shortages at the farm-household level and a reduction in productivity per hectare and per worker.

Retention of the rural home base

A related implication of the household economics model of the farm-household is that under traditional tenure the full costs of obtaining a wide range of household maintenance goods in the rural areas are likely to be much less than purchasing them in urban areas.

In most of southern Africa traditional land tenure arrangements accord land rights to individual households, which they maintain as long as they continue to cultivate the land. Together with the allocation of arable land for the exclusive use of the household, goes the right to clear a homestead site and build housing units, as well as a number of communal rights within the chiefdom. These latter include access to and the use of water for washing and drinking, grazing for livestock, grass for thatching, and wood for building and fuel.

All the household has to do to maintain these rights is to continue to cultivate their allocated area to some extent. The costs of maintaining these rights and utilising them will generally be small because both require labour-time inputs that are part of related subsistence activities and because they can be performed by household members with low opportunity market wage costs. The full costs of procuring these goods will thus generally be much lower in rural than urban areas. Added to these cost incentives for retaining a rural base is the security afforded by traditional land use rights, which ensure a means of livelihood in periods of unemployment or old age.

Premature urbanisation

With the strong incentive to retain a rural base, urbanisation becomes a partial process which is undertaken by selected members of the household who have a comparative advantage in off-farm employment and it takes

place well before the marginal productivity to labour on the family farm begins to fall. Hyden⁶ refers to this type of labour migration pattern as 'premature urbanisation' (premature in relation to the Lewis model). Hyden sees this 'premature urbanisation' as being associated with three special characteristics of the socio-economic environment in which African farm-households operate:

- (a) universal access to land by all members of society;
- (b) a lack of agricultural surplus labour;
- (c) the maintenance of strong rural links by urban migrants.

From a farm-household perspective we can see that these characteristics are closely linked. Universal access to land results in specialisation taking place *within* rather than *between* households. Where wage employment or other non-farm production opportunities exist this means that farm-households are often not primarily or solely farmers. Some members specialise in non-farm or wage employment, while those who remain on the farm have other household maintenance activities besides farming. As there are few landless families, and especially where other job opportunities exist, it is not possible to hire labour to substitute for alternatively occupied family labour. Farm production is therefore strongly conditioned by a shortage of family workers who are able to devote most of their time and attention to farming.

MATCHING TECHNOLOGY TO FARM-HOUSEHOLD DEMANDS

This analysis of the labour constraint/rapid urbanisation problem suggests three aspects of the farm-household economy are important for researchers to keep in mind as they seek to design technology that will be acceptable to farm-households in southern Africa. These are discussed in turn below.

The need to take a whole household perspective

On-farm research has come to be the accepted tool for designing appropriate technology in southern African research services. However, on-farm research methodology currently focuses on the farm and tends to ignore the household perspective. According to Bhenke and Kerven this concentration on the farming system may have two undesirable results.

'First it may encourage researchers to think of those who farm as primarily or solely farmers, and thereby underestimate the role of non-agricultural activities in the larger household economy. Secondly, an

exclusive concentration on farming may ill-equip FSR to address one of the major issues in agricultural development in Africa: the withdrawal of labour from agriculture due to rural-urban migration.’²

In eastern and southern Africa farming is seldom the only source of income and in many cases it is not the major one. Wage employment, beer brewing, handicrafts, trading and teaching are common additional sources of income for rural households. While on-farm researchers are concerned with measuring and increasing farm income, farmers are concerned with stabilising and increasing their *entire* welfare, much of which may come from non-farm production. Thus in order to understand ‘farmers’ goals and objectives, on-farm researchers need to adopt a household perspective and attempt to see how diverse production activities are combined to maximise household utility. To quote Bhenke and Kerven again:

‘the acceptability of a farming innovation cannot be adequately judged solely by its technical and economic impact on farming. It must also be assessed in terms of its positive or negative contribution to the household economy as a whole. This will especially be the case when technical innovations require additional labour or capital, that could be invested elsewhere, for example, in the search for urban jobs or in the education of children.’² (p. 10).

Application of a household economics perspective will help on-farm researchers to understand farmer strategies in a household context and thus to search for farm technologies that are appropriate to the overall, farm and non-farm, circumstances facing farmers. Given a household perspective it is possible to see, for example, that one important risk-reducing strategy adopted by many farmers is the search for off-farm employment by one or more members of the rural household. During the early 1980s drought years in southern Africa those households that have had a wage earning member have suffered much less than those that have not had a reliable non-farm source of income. Clearly where the chances of obtaining off-farm employment are quite good, any farm-based risk avoidance strategy, such as planting an extra area of cassava, or tied ridging or mulching or insect control must be compared with the reliability and returns from engaging in off-farm activities which provide income streams unrelated to climate, pests, etc. Labour constrained farmers are more likely to be willing to accept on-farm risk averting technology with minimal extra labour demands, such as shorter season maize varieties. For example, in Eastern Province of Zambia where labour is in short supply for planting and weeding maize, farmers in a plateau farming system were enthusiastic about a short maturing composite

maize variety MMV400, which had been bred primarily for the drier valley areas. Farmers liked the earliness of the variety because it secured their early food needs and could be planted over a longer period.

Norman¹⁴ notes that in Botswana farmers are reluctant to invest very much (money or time) in crop production because such investment is risky compared with livestock and off-farm activities. Such a realisation clearly has important implications for the generation of relevant improved agricultural technology for small farmers in Botswana.

The importance of the time constraint

According to household economics thinking, the time of its members is the basic household resource. An implication of the theory is that time and cash are substitutable. Time can be 'sold' to generate cash or non-market goods and it can also be 'purchased' by spending cash on time-saving inputs. Households will seek to use the time of their members as efficiently as possible by minimising the full costs of production per unit of consumption good. The opportunity cost of household members' time in alternative market and non-market activities thus becomes a key factor in calculating the full costs of producing a unit of any consumption good. Furthermore, this cost is likely to differ for different household members depending on age, gender, skills or other characteristics that influence opportunity time costs in alternative activities.

The central role of labour time has been highlighted by many diagnostic on-farm research studies in southern Africa which indicate that farmers often compromise on crop and livestock management, not because of lack of knowledge or lack of cash to purchase inputs or because inputs are not available, but because of time constraints.

Often seemingly appropriate production increasing innovations are not adopted because of their implications in terms of time. For example, commenting on the results of experimental work on livestock feeding in the Kenya Dryland Farming Research and Development project, Tessema¹⁶ concluded that the rate of adoption of innovations was disappointingly poor. He observed that:

- Kenyan farmers valued their leisure more than the gains they could get from clearing bush to encourage good forage growth;
- most farmers graze their crop residues *in situ* and realise that they waste about 40 per cent of production in so doing. Since they still go ahead with this practice, it seems that, in terms of labour use, farmers choose the least burdensome way of doing a job, even if they are aware that an increased input will give a higher return;

—the growing of fodder crops creates greater demand for labour and oxen time, which the farmer cannot cope with if he has to carry out operations of ploughing, planting and weeding for food crop production. Thus only a handful of farmers were persuaded to include fodder crops in their cropping system.

Women farmers

Another important dimension of the time constraint is related to the comparative advantage for males to migrate and women to remain at the rural homestead. As on-farm researchers conduct surveys and establish trials in eastern and southern Africa, they increasingly find themselves dealing with women farmers. At farmers' group meetings women invariably outnumber men and it is commonly accepted that most farmers in Africa are women.

Given that women the world over are responsible for household production activities (household maintenance, child care, etc.), it follows that much of the agricultural work in Africa competes with household production activities for the allocation of women's time.

On-farm researchers and farm management economists are accustomed to assessing potential technical innovations in terms of labour demands for competing farm activities. Or alternative market wage activities are accounted for by imputing an opportunity cost of time. Seldom are the demands of household production considered, either directly or indirectly through an imputed opportunity cost.

For example, it has been shown for western societies that the opportunity cost of women's time in household maintenance increases considerably when they have children. The response of western women is to withdraw from the labour force at this time.^{5,9} So too can we expect African wives with young children to place a high opportunity cost on household maintenance tasks and to respond by reducing their effort on crop production to attend to the demands of a young family.

In the face of rising time values in wage employment and/or household activities, methods will be sought to raise time values in other activities to the new equi-marginal level.¹⁰ These other activities include farm production, and one way of increasing labour returns in cropping is to apply less labour per hectare. An alternative is to reduce the time required to complete household maintenance tasks.

Rural household studies are beginning to highlight the large amounts of time allocated to non-farm non-market household activities, especially by women. Often the costs of not performing some of these essential or socially necessary tasks (e.g. fetching water or working in another's field) are quite

high and significantly reduce the real benefits of technologies that compete for the time of household members. In Malawi, for example, a group of women farmers were asked why they did not begin to prepare their land for planting in the winter months after harvesting. They replied that this was the time reserved for house building and for cutting and carting thatching grass. Technologies that reduce the time taken for household maintenance tasks should be legitimate areas of concern for researchers seeking to improve the level of crop management, especially for tasks undertaken largely by women.

Intra-household determinants of recommendation domains

Given the recognition that different farmers face different circumstances, but that resources do not permit research to be geared towards individual farmers, the concept of the recommendation domain has become central to on-farm research methodology. The definition of a recommendation domain is a homogeneous group of farmers who share the same problems and possess similar resources for solving these problems. This group of farmers is expected to adopt (or not adopt) the same recommendation given equal access to information. In much of southern Africa, different recommendation domains occur not only because of differences in farmer resources, cropping opportunities, market access and inherent land fertility but also because, at any one time, farm households have different opportunities for non-farm wage employment or other income-earning activities. Often it is the nature and extent to which farm households exploit these non-farm opportunities that most strongly influences farming practices and the aims and objectives of farm production.

Thus it is commonly observed that within homogeneous agro-climatic locations with similar market opportunities, neighbouring farmers with similar income or resource levels farm in very different ways. Households that are in a position to exploit non-farm income opportunities, by dint of better qualifications, experience or enterprise, tend not to have the time or inclination to manage their farming operations in as thorough a manner as their less wage employment orientated neighbours. These households may be interested in employing cash expensive inputs as a substitute for labour time in farming. In Lesotho, for example, a World Bank mission noted that fertiliser was used by Basotho farmers without the range of complementary management practices needed to make full use of the input. They commented that 'fertiliser seems to be commonly used in Lesotho as a substitute for good husbandry rather than a complement to it'.⁷ This pertains in a situation where most households have an adult wage-earner employed on the mines in South Africa. Households which are less able to exploit non-farm opportunities are more likely to evaluate a cash expensive

technology in terms of the direct returns to cash invested and it will often be necessary to include complementary management practices to achieve acceptable returns.

A recommendation domain exercise was carried out in Swaziland with the expectation that different farming systems would be observed in the very different ecological conditions of the highveld, middleveld and lowveld areas in the country.¹⁸ However, it was found that the variations in cropping patterns and husbandry practices within the regions were much greater than between them. The within-region variation stemmed from differences in internal household circumstances rather than from external circumstances.¹¹ And in the Agricultural Technology Improvement Project in Botswana researchers concluded that the variation within villages was greater than variations between villages and recommendation domains have been identified on the basis of internal household characteristics such as asset ownership, wage income, access to draft and commitment to farming.

CONCLUSION

In this paper I have attempted to:

- (a) Elaborate on the components of Mellor's labour constraint/rapid urbanisation problem in the southern African context. The problem needs to be seen as resulting from rational decisions by rural households to combine the benefits of indigenous land-use arrangements with the advantages of non-farm wage employment at one and the same time.
- (b) Discuss the implications of this situation for research, seeking to develop appropriate technologies. Specifically it becomes important to be aware of the farm and non-farm objectives and strategies of farm-households, to recognise intra-household causes of differentiation between households and to appreciate that a major concern of farm-households will be to utilise the time of their members in the most efficient way and maximise household welfare by minimising the full cost of producing a unit of output.

Binswanger³ has recently argued that the obsession with yield per unit of land that most agricultural specialists bring from the developed world or from Asia is inappropriate in Africa, where the amount of land available to farmers is not fixed. His argument, based on relative factor scarcities, that reduction in costs per unit of output is a more appropriate criterion of acceptability in Africa is complementary to the analysis I have presented

here for southern Africa. Both point to a similar conclusion: that the limited impact of yield increasing biological research in Africa is not only related to the influence of agroclimatic, soils and historical factors on the supply of biological innovations, but also has to do with the influence of economic and social circumstances on the nature of the innovations demanded by African farmers.

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